Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.402. Principles of Applied Engineering (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Principles of Applied Engineering provides an overview of the various fields of science, technology, engineering, and mathematics and their interrelationships. Students will develop engineering communication skills, which include computer graphics, modeling, and presentations, by using a variety of computer hardware and software applications to complete assignments and projects. Upon completing this course, students will have an understanding of the various fields of engineering and will be able to make informed career decisions. Further, students will have worked on a design team to develop a product or system. Students will use multiple software applications to prepare and present course assignments.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress, speak, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dressfor the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress, speak, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress, speak, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in an effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present oral communication in an effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(A) investigate and report on the history of engineering science	(i) investigate the history of engineering science
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(A) investigate and report on the history of engineering science	(ii) report on the history of engineering science

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(B) identify the inputs, processes, and outputs associated with technological systems	(i) identify the inputs associated with technological systems
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(B) identify the inputs, processes, and outputs associated with technological systems	(ii) identifly the processes associated with technological systems
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(B) identify the inputs, processes, and outputs associated with technological systems	(iii) identify the outputs associated with technological systems
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(C) describe the difference between open and closed systems	(i) describe the difference between open and closed systems
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(D) describe how technological systems interact to achieve common goals	(i) describe how technological systems interact to achieve common goals
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(E) compare and contrast engineering, science, and technology careers	(i) compare and contrast engineering, science, and technology careers
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(F) conduct and present research on emerging and innovative tehcnhology	(i) conduct research on emerging technology

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(F) conduct and present research on emerging and innovative tehcnhology	(ii) conduct research on innovative technology
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(F) conduct and present research on emerging and innovative tehcnhology	(iii) present research on emerging technology
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(F) conduct and present research on emerging and innovative tehcnhology	(iv) present research on innovative technology
(2) The student investigates the components of engineering and technology systems. The student is expected to:	(G) demonstrate proficiency of the engineering design process	(i) demonstrate proficiency of the engineering design process
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(i) use clear written communication techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(ii) use clear verbal communication techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(iii) use clear visual communication techniques

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(iv) use concise written communication techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(v) use concise verbal communication techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(A) use clear and concise written, verbal, and visual communication techniques	(vi) use concise visual communication techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(B) maintain a design and computation engineering notebook	(i) maintain a design and computation engineering notebook
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(C) use sketching and computer-aided drafting and design (CADD) to develop and present ideas	(i) use sketching to develop ideas
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(C) use sketching and computer-aided drafting and design (CADD) to develop and present ideas	(ii) use sketching to present ideas
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(C) use sketching and computer-aided drafting and design (CADD) to develop and present ideas	(iii) use computer-aided drafting and design (CADD) to develop ideas

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(C) use sketching and computer-aided drafting and design (CADD) to develop and present ideas	(iv) use computer-aided drafting and design (CADD) to present ideas
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(D) use industry standard visualization techniques and media	(i) use industry standard visualization techniques
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(D) use industry standard visualization techniques and media	(ii) use industry standard visualization media
(3) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:	(E) use the engineering documentation process to maintain a paper or digital portfolio	(i) use the engineering documentation process to maintain a paper or digital portfolio
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(B) follow lab safety guidelines as prescribed by instructor in compliance with local, state, and federal regulations	(i) follow lab safety guidelines as prescribed by instructor in compliance with local regulations
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(B) follow lab safety guidelines as prescribed by instructor in compliance with local, state, and federal regulations	(ii) follow lab safety guidelines as prescribed by instructor in compliance with state regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(B) follow lab safety guidelines as prescribed by instructor in compliance with local, state, and federal regulations	(iii) follow lab safety guidelines as prescribed by instructor in compliance with federal regulations
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(C) recognize the classification of hazardous materials and wastes	(i) recognize the classification of hazardous materials
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(C) recognize the classification of hazardous materials and wastes	(ii) recognize the classification of hazardous wastes
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(E) maintain, safely handle, and properly store laboratory equipment	(i) maintain laboratory equipment
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(E) maintain, safely handle, and properly store laboratory equipment	(ii) safely handle laboratory equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(E) maintain, safely handle, and properly store laboratory equipment	(iii) properly store laboratory equipment
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(F) describe the implications of negligent or improper maintenance	(i) describe the implications of negligent or improper maintenance
(4) The student uses appropriate tools and demonstrates safe work habits. The student is expected to:	(G) demonstrate the use of precision measuring instruments	(i) demonstrate the use of precision measuring instruments
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(A) describe how technology has affected individuals, societies, cultures, economies, and environments	(i) describe how technology has affected individuals
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(A) describe how technology has affected individuals, societies, cultures, economies, and environments	(ii) describe how technology has affected societies
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(A) describe how technology has affected individuals, societies, cultures, economies, and environments	(iii) describe how technology has affected cultures

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(A) describe how technology has affected individuals, societies, cultures, economies, and environments	(iv) describe how technology has affected economies
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(A) describe how technology has affected individuals, societies, cultures, economies, and environments	(v) describe how technology has affected environments
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(B) describe how the development and use of technology influenced past events	(i) describe how the development of technology influenced past events
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(B) describe how the development and use of technology influenced past events	(ii) describe how the use of technology influenced past events
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(C) describe how and why technology progresses	(i) describe how technology progresses
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(C) describe how and why technology progresses	(ii) describe why technology progresses

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student describes the factors that affect the progression of technology and the potential intended and unintended consequences of technological advances. The student is expected to:	(D) predict possible changes caused by the advances of technology	(i) predict possible changes caused by the advances of technology
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(i) identify the fundamental processes needed for a project, including the design process
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(ii) identify the fundamental processes needed for a project, including prototype development
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(iii) identify the fundamental processes needed for a project, including initiating a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(iv) identify the fundamental processes needed for a project, including planning a project

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(v) identify the fundamental processes needed for a project, including executing a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(vi) identify the fundamental processes needed for a project, including monitoring a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(vii) identify the fundamental processes needed for a project, including controlling a project
(+79:846) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(viii) identify the fundamental processes needed for a project, including closing a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(ix) describe the fundamental processes needed for a project, including the design process

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(x) describe the fundamental processes needed for a project, including prototype development
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xi) describe the fundamental processes needed for a project, including initiating a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xii) describe the fundamental processes needed for a project, including planning a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xiii) describe the fundamental processes needed for a project, including executing a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xiv) describe the fundamental processes needed for a project, including monitoring a project

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xv) describe the fundamental processes needed for a project, including controlling a project
(+79:846) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(A) identify and describe the fundamental processes needed for a project, including the design process and prototype development and initiating, planning, executing, monitoring and controlling, and closing a project	(xvi) describe the fundamental processes needed for a project, including closing a project
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(B) identify the chemical, mechanical, and physical properties of engineering materials	(i) identify the chemical properties of engineering materials
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(B) identify the chemical, mechanical, and physical properties of engineering materials	(ii) identify the mechanical properties of engineering materials
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(B) identify the chemical, mechanical, and physical properties of engineering materials	(iii) identify the physical properties of engineering materials
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(C) use problem-solving techniques to develop technological solutions	(i) use problem-solving techniques to develop technological solutions

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(D) use consistent units for all measurements and computations	(i) use consistent units for all measurements
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(D) use consistent units for all measurements and computations	(i) use consistent units for all computations
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(E) assess the risks and benefits of a design solution	(i) assess the risks of a design solution
(6) The student thinks critically and applies fundamental principles of system modeling and design to multiple design projects. The student is expected to:	(E) assess the risks and benefits of a design solution	(ii) assess the benefits of a design solution
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(A) describe applications of robotics, process control, and automation systems	(i) describe applications of robotics systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(A) describe applications of robotics, process control, and automation systems	(ii) describe applications of process control systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(A) describe applications of robotics, process control, and automation systems	(iii) describe applications of automation systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(B) apply design concepts to problems in robotics, process control, and automation systems	(i) apply design concepts to problems in robotics systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(B) apply design concepts to problems in robotics, process control, and automation systems	(ii) apply design concepts to problems in process control systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(B) apply design concepts to problems in robotics, process control, and automation systems	(iii) apply design concepts to problems in automation systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(i) identify fields related to robotics systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(ii) identify fields related to process control systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(iii) identify fields related to automation systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(iv) identify career opportunities related to robotics systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(v) identify career opportunities related to process control systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(C) identify fields and career opportunities related to robotics, process control, and automation systems	(vi) identify career opportunities related to automation systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(D) identify emerging trends in robotics, process control, and automation systems	(i) identify emerging trends in robotics systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(D) identify emerging trends in robotics, process control, and automation systems	(ii) identify emerging trends in process control systems
(7) The student understands the opportunities and careers in fields related to robotics, process control, and automation systems. The student is expected to:	(D) identify emerging trends in robotics, process control, and automation systems	(iii) identify emerging trends in automation systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(A) describe the applications of electrical and mechanical systems	(i) describe the applications of electrical systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(A) describe the applications of electrical and mechanical systems	(ii) describe the applications of mechanical systems

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(B) describe career opportunities in electrical and mechanical systems	(i) describe career opportunities in electrical systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(B) describe career opportunities in electrical and mechanical systems	(ii) describe career opportunities in mechanical systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(C) identify emerging trends in electrical and mechanical systems	(i) identify emerging trends in electrical systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(C) identify emerging trends in electrical and mechanical systems	(ii) identify emerging trends in mechanical systems
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(D) describe and apply basic electronic theory	(i) describe basic electronic theory
(8) The student understands the opportunities and careers in fields related to electrical and mechanical systems. The student is expected to:	(D) describe and apply basic electronic theory	(ii) apply basic electronic theory
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(A) apply the design process as a team participant	(i) apply the design process as a team participant

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(B) assume different roles as a team member within the project	(i) assume different roles as a team member within the project
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(C) maintain an engineering notebook for the project	(i) maintain an engineering notebook for the project
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(D) develop and test the model for the project	(i) develop the model for the project
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(D) develop and test the model for the project	(ii) test the model for the project
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(E) demonstrate communication skills by preparing and presenting the project	(i) demonstrate communication skills by preparing the project
(9) The student demonstrates the ability to function as a team member while completing a comprehensive project. The student is expected to:	(E) demonstrate communication skills by preparing and presenting the project	(ii) demonstrate communication skills by presenting the project
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(A) set up, create, and modify drawings	(i) setup drawings

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(A) set up, create, and modify drawings	(ii) create drawings
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(A) set up, create, and modify drawings	(iii) modify drawings
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(B) store and retrieve geometry	(i) store geometry
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(B) store and retrieve geometry	(ii) retrieve geometry
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(C) demonstrate an understanding of the use of line-types in engineering drawings	(i) demonstrate an understanding of the use of line-types in engineering drawings
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(D) draw 2-D single view objects	(i) draw 2-D single view objects

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(E) create multi-view working drawings using orthographic projection	(i) create multi-view working drawings using orthographic projection
(10) The student demonstrates a knowledge of drafting by completing a series of drawings that can be published by various media. The student is expected to:	(F) dimension objects using current American National Standards Institute (ANSI) standards	(i) dimension objects using current American National Standards Institute (ANSI) standards

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.403. Principles of Biosciences (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Principles of Biosciences is a strong reinforcement of Biology content that provides an overview of biotechnology, bioengineering, and related fields. Topics include genetics, cell structure, proteins, nucleic acids, and the impact of immunological events in biotechnology. Students will further study the increasingly important agricultural, environmental, economic, and political roles of bioenergy and biological remediation; the roles of nanoscience and nanotechnology in biotechnology medical research; and future trends in biological science and biotechnology.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student explores biotechnology career opportunities. The student is expected to:	(A) determine interests and aptitudes through conversations with biotechnology professionals	(i) determine interests through conversations with biotechnology professionals
(2) The student explores biotechnology career opportunities. The student is expected to:	(A) determine interests and aptitudes through conversations with biotechnology professionals	(ii) determine aptitudes through conversations with biotechnology professionals
(2) The student explores biotechnology career opportunities. The student is expected to:	(B) identify career options in the field of biotechnology	(i) identify career options in the field of biotechnology

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student explores biotechnology career opportunities. The student is expected to:	(C) identify reliable sources of career information	(i) identify reliable sources of career information
(2) The student explores biotechnology career opportunities. The student is expected to:	(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation	(i) research interests needed in a biotechnology-related occupation
(2) The student explores biotechnology career opportunities. The student is expected to:	(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation	(ii) research knowledge needed in a biotechnology-related occupation
(2) The student explores biotechnology career opportunities. The student is expected to:	(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation	(iii) research educational level needed in a biotechnology-related occupation
(2) The student explores biotechnology career opportunities. The student is expected to:	(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation	(iv) research abilities needed in a biotechnology-related occupation
(2) The student explores biotechnology career opportunities. The student is expected to:	(D) research interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation	(v) research skills needed in a biotechnology-related occupation
(2) The student explores biotechnology career opportunities. The student is expected to:	(E) seek a mentor in the biotechnology area	(i) seek a mentor in the biotechnology area
(2) The student explores biotechnology career opportunities. The student is expected to:	(F) identify conventional and non-conventional career opportunities that match interests and aptitudes	(i) identify conventional career opportunities that match interests

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student explores biotechnology career opportunities. The student is expected to:	(F) identify conventional and non-conventional career opportunities that match interests and aptitudes	(ii) identify conventional opportunities that match aptitudes
(2) The student explores biotechnology career opportunities. The student is expected to:	(F) identify conventional and non-conventional career opportunities that match interests and aptitudes	(iii) identify non-conventional career opportunities that match interests
(2) The student explores biotechnology career opportunities. The student is expected to:	(F) identify conventional and non-conventional career opportunities that match interests and aptitudes	(iv) identify non-conventional career opportunities that match aptitudes
(2) The student explores biotechnology career opportunities. The student is expected to:	(G) research applications of biotechnology and biomaterials such as the areas of medicine and the environment and pharmaceutical, agricultural, and industrial settings	(i) research applications of biotechnology
(2) The student explores biotechnology career opportunities. The student is expected to:	(G) research applications of biotechnology and biomaterials such as the areas of medicine and the environment and pharmaceutical, agricultural, and industrial settings	(ii) research applications of biomaterials
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(i) use technology to research biotechnology topics
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(ii) use technology to identify pertinent scientific articles

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(iii) use technology to obtain articles of interest
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(iv) use technology to write a formal research paper in the format used by academic journals
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(v) use technology to write a formal research paper in the format used by professional journals
(2) The student explores biotechnology career opportunities. The student is expected to:	(H) use technology to research biotechnology topics, identify pertinent scientific articles, obtain articles of interest, and write a formal research paper in the format used by academic and professional journals and magazines	(vi) use technology to write a formal research paper in the format used by magazines
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(A) identify current ethical and legal issues	(i) identify current ethical issues
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(A) identify current ethical and legal issues	(ii) identify current legal issues

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(B) describe the history of biotechnology and related current issues	(i) describe the history of biotechnology
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(B) describe the history of biotechnology and related current issues	(ii) describe related current issues
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(C) discuss legal and technology issues for at least two biotechnology related areas	(i) discuss legal issues for at least two biotechnology related areas
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(C) discuss legal and technology issues for at least two biotechnology related areas	(ii) discuss technology issues for at least two biotechnology related areas
(3) The student evaluates ethical and legal issues in biotechnology. The student is expected to:	(D) compare and contrast examples of objective and subjective scientific, economic, and political data and positions used to defend biotechnology views	(i) compare and contrast examples of objective and subjective scientific, economic, and political data and positions used to defend biotechnology views
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(A) identify local, state, and federal agencies responsible for regulating the biotechnology industry	(i) identify local agencies responsible for regulating the biotechnology industry
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(A) identify local, state, and federal agencies responsible for regulating the biotechnology industry	(ii) identify state agencies responsible for regulating the biotechnology industry

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(A) identify local, state, and federal agencies responsible for regulating the biotechnology industry	(iii) identify federal agencies responsible for regulating the biotechnology industry
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(B) identify professional organizations participating in the development of biotechnology policies	(i) identify professional organizations participating in the development of biotechnology policies
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(C) identify and define terms related to biotechnology regulations	(i) identify terms related to biotechnology regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(C) identify and define terms related to biotechnology regulations	(ii) define terms related to biotechnology regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(i) outline the methods used in biotechnology laboratories to follow local regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(ii) outline the methods used in biotechnology laboratories to follow state regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(iii) outline the methods used in biotechnology laboratories to follow federal regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(iv) outline the methods used in biotechnology laboratories to enforce local regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(v) outline the methods used in biotechnology laboratories to enforce state regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(vi) outline the methods used in biotechnology laboratores to enforce federal regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(vii) outline the procedures used in biotechnology laboratories to follow local regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(viii) outline the procedures used in biotechnology laboratories to follow state regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(ix) outline the procedures used in biotechnology laboratories to follow federal regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(x) outline the procedures used in biotechnology laboratories to enforce local regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(xi) outline the procedures used in biotechnology laboratories to enforce state regulations
(4) The student examines federal, state, local, and industry regulations as applied to biotechnical processes through library research and Internet research. The student is expected to:	(D) outline the methods and procedures used in biotechnology laboratories to follow and enforce local, state, and federal regulations such as those in the agricultural and health areas	(xii) outline the procedures used in biotechnology laboratories to enforce federal regulations
(5) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:	(A) identify professional publications	(i) identify professional publications
(5) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:	(B) identify the various biotechnology industry sectors	(i) identify the various biotechnology industry sectors

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:	(C) investigate and report on career opportunities in the biotechnology industry sectors	(i) investigate career opportunities in the biotechnology industry sectors
(5) The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:	(C) investigate and report on career opportunities in the biotechnology industry sectors	(ii) report on career opportunities in the biotechnology industry sectors
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(A) demonstrate verbal, nonverbal, written, and electronic communication skills	(i) demonstrate verbal communication skills
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(A) demonstrate verbal, nonverbal, written, and electronic communication skills	(ii) demonstrate nonverbal communication skills
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(A) demonstrate verbal, nonverbal, written, and electronic communication skills	(iii) demonstrate written communication skills
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(A) demonstrate verbal, nonverbal, written, and electronic communication skills	(iv) demonstrate electronic communication skills
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(B) demonstrate skills used to secure and maintain employment	(i) demonstrate skills used to secure employment

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(B) demonstrate skills used to secure and maintain employment	(ii) demonstrate skills used to maintain employment
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(C) demonstrate appropriate workplace etiquette	(i) demonstrate appropriate workplace etiquette
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(D) display productive work habits and attitudes	(i) display productive work habits
(6) The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:	(D) display productive work habits and attitudes	(ii) display productive work attitudes
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(A) investigate at least three end products from biotechnology manufacturing processes	(i) investigate at least three end products from biotechnology manufacturing processes
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(B) investigate the effects of waste on environmental and biological life cycles	(i) investigate the effects of waste on environmental life cycles
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(B) investigate the effects of waste on environmental and biological life cycles	(ii) investigate the effects of waste on biological life cycles

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(C) investigate the impacts of waste on the environment	(i) investigate the impacts of waste on the environment
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(D) analyze the results of manufacturing refuse	(i) analyze the results of manufacturing refuse
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(E) explain the negative impacts of waste with respect to the individual, society, and the global population	(i) explain the negative impacts of waste with respect to the individual
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(E) explain the negative impacts of waste with respect to the individual, society, and the global population	(ii) explain the negative impacts of waste with respect to society
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(E) explain the negative impacts of waste with respect to the individual, society, and the global population	(iii) explain the negative impacts of waste with respect to the global population
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(F) research solutions to biological waste with respect to commercial applications through investigation of various pollution waste treatments using natural organisms	(i) research solutions to biological waste with respect to commercial applications through investigation of various pollution waste treatments using natural organisms
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(G) investigate biotechnology as it relates to health and well-being	(i) investigate biotechnology as it relates to health

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(G) investigate biotechnology as it relates to health and well-being	(ii) investigate biotechnology as it relates to well-being
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(i) cite evidence regarding regulations
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(ii) cite evidence regarding patents
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(iii) cite evidence regarding public policy
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(iv) cite evidence regarding design development
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(v) cite evidence regarding design testing
(7) The student investigates the origins of waste and examines the relationship of biotechnology to resource recovery. The student is expected to:	(H) cite evidence regarding regulations, patents and public policy, design development and testing, and safety	(vi) cite evidence regarding safety

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(A) identify the ability to change or enhance genetic characteristics	(i) identify the ability to change or enhance genetic characteristics
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(B) identify applications of genetic engineering	(i) identify applications of genetic engineering
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(C) identify applications of nanotechnology in biotechnology	(i) identify applications of nanotechnology in biotechnology
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(D) identify applications of bioinformatics in biotechnology	(i) identify applications of bioinformatics in biotechnology
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(E) identify the applications of biotechnology in fields such as medicine, forensics, and law enforcement	(i) identify applications of biotechnology in fields
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(i) research ethical considerations governing genetic engineering
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(ii) research ethical considerations governing nanotechnology

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(iii) research laws governing genetic engineering
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(iv) research laws governing nanotechnology
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(v) research regulations governing genetic engineering
(8) The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:	(F) research ethical considerations, laws, and regulations governing genetic engineering and nanotechnology	(vi) research regulations governing nanotechnology

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.404. Principles of Technology (One Credit), Adopted 2015**

(a) General Requirements. This course is recommended for students in Grades 10-12. Prerequisites: one credit of high school science and Algebra I. Students must meet 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) In Principles of Technology, students will conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Various systems will be described in terms of space, time, energy, and matter. Students will study a variety of topics that include laws of motion, conservation of energy, momentum, electricity, magnetism, thermodynamics, and characteristics and behavior of waves. Students will apply physics concepts and perform laboratory experimentations for at least 40% of instructional time using safe practices.
(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(8) Students are encouraged to participate in extended learning experiences such as carreer and technical student organizations and other leadership or extracurricular organizations.
(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficience results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(i) demonstrate safe practices during laboratory investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(ii) demonstrate safe practices during field investigations

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(iii) demonstrate an understanding of the proper disposal or recycling of materials
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(i) know the definition of science, as specified in subsection (b)(4) [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(4) [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions, are incorporated into theories	(i) know that hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions, are incorporated into theories	(ii) know that hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions, are incorporated into theories	(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(i) know that scientific theories are based on natural and physical phenomena
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(ii) know that scientific theories are capable of being tested by multiple independent researchers

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iii) [know that] unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iv) [know that], unlike hypotheses, scientific theories are highly-reliable explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(v) [know that] scientific theories may be subject to change as new areas of science are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(vi) [know that] scientific theories may be subject to change as new technologies are developed

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(i) design investigative procedures, including making observations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ii) design investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iii) design investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iv) design investigative procedures, including identifying variables

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(v) design investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vi) design investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vii) design investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(viii) implement investigative procedures, including making observations

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ix) implement investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(x) implement investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xi) implement investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xii) implement investigative procedures, including selecting appropriate equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiii) implement investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiv) implement investigative procedures, including evaluating numerical answers for reasonableness

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(i) collect qualitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(ii) organize qualitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(iii) collect quantitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(iv) organize quantitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(v) make measurements with accuracy using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers	(vi) make measurements with precision using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) use a wide variety of additional course equipment as appropriate such as ripple tank with wave generator, wave motion rope, micrometer, caliper, radiation monitor, computer ballistic pendulum, electroscope, inclined plane, optics bench, optics kit, pulley with table clamp, resonance tube, ring stand screen, four-inch ring, stroboscope, graduated cylinders, and ticker timer	(i) use a wide variety of additonal course equipment as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(i) make measurements with accuracy using scientific notation
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(ii) make measurements with precision using scientific notation
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(iii) make measurements with accuracy using International System (SI) units
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(iv) make measurements with precision using International System (SI) units
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(v) record data with accuracy using scientific notation
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(vi) record data with precision using scientific notation
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(vii) record data with accuracy using International System (SI) units

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units	(viii) record data with precision using International System (SI) units
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) identify and quantify causes and effects of uncertainties in measured data	(i) identify causes of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) identify and quantify causes and effects of uncertainties in measured data	(ii) identify effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) identify and quantify causes and effects of uncertainties in measured data	(iii) quantify causes of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) identify and quantify causes and effects of uncertainties in measured data	(iv) quantify effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(i) organize data, including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(ii) organize data, including the use of charts

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(iii) organize data, including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(iv) evaluate data, including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(v) evaluate data, including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(vi) evaluate data, including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(vii) make inferences from data, including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(viii) make inferences from data, including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs	(ix) make inferences from data, including the use of graphs

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(K) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions supported by the data through [various] methods
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(i) express relationships among physical variables quantitatively, including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(ii) express relationships among physical variables quantitatively, including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(iii) express relationships among physical variables quantitatively, including the use of equations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(iv) manipulate relationships among physical variables quantitatively, including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(v) manipulate relationships among physical variables quantitatively, including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations	(vi) manipulate relationships among physical variables quantitatively, including the use of equations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(i) in all fields of science, analyze scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ii) in all fields of science, analyze scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iii) in all fields of science, analyze scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iv) in all fields of science, analyze scientific explanations by using observational testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vi) in all fields of science, evaluate scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vii) in all fields of science, evaluate scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(viii) in all fields of science, evaluate scientific explanations by using experimental testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ix) in all fields of science, evaluate scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xi) in all fields of science, critique scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xii) in all fields of science, critique scientific explanations by using logical reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiii) in all fields of science, critique scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiv) in all fields of science, critique scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(i) explain the impacts of the scientific contributions of a variety of historical scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(ii) explain the impacts of the scientific contributions of a variety of historical scientists on scientific society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iii) explain the impacts of the scientific contributions of a variety of contemporary scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iv) explain the impacts of scientific contributions of a variety of contemporary scientitists on scientific society

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) research and describe the connections between physics and future careers	(i) research the connections between physics and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) research and describe the connections between physics and future careers	(ii) describe the connections between physics and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(i) express relationships symbolically to make predictions mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(ii) express relationships symbolically to make predictions mathematically, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iii) express relationships symbolically to solve problems mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iv) express relationships symbolically to solve problems mathematically, including problems requiring graphical vector addition

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(v) interpret relationships symbolically to make predictions mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vi) interpret relationships symbolically to make predictions mathematically, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vii) interpret relationships symbolically to solve problems mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(viii) interpret relationships symbolically to solve problems mathematically, including problems requiring graphical vector addition
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(A) demonstrate an understanding that scientific hypotheses are tentative and testable statements that must be capable of being supported by observational evidence	(i) demonstrate an understanding that scientific hypotheses are tentative statements that must be capable of being supported by observational evidence
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(A) demonstrate an understanding that scientific hypotheses are tentative and testable statements that must be capable of being supported by observational evidence	(ii) demonstrate an understanding that scientific hypotheses are testable statements that must be capable of being supported by observational evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(B) demonstrate an understanding that scientific theories are based on physical phenomena and are capable of being tested by multiple independent researchers	(i) demonstrate an understanding that scientific theories are based on physical phenomena
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(B) demonstrate an understanding that scientific theories are based on physical phenomena and are capable of being tested by multiple independent researchers	(ii) demonstrate an understanding that scientific theories are capable of being tested by multiple independent researchers
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(C) design and implement investigative procedures	(i) design investigative procedures
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(C) design and implement investigative procedures	(ii) implement investigative procedures
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(D) demonstrate the appropriate use and care of laboratory equipment	(i) demonstrate the appropriate use of laboratory equipment
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(D) demonstrate the appropriate use and care of laboratory equipment	(ii) demonstrate the appropriate care of laboratory equipment
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(E) demonstrate accurate measurement techniques using precision instruments	(i) demonstrate accurate measurement techniques using precision instruments
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(F) record data using scientific notation and International System (SI) of units	(i) record data using scientific notation
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(F) record data using scientific notation and International System (SI) of units	(ii) record data using International System (SI) of units

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(G) identify and quantify causes and effects of uncertainties in measured data	(i) identify causes of uncertainties in measured data
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(G) identify and quantify causes and effects of uncertainties in measured data	(ii) identify effects of uncertainties in measured data
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(G) identify and quantify causes and effects of uncertainties in measured data	(iii) quantify causes of uncertainties in measured data
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(G) identify and quantify causes and effects of uncertainties in measured data	(iv) quantify effects of uncertainties in measured data
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(i) organize data, including the use of tables
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(ii) organize data, including the use of charts
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(iii) organize data, including the use of graphs
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(iv) evaluate data, including the use of tables
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(v) evaluate data, including the use of charts

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(H) organize and evaluate data, including the use of tables, charts, and graphs	(vi) evaluate data, including the use of graphs
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(I) communicate conclusions supported through various methods such as laboratory reports, labeled drawings, graphic organizers, journals, summaries, oral reports, or technology-based reports	(i) communicate conclusions supported through various methods
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(i) record data using graphs
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(ii) record data using charts
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(iii) record data using equations
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(iv) express data using graphs
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(v) express data using charts
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(vi) express data using equations
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(vii) manipulate data using graphs

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(viii) manipulate data using charts
(5) The student uses the scientific process to investigate physical concepts. The student is expected to:	(J) record, express, and manipulate data using graphs, charts, and equations	(ix) manipulate data using equations
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(A) master relevant safety procedures	(i) master relevant safety procedures
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(C) identify and classify hazardous materials and wastes	(i) identify hazardous materials
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(C) identify and classify hazardous materials and wastes	(ii) identify hazardous wastes

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(C) identify and classify hazardous materials and wastes	(iii) classify hazardous materials
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(C) identify and classify hazardous materials and wastes	(iv) classify hazardous wastes
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes	(i) make prudent choices in the conservation of resources
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes	(ii) make prudent choices in the use of resources
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes	(iii) make prudent choices in the appropriate disposal of hazardous materials
(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:	(D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes	(iv) make prudent choices in the appropriate disposal of hazardous wastes

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(i) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for displacement
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(ii) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for distance
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(iii) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for speed

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(iv) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for velocity
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(v) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for average velocity
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(vi) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for acceleration

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(vii) generate relevant equations using graphs for one-dimensional motion, including using one-dimensional equations for average acceleration
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(viii) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for displacement
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(ix) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for distance

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(x) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for speed
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xi) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for velocity
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xii) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for average velocity

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xiii) generate relevant equations using graphs for one-dimensional motion, including describing one-dimensional equations for acceleration
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xiv) generate relevant equations using graphs for one-dimensional motion, including describing two-dimensional equations for average acceleration
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xv) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for displacement

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xvi) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for distance
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xvii) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for speed
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xviii) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for velocity

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xix) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for average velocity
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xx) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for acceleration
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(xxi) generate relevant equations using graphs for two-dimensional motion, including using one-dimensional equations for average acceleration

Knowledge and Skill Statement	Student Expectation	Breakout
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Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlii) interpret relevant equations using charts for one-dimensional motion, including describing two-dimensional equations for projectile motion
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxliii) interpret relevant equations using charts for one-dimensional motion, including describing two-dimensional equations for circular motion
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxliv) interpret relevant equations using charts for two-dimensional motion, including using two-dimensional equations for projectile motion

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlv) interpret relevant equations using charts for two-dimensional motion, including using two-dimensional equations for circular motion
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlvi) interpret relevant equations using charts for two-dimensional motion, including describing two-dimensional equations for projectile motion
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlvii) interpret relevant equations using charts for two-dimensional motion, including describing two-dimensional equations for circular motion

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlviii) generate relevant equations using graphs for one-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cxlix) generate relevant equations using graphs for one-dimensional motion, including using vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cl) generate relevant equations using graphs for one-dimensional motion, including describing vector forces

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cli) generate relevant equations using graphs for one-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clii) generate relevant equations using graphs for two-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cliii) generate relevant equations using graphs for two-dimensional motion, including using vector resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(cliv) generate relevant equations using graphs for two-dimensional motion, including describing vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clv) generate relevant equations using graphs for two-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clvi) generate relevant charts for one-dimensional motion, including using vector forces

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clvii) generate relevant charts for one- dimensional motion, including using vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clviii) generate relevant equations using charts for one-dimensional motion, including describing vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clix) generate relevant equations using charts for one-dimensional motion, including describing vector resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clx) generate relevant equations using charts for two-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxi) generate relevant equations using charts for two-dimensional motion, including using vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxii) generate relevant equations using charts for two-dimensional motion, including describing vector forces

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxiii) generate relevant equations using charts for two-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxiv) interpret relevant equations using graphs for one-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxv) interpret relevant equations using graphs for one-dimensional motion, including using vector resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxvi) interpret relevant equations using graphs for one-dimensional motion, including describing vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxvii) interpret relevant equations using graphs for one-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxviii) interpret relevant equations using graphs for two-dimensional motion, including using vector forces

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxix) interpret relevant equations using graphs for two-dimensional motion, including using vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxx) interpret relevant equations using graphs for two-dimensional motion, including describing vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxi) interpret relevant equations using graphs for two-dimensional motion, including describing vector resolution

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(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxii) interpret relevant equations using charts for one-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxiii) interpret relevant equations using charts for one-dimensional motion, including using vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxiv) interpret relevant equations using charts for one-dimensional motion, including describing vector forces

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxv) interpret relevant equations using charts for one-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxvi) interpret relevant equations using charts for two-dimensional motion, including using vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxvii) interpret relevant equations using charts for two-dimensional motion, including using vector resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxviii) interpret relevant equations using charts for two-dimensional motion, including describing vector forces
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(A) generate and interpret relevant equations using graphs and charts for one- and two- dimensional motion, including: (i) using and describing one-dimensional equations for displacement, distance, speed, velocity, average velocity, acceleration, and average acceleration; (ii) using and describing two-dimensional equations for projectile and circular motion; and (iii) using and describing vector forces and resolution	(clxxix) interpret relevant equations using charts for two-dimensional motion, including describing vector resolution
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(i) describe the effects of forces on objects, including law of intertia
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(ii) describe the effects of forces on objects, including law of impulse
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(iii) describe the effects of forces on objects, including conservation of momentum

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(iv) calculate the effects of forces on objects, including law of intertia
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(v) calculate the effects of forces on objects, including law of impulse
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum	(vi) calculate the effects of forces on objects, including conservation of momentum
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(C) develop and interpret free-body force diagrams	(i) develop free-body force diagrams
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(C) develop and interpret free-body force diagrams	(ii) interpret free-body force diagrams
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(D) identify and describe motion relative to different frames of reference	(i) identify motion relative to different frames of reference
(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:	(D) identify and describe motion relative to different frames of reference	(ii) describe motion relative to different frames of reference

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(i) research the historical development of the concepts of gravitational electromagnetic forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(ii) research the historical development of the concepts of weak nuclear forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(iii) research the historical development of the concepts of strong nuclear forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(iv) describe the historical development of the concepts of gravitational electromagnetic forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(v) describe the historical development of the concepts of weak nuclear forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces	(vi) describe the historical development of the concepts of strong nuclear forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(B) describe and calculate the magnitude of gravitational forces between two objects	(i) describe the magnitude of gravitational forces between two objects
(8) The student describes the nature of forces in the physical world. The student is expected to:	(B) describe and calculate the magnitude of gravitational forces between two objects	(ii) calculate the magnitude of gravitational forces between two objects

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student describes the nature of forces in the physical world. The student is expected to:	(C) describe and calculate the magnitude of electrical forces	(i) describe the magnitude of electrical forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(C) describe and calculate the magnitude of electrical forces	(ii) calculate the magnitude of electrical forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(D) describe the nature and identify everyday examples of magnetic forces and fields	(i) describe the nature of magnetic forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(D) describe the nature and identify everyday examples of magnetic forces and fields	(ii) describe the nature of magnetic fields
(8) The student describes the nature of forces in the physical world. The student is expected to:	(D) describe the nature and identify everyday examples of magnetic forces and fields	(iii) identify everyday examples of magnetic forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(D) describe the nature and identify everyday examples of magnetic forces and fields	(iv) identify everyday examples of magnetic fields
(8) The student describes the nature of forces in the physical world. The student is expected to:	(E) describe the nature and identify everyday examples of electromagnetic forces and fields	(i) describe the nature of electromagnetic forces
(8) The student describes the nature of forces in the physical world. The student is expected to:	(E) describe the nature and identify everyday examples of electromagnetic forces and fields	(ii) describe the nature of electromagnetic fields
(8) The student describes the nature of forces in the physical world. The student is expected to:	(E) describe the nature and identify everyday examples of electromagnetic forces and fields	(iii) identify everyday examples of electromagnetic forces

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student describes the nature of forces in the physical world. The student is expected to:	(E) describe the nature and identify everyday examples of electromagnetic forces and fields	(iv) identify everyday examples of electromagnetic fields
(8) The student describes the nature of forces in the physical world. The student is expected to:	(F) characterize materials as conductors or insulators based on their electrical properties	(i) characterize materials as conductors or insulators based on their electrical properties
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(i) design series circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(ii) design parallel circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(iii) construct series circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(iv) construc parallel circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(v) calculate current of various circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(vi) calculate potential difference of various circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(vii) calculate resistance of various circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits	(viii) calculate power of various circuits
(8) The student describes the nature of forces in the physical world. The student is expected to:	(H) investigate and describe the relationship between electric and magnetic fields in applications such as generators, motors, and transformers	(i) investigate the relationship between electric and magnetic fields in applications
(8) The student describes the nature of forces in the physical world. The student is expected to:	(H) investigate and describe the relationship between electric and magnetic fields in applications such as generators, motors, and transformers	(ii) describe the relationship between electric and magnetic fields in applications
(8) The student describes the nature of forces in the physical world. The student is expected to:	(I) describe technological applications of the strong and weak nuclear forces in nature	(i) describe technological applications of the strong nuclear forces in nature
(8) The student describes the nature of forces in the physical world. The student is expected to:	(I) describe technological applications of the strong and weak nuclear forces in nature	(ii) describe technological applications of the weak nuclear forces in nature
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(A) describe the tranformational process between work, potential energy, and kinetic energy (work-energy theorem)	(i) describe the transformational process between work, potential energy, and kinetic energy (work-energy theorem)
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(B) use examples to analyze and calculate the relationships among work, kinetic energy, and potential energy	(i) use examples to analyze the relationships among work, kinetic energy, and potential energy

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(B) use examples to analyze and calculate the relationships among work, kinetic energy, and potential energy	(ii) use examples to calculate the relationships among work, kinetic energy, and potential energy
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(i) describe the mechanical energy of a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(ii) describe the power generated within a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(iii) describe the impulse applied to a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(iv) describe the momentum of a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(v) calculate the mechanical energy of a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(vi) calculate the power generated within a physical system

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(vi) calculate the impulse applied to a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system	(vii) calculate the momentum of a physical system
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(D) describe and apply the laws of conservation of energy and conservation of momentum	(i) describe the laws of conservation of energy
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(D) describe and apply the laws of conservation of energy and conservation of momentum	(ii) describe the laws of conservation of momentum
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(D) describe and apply the laws of conservation of energy and conservation of momentum	(iii) apply the laws of conservation of energy
(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:	(D) describe and apply the laws of conservation of energy and conservation of momentum	(iv) apply the laws of conservation of momentum
(10) The student analyzes the concept of thermal energy. The student is expected to:	(A) describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms	(i) describe how the macroscopic properties of a thermodynamic system are related to the molecular level of matter, including kinetic energy of atoms

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student analyzes the concept of thermal energy. The student is expected to:	(B) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation	(i) contrast different processes of thermal energy transfer, including conduction, convection, and radiation
(10) The student analyzes the concept of thermal energy. The student is expected to:	(B) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation	(ii) give examples of different processes of thermal energy transfer, including conduction
(10) The student analyzes the concept of thermal energy. The student is expected to:	(B) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation	(iii) give examples of different processes of thermal energy transfer, including convection
(10) The student analyzes the concept of thermal energy. The student is expected to:	(B) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation	(iv) give examples of different processes of thermal energy transfer, including radiation
(10) The student analyzes the concept of thermal energy. The student is expected to:	(C) analyze and explain technological examples such as solar and wind energy that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy	(i) analyze technological examples that illustrate the laws of thermodynamics, including the law of conservation of energy
(10) The student analyzes the concept of thermal energy. The student is expected to:	(C) analyze and explain technological examples such as solar and wind energy that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy	(ii) analyze technological examples that illustrate the laws of thermodynamics, including the law of entropy
(10) The student analyzes the concept of thermal energy. The student is expected to:	(C) analyze and explain technological examples such as solar and wind energy that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy	(iii) explain technological examples that illustrate the laws of thermodynamics, including the law of conservation of energy

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student analyzes the concept of thermal energy. The student is expected to:	(C) analyze and explain technological examples such as solar and wind energy that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy	(iv) explain technological examples that illustrate the laws of thermodynamics, including the law of entropy
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(A) examine and describe oscillatory motion and wave propagation in various types of media	(i) examine oscillatory motion in various types of media
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(A) examine and describe oscillatory motion and wave propagation in various types of media	(ii) examine wave propagation in various types of media
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(A) examine and describe oscillatory motion and wave propagation in various types of media	(iii) describe oscillatory motion in various types of media
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(A) examine and describe oscillatory motion and wave propagation in various types of media	(iv) describe wave propagation in various types of media
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(i) investigate characteristics of waves, including period
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(ii) investigate characteristics of waves, including velocity
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(iii) investigate characteristics of waves, including frequency

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(iv) investigate characteristics of waves, including amptitude
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(v) investigate characteristics of waves, including wavelength
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(vi) analyze characteristics of waves, including period
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(vii) analyze characteristics of waves, including velocity
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(viii) analyze characteristics of waves, including frequency
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(ix) analyze characteristics of waves, including amptitude
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength	(x) analyze characteristics of waves, including wavelength

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(C) investigate and calculate the relationship between wave speed, frequency, and wavelength	(i) investigate the relationship between wave speed, frequency, and wavelength
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(C) investigate and calculate the relationship between wave speed, frequency, and wavelength	(ii) calculate the relationship between wave speed, frequency, and wavelength
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(D) compare and contrast the characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and longitudinal waves, including sound waves	(i) compare and contrast the characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and longitudinal waves, including sound waves
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect	(i) investigate behaviors of waves, including reflection
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(ii) investigate behaviors of waves, including refraction
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(iii) investigate behaviors of waves, including diffraction
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(iv) investigate behaviors of waves, including interference

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(v) investigate behaviors of waves, including resonance
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(vi) investigate behaviors of waves, including polarization
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect	(vii) investigate behaviors of waves, including the Doppler effect
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens	(i) describe image formation as a consequence of reflection from a plane mirror
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens	(ii) describe image formation as a consequence of refraction through a thin convex lens
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens	(iii) predict image formation as a consequence of reflection from a plane mirror
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens	(iv) predict image formation as a refraction through a thin convex lens

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(G) describe the role of wave characteristics and behaviors in medical and industrial technology applications	(i) describe the role of wave characteristics in medical technology applications
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(G) describe the role of wave characteristics and behaviors in medical and industrial technology applications	(ii) describe the role of wave characteristics in industrial technology applications
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(G) describe the role of wave characteristics and behaviors in medical and industrial technology applications	(iii) describe the role of wave behaviors in medical technology applications
(11) The student analyzes the properties of wave motion and optics. The student is expected to:	(G) describe the role of wave characteristics and behaviors in medical and industrial technology applications	(iv) describe the role of wave behaviors in industrial technology applications
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(A) describe the photoelectric effect and the dual nature of light	(i) describe the photoelectric effect
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(A) describe the photoelectric effect and the dual nature of light	(ii) describe the dual nature of light
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(B) compare and explain emission spectra produced by various atoms	(i) compare emission spectra produced by various atoms

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(B) compare and explain emission spectra produced by various atoms	(ii) explain emission spectra produced by various atoms
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(C) describe the significance of mass-energy equivalence and apply it in explanations of phenomena such as nuclear stability, fission, and fusion	(i) describe the significance of mass-energy equivalence
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(C) describe the significance of mass-energy equivalence and apply it in explanations of phenomena such as nuclear stability, fission, and fusion	(ii) apply [mass-energy equivalence] in explanations of phenomena
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(D) describe the process of radioactive decay given an isotope and half-life	(i) describe the process of radioactive decay given an isotope and half-life
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(E) describe the role of mass-energy equivalence for areas such as nuclear stability, fission, and fusion	(i) describe the role of mass-energy equivalence for areas
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(F) explore technology applications of atomic, nuclear, and quantum phenomena such as nanotechnology, radiation therapy, diagnostic imaging, and nuclear power	(i) explore technology applications of atomic phenomena
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(F) explore technology applications of atomic, nuclear, and quantum phenomena such as nanotechnology, radiation therapy, diagnostic imaging, and nuclear power	(ii) explore technology applications of nuclear phenomena

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:	(F) explore technology applications of atomic, nuclear, and quantum phenomena such as nanotechnology, radiation therapy, diagnostic imaging, and nuclear power	(iii) explore technology applications of quantum phenomena

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.405. AC/DC Electronics (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 7-8.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) AC/DC Electronics focuses on the basic electricity principles of alternating current/direct current (AC/DC) circuits. Students will demonstrate knowledge and applications of circuits, electronic measurement, and electronic implementation. Through use of the design process, students will transfer academic skills to component designs in a project-based environment. Students will use a variety of computer hardware and software applications to complete assignments and projects. Additionally, students will explore career opportunities, employer expectations, and educational needs in the electronics industry.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(i) present written communication in a clear manner, including explaining actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ii) present written communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iii) present written communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iv) present written communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(v) present written communication in an effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vi) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vii) present oral communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(viii) present oral communication in a clear manner, including justifying actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ix) present oral communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(x) present oral communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xi) present oral communication in an effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xii) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time management skills in performing goal-relevant activities in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences among an electronic technician, electronic technologist, and electrical engineer	(i) identify training opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(ii) identify education opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(iii) identify employment opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(iv) identify career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer;
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) investigate and work toward industry certifications	(i) investigate industry certifications
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) investigate and work toward industry certifications	(ii) work toward industry certifications
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(C) discuss ethical issues related to electronics	(i) discuss ethical issues related to electronics
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) identify and demonstrate respect for diversity in the workplace	(i) identify diversity in the workplace
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) identify and demonstrate respect for diversity in the workplace	(ii) demonstrate respect for diversity in the workplace
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(i) identify appropriate actions relating to discrimination

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(ii) demonstrate appropriate actions relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(iii) identify appropriate actions relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(iv) demonstrate appropriate actions relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(v) identify appropriate actions relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(vi) demonstrate appropriate actions relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(vii) identify appropriate consequences relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(viii) demonstrate appropriate consequences relating to discrimination

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(ix) identify appropriate consequences relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(x) demonstrate appropriate consequences relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(xi) identify appropriate consequences relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate appropriate actions and consequences relating to discrimination, harassment, and inequality	(xii) demonstrate appropriate consequences relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including job mentoring
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including job apprenticeship training

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(i) discuss Accreditation Board for Engineering and Technology (ABET) accreditation
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(ii) discuss Accreditation Board for Engineering and Technology (ABET) implications
(3) The student participates in team projects in various roles. The student is expected to:	(A) explain the importance of teamwork in the field of electronics	(i) explain the importance of teamwork in the field of electronics
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(i) apply principles of effective teamwork including collaboration
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(ii) apply principles of effective teamwork including conflict resolution
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(iii) apply principles of problem solving including collaboration
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(iv) apply principles of problem solving including conflict resolution
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(i) demonstrate proper attitudes as a team leader
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(ii) demonstrate proper attitudes as a team member

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implemement project management methodologies, including closing a project
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project; and
(4) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product
(5) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(i) identify governmental regulations for health in the workplace related to electronics
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(ii) identify governmental regulations for safety in the workplace related to electronics
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iii) identify organizational regulations for health in the workplace related to electronics

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iv) identify organizational regulations for safety in the workplace related to electronics
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(i) identify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(ii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(iii) identify hazardous materials according to industry standards
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(iv) classify hazardous materials according to industry standards
(5) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials appropriately	(i) dispose of hazardous materials appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(i) handle tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(ii) store tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iii) handle materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iv) store materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(i) describe the results of improper maintenance of material
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(ii) describe the results of improper maintenance of tools
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(iii) describe the results of improper maintenance of equipment
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(A) describe DC and give examples of its application and generation	(i) describe DC

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(A) describe DC and give examples of its application and generation	(ii) give examples of [DC] application
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(A) describe DC and give examples of its application and generation	(iii) give examples [DC] generation
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(B) demonstrate an understanding of atomic theory and the relationship between atomic number and a material's conductivity and insulation characteristics	(i) demonstrate an understanding of atomic theory
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(B) demonstrate an understanding of atomic theory and the relationship between atomic number and a material's conductivity and insulation characteristics	(ii) demonstrate an understanding of the relationship between atomic number and a material's conductivity and insulation characteristics
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(i) identify the proper use of electronic schematics and symbols, including switches
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(ii) identify the proper use of electronic schematics and symbols, including voltage
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(iii) identify the proper use of electronic schematics and symbols, including current

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(iv) identify the proper use of electronic schematics and symbols, including ground
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(v) identify the proper use of electronic schematics and symbols, including resistors
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(vi) identify the proper use of electronic schematics and symbols, including fuses
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(vii) identify the proper use of electronic schematics and symbols, including circuit breakers
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(viii) identify the proper use of electronic schematics and symbols, including volt meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(ix) identify the proper use of electronic schematics and symbols, including amp meters

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(x) apply the proper use of electronic schematics and symbols, including switches
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xi) apply the proper use of electronic schematics and symbols, including voltage
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xii) apply the proper use of electronic schematics and symbols, including current
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xiii) apply the proper use of electronic schematics and symbols, including ground
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xiv) apply the proper use of electronic schematics and symbols, including resistors
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xv) apply the proper use of electronic schematics and symbols, including fuses

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xvi) apply the proper use of electronic schematics and symbols, including circuit breakers
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xvii) apply the proper use of electronic schematics and symbols, including volt meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xviii) apply the proper use of electronic schematics and symbols, including amp meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(C) identify and apply the proper use of electronic schematics and symbols, including switches, voltage, current, ground, resistors, fuses, circuit breakers, volt meters, and amp meters	(xix) identify the proper use of electronic schematic symbols for amp meters;
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(i) define switches
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(ii) describe switches

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(iii) define voltage source
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(iv) describe [a] voltage source
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(v) define current source
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(vi) describe [a] current source
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(vii) define ground
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(viii) describe ground

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(ix) define resistors
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(x) describe resistors
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xi) define fuses
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xii) describe fuses
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xiii) define circuit breakers
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xiv) describe circuit breakers

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xv) define volt meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xvi) describe volt meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xvii) define amp meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xviii) describe amp meters
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xix) define voltage
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xx) describe voltage

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xxi) define current
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xxii) describe current
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xxiii) define resistance
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(D) define and describe switches, voltage source, current source, ground, resistors, fuses, circuit breakers, volt meters, amp meters, voltage, current, and resistance	(xxiv) describe resistance
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(E) identify the resistance value from the resistor color code	(i) identify the resistance value from the resistor color code
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(F) express Ohm's Law in three forms with appropriate symbols and units	(i) express Ohm's Law in three forms with appropriate symbols

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(F) express Ohm's Law in three forms with appropriate symbols and units	(ii) express Ohm's Law in three forms with appropriate units
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(G) express the Power Law in three forms with appropriate symbols and units	(i) express the Power Law in three forms with appropriate symbols
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(G) express the Power Law in three forms with appropriate symbols and units	(ii) express the Power Law in three forms with appropriate units
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(H) describe series, parallel, and combination circuits	(i) describe series circuits
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(H) describe series, parallel, and combination circuits	(ii) describe parallel circuits
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(H) describe series, parallel, and combination circuits	(iii) describe combination circuits
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(i) apply Ohm's Law to calculate current for each component in a multi-component series circuit

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(ii) apply Ohm's Law to calculate current for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(iii) apply Ohm's Law to calculate current for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(iv) apply Ohm's Law to calculate voltage drops for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(v) apply Ohm's Law to calculate voltage drops for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(vi) apply Ohm's Law to calculate voltage drops for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(vii) apply Ohm's Law to calculate resistance for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(viii) apply Ohm's Law to calculate resistance for each component in a multi-component parallel circuit

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(I) apply Ohm's Law to calculate current, voltage drops, and resistance for each component in a multi-component series, parallel, and combination circuit	(ix) apply Ohm's Law to calculate resistance for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(i) apply the Power Law to calculate current for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(ii) apply the Power Law Law to calculate current for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(iii) apply the Power Law to calculate current for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(iv) apply the Power Law to calculate voltage drops for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(v) apply the Power Law to calculate voltage drops for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(vi) apply the Power Law to calculate voltage drops for each component in a multi-component combination circuit

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(vii) apply the Power Law to calculate resistance for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(viii) apply the Power Law to calculate resistance for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(ix) apply the Power Law to calculate resistance for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(x) apply the Power Law to calculate power for each component in a multi-component series circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(xi) apply the Power Law to calculate power for each component in a multi-component parallel circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(J) apply the Power Law to calculate current, voltage drops, resistance, and power for each component in a multi-component series, parallel, and combination circuit	(xii) apply the Power Law to calculate power for each component in a multi-component combination circuit
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(K) express current and resistance values in both scientific notation and engineering notation	(i) express current values in scientific notation

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(K) express current and resistance values in both scientific notation and engineering notation	(ii) express current values in engineering notation
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(K) express current and resistance values in both scientific notation and engineering notation	(iii) express resistance values in scientific notation
(6) The student develops an understanding of basic direct current (DC) electricity principles. The student is expected to:	(K) express current and resistance values in both scientific notation and engineering notation	(iv) express resistance values in engineering notation
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(A) describe AC and give examples of its application and generation	(i) describe AC
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(A) describe AC and give examples of its application and generation	(ii) give examples of [AC] application
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(A) describe AC and give examples of its application and generation	(iii) give examples [AC] generation
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(B) calculate peak, peak-to-peak, average, and root mean square (RMS) voltage	(i) calculate peak voltage

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(B) calculate peak, peak-to-peak, average, and root mean square (RMS) voltage	(ii) calculate peak-to-peak voltage
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(B) calculate peak, peak-to-peak, average, and root mean square (RMS) voltage	(iii) calculate average voltage
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(B) calculate peak, peak-to-peak, average, and root mean square (RMS) voltage	(iv) calculate root mean square (RMS) voltage
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(C) explain the relationship between mechanical load and current in a generator	(i) explain the relationship between mechanical load and current in a generator
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(D) identify the purpose and application of a transformer	(i) identify the purpose of a transformer
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(D) identify the purpose and application of a transformer	(ii) identify the application of a transformer
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(E) identify voltage and current values relative to a turns ratio in a transformer	(i) identify voltage values relative to a turns ratio in a transformer

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(E) identify voltage and current values relative to a turns ratio in a transformer	(ii) identify current values relative to a turns ratio in a transformer
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(F) describe and calculate capacitance and capacitive reactance	(i) describe capacitance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(F) describe and calculate capacitance and capacitive reactance	(ii) calculate capacitance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(F) describe and calculate capacitance and capacitive reactance	(iii) describe capacitive reactance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(F) describe and calculate capacitance and capacitive reactance	(iv) calculate capacitive reactance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(G) describe and calculate inductance and inductive reactance	(i) describe inductance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(G) describe and calculate inductance and inductive reactance	(ii) calculate inductance

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(G) describe and calculate inductance and inductive reactance	(iii) describe inductive reactance
(7) The student develops an understanding of basic alternating current (AC) electricity principles. The student is expected to:	(G) describe and calculate inductance and inductive reactance	(iv) calculate inductive reactance
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to actual or simulated circuits	(i) apply Ohm's law to actual or simulated circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to actual or simulated circuits	(ii) apply Kirchhoff's laws to actual or simulated circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to actual or simulated circuits	(iii) apply power laws to actual or simulated circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(B) build series, parallel, and combination circuits	(i) build series circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(B) build series, parallel, and combination circuits	(ii) build parallel circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(B) build series, parallel, and combination circuits	(iii) build combination circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(C) demonstrate an understanding of magnetism and induction as they relate to electronic circuits	(i) demonstrate an understanding of magnetism as [it] relates to electronic circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(C) demonstrate an understanding of magnetism and induction as they relate to electronic circuits	(ii) demonstrate an understanding of induction as [it] relates to electronic circuits
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(D) perform electrical-electronic troubleshooting assignments	(i) perform electrical-electronic troubleshooting assignments
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(i) identify actual electronic components, including resistors
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(ii) identify actual electronic components, including capacitors
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(iii) identify actual electronic components, including switches

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(iv) identify actual electronic components, including fuses
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(v) identify actual electronic components, including power sources
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(E) identify actual electronic components, including resistors, capacitors, switches, fuses, power sources, and inductors	(vi) identify actual electronic components, including inductors

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(F) explain how torque is produced in a motor	(i) explain how torque is produced in a motor
(8) The student implements the concepts and skills that form the technical knowledge of electronics using project-based assessments. The student is expected to:	(G) explain where counter electromotive force (CEMF) comes from in a motor	(i) explain where counter electromotive force (CEMF) comes from in a motor
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(i) measure resistance in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(ii) measure resistance in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(iii) measure resistance in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(iv) calculate resistance in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(v) calculate resistance in parallel circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(vi) calculate resistance in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(vii) measure current in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(viii) measure current in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(ix) measure current in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(x) calculate current in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xi) calculate current in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xii) calculate current in complex circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xiii) measure voltage in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xiv) measure voltage in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xv) measure voltage in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xvi) calculate voltage in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xvii) calculate voltage in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xviii) calculate voltage in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xix) measure power in series circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xx) measure power in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xxi) measure power in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xxii) calculate power in series circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xxiii) calculate power in parallel circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(A) measure and calculate resistance, current, voltage, and power in series, parallel, and complex circuits	(xxiv) calculate power in complex circuits
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(B) apply electrical theory to generators, electric motors, and transformers	(i) apply electrical theory to generators
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(B) apply electrical theory to generators, electric motors, and transformers	(ii) apply electrical theory to electric motors

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(B) apply electrical theory to generators, electric motors, and transformers	(iii) apply electrical theory to transformers
(9) The student applies the concepts and skills to simulated and actual work situations. The student is expected to:	(C) design analog circuits using common components	(i) design analog circuits using common components
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(A) use tools and laboratory equipment to construct and repair circuits	(i) use tools to construct circuits
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(A) use tools and laboratory equipment to construct and repair circuits	(ii) use tools to repair circuits
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(A) use tools and laboratory equipment to construct and repair circuits	(iii) use laboratory equipment to construct circuits
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(A) use tools and laboratory equipment to construct and repair circuits	(iv) use laboratory equipment to repair circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(B) use precision measuring instruments to analyze circuits and prototypes	(i) use precision measuring instruments to analyze circuits
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(B) use precision measuring instruments to analyze circuits and prototypes	(ii) use precision measuring instruments to analyze prototypes
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(C) demonstrate an understanding of the difference between current and voltage measurement	(i) demonstrate an understanding of the difference between current and voltage measurement
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(D) use a multimeter to perform resistance, voltage, and current measurements	(i) use a multimeter to perform a resistance measurements
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(D) use a multimeter to perform resistance, voltage, and current measurements	(ii) use a multimeter to perform a voltage measurements
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(D) use a multimeter to perform resistance, voltage, and current measurements	(iii) use a multimenter to perform a current measurements

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(E) describe and perform measurements, including period and amplitude, using an oscilloscope	(i) describe measurements, including period, using an oscilloscope
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(E) describe and perform measurements, including period and amplitude, using an oscilloscope	(ii) describe measurements, including amplitude, using an oscilloscope
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(E) describe and perform measurements, including period and amplitude, using an oscilloscope	(iii) perform measurements, including period, using an oscilloscope
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(E) describe and perform measurements, including period and amplitude, using an oscilloscope	(iv) perform measurements, including amplitude, using an oscilloscope
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(F) use multiple software applications to simulate circuit behavior and present concepts	(i) use multiple software applications to simulate circuit behavior
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(F) use multiple software applications to simulate circuit behavior and present concepts	(ii) use multiple software applications to present concepts

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(i) use a project notebook to record measured values
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(ii) use a project notebook to record lab observations
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(iii) use a project notebook to record lab results
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(iv) use a project notebook to record circuit operational requirements
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(v) use a project notebook to record circuit design
(10) The student learns the function and application of the tools, equipment, and materials used in electronics through project-based assignments. The student is expected to:	(G) use a project notebook to record measured values, lab observations and results, circuit operational requirements, and circuit design and modifications	(vi) use a project notebook to record circuit modifications

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(A) interpret industry standard circuit schematics	(i) interpret industry standard circuit schematics
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a circuit	(i) identify areas where quality can be designed into a circuit
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a circuit	(ii) identify areas where reliability can be designed into a circuit
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a circuit	(iii) identify areas where safety can be designed into a circuit
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(C) improve a circuit design to meet a specified need	(i) improve a circuit design to meet a specified need
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(D) sketch schematics	(i) sketch schematics
(11) The student designs a circuit using appropriate design processes and techniques. The student is expected to:	(E) explore new technologies that may affect electronics	(i) explore new technologies that may affect electronics

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(i) identify the steps needed to produce a prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(ii) describe the steps needed to produce a prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(12) The student builds a prototype circuit using the appropriate tools, materials, and techniques. The student is expected to:	(C) present a final project using a variety of media	(i) present a final project using a variety of media

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.406. Solid State Electronics (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: AC/DC Electronics. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) In Solid State Electronics, students will demonstrate knowledge and applications of advanced circuits, electrical measurement, and electrical implementation used in the electronics and computer industries. Students will transfer advanced academic skills to apply engineering principles and technical skills to troubleshoot, repair, and modify electronic components, equipment, and power electronic systems in a project-based environment. Additionally, students will explore career opportunities, employer expectations, and educational needs in the electronics industry.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(i) present written communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ii) present written communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iii) present written communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iv) present written communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(v) present written communication in an effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vi) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vii) present oral communication in a clear manner, including explaining actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(viii) present oral communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ix) present oral communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(x) present oral communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xi) present oral communication in an effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xii) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time management skills in following schedules in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(i) identify training opportunities

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(ii) identify education opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(iii) identify employment opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) identify training, education, employment, and career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer	(iv) identify career opportunities, including differences between an electronic technician, electronic technologist, and electrical engineer;
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(C) identify industry certifications	(i) identify industry certifications

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to electronics and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to electronics
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to electronics and incorporate proper ethics in submitted projects	(ii) incorporate proper ethics in submitted projects
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(i) identify diversity in the workplace
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(ii) demonstrate respect for diversity in the workplace
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(i) identify appropriate actions relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(ii) identify appropriate actions relating to harrassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(iii) identify appropriate actions relating to inequality

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(iv) identify appropriate consequences relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(v) identify appropriate consequences relating to harrassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(vi) identify appropriate consequences relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore electronics career and preparation programs	(i) explore electronics careers
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore electronics career and preparation programs	(ii) explore electronics preparation programs
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including, but not limited to, job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including, but not limited to, job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including mentoring

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including, but not limited to, job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including apprenticeship training
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(i) discuss Accreditation Board for Engineering and Technology (ABET) accreditation
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(ii) discuss Accreditation Board for Engineering and Technology (ABET) implications
(3) The student participates in team projects in various roles. The student is expected to:	(A) explain the importance of teamwork in the field of electronics	(i) explain the importance of teamwork in the field of electronics
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(i) apply principles of effective teamwork, including collaboration
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(ii) apply principles of effective teamwork, including conflict resolution
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(iii) apply principles of effective problem solving, including collaboration
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective teamwork and problem solving, including collaboration and conflict resolution	(iv) apply principles of effective problem solving, including conflict resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(i) demonstrate proper attitudes as a team leader
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(ii) demonstrate proper attitudes as a team member
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(A) complete work orders and related documentation	(i) complete work orders
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(A) complete work orders and related documentation	(ii) complete related documentation

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(B) identify factors affecting cost and strategies to minimize costs	(i) identify factors affecting cost
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(B) identify factors affecting cost and strategies to minimize costs	(ii) identify strategies to minimize costs
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(C) prepare a project budget	(i) prepare a project budget
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(D) prepare a production schedule	(i) prepare a production schedule
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(E) identify intellectual property and other legal restrictions	(i) identify intellectual property
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(E) identify intellectual property and other legal restrictions	(ii) identify other legal restrictions
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(i) read technical drawings

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(ii) read technical manuals
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(iii) read technical bulletins
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(iv) interpret technical drawings
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(v) interpret technical manuals
(5) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(vi) interpret bulletins
(6) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(i) identify governmental regulations for health in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(ii) identify organizational regulations for health in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iii) identify governmental regulations for safety in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iv) identify organizational regulations for safety in the workplace related to electronicas
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(i) identify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(ii) identify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(v) identify hazardous materials according to industry standards
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(vi) identify hazardous wastes according to industry standards
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(vii) classify hazardous materials according to industry standards
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations and industry standards	(viii) classify hazardous wastes according to industry standards

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(i) handle tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(ii) handle materials correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iii) store tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iv) store materials correctly

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of negligent or improper maintenance of material, tools, and equipment	(i) describe the results of negligent or improper maintenance of material
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of negligent or improper maintenance of material, tools, and equipment	(ii) describe the results of negligent or improper maintenance of tools
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of negligent or improper maintenance of material, tools, and equipment	(iii) describe the results of negligent or improper maintenance of equipment
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to advanced circuit theory	(i) apply Ohm's laws to advanced circuit theory
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to advanced circuit theory	(ii) apply Kirchhoff's laws to advanced circuit theory
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(A) apply Ohm's law, Kirchhoff's laws, and power laws to advanced circuit theory	(iii) apply power laws to advanced circuit theory
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(i) demonstrate advanced knowledge of the theory of direct current through Thevenin's theorems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(ii) demonstrate advanced knowledge of the theory of direct current through Norton's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(iii) demonstrate advanced knowledge of the theory of alternating current through Thevenin's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(iv) demonstrate advanced knowledge of the theory of alternating current through Norton's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(v) demonstrate advanced knowledge of the theory of digital circuits through Thevenin's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(vi) demonstrate advanced knowledge of the theory of digital circuits through Norton's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(vii) demonstrate advanced knowledge of the theory of semi-conductor circuits through Thevenin's theorems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(B) demonstrate advanced knowledge of the theory of direct current, alternating current, digital circuits, and semi-conductor circuits through Thevenin's and Norton's theorems	(viii) demonstrate advanced knowledge of the theory of semi-conductor circuits through Norton's theorems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(C) apply knowledge of voltage regulation devices	(i) apply knowledge of voltage regulation devices
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(i) apply knowledge of the design of diodes with integrated circuits
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(ii) apply knowledge of the design of transistors with integrated circuits
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(iii) apply knowledge of the design of analog components with integrated circuits
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(iv) apply knowledge of the use of diodes with integrated circuits
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(v) apply knowledge of the use of transistors with integrated circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(D) apply knowledge of the design and use of diodes, transistors, and analog components with integrated circuits	(vi) apply knowledge of the use of analog components with integrated circuits
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(E) implement knowledge of solid-state components and devices such as a power supply design	(i) implement knowledge of solid-state components
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(E) implement knowledge of solid-state components and devices such as a power supply design	(ii) implement knowledge of solid-state devices
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(F) demonstrate knowledge of the similarities and differences in optoelectronic devices	(i) demonstrate knowledge of the similarities in optoelectronic devices
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(F) demonstrate knowledge of the similarities and differences in optoelectronic devices	(ii) demonstrate knowledge of the similarities and differences in optoelectronic devices
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(G) implement knowledge of transmission theory	(i) implement knowledge of transmission theory
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(H) implement knowledge of microprocessor applications	(i) implement knowledge of microprocessor applications

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(i) apply electronic theory to generators
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(ii) apply electronic theory to electric motors
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(iii) apply electronic theory to power supplies
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(iv) apply electronic theory to electronic amplifiers
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(v) apply electronic theory to electronic oscillators
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(vi) apply electronic theory to communication circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(I) apply electronic theory to generators, electric motors, power supplies, electronic amplifiers, electronic oscillators, communication circuits, and systems	(vii) apply electronic theory to systems
(7) The student implements the concepts and skills that form advanced knowledge of electronics using project-based rubrics. The student is expected to:	(J) complete advanced electrical-electronic troubleshooting assignments to industry standards	(i) complete advanced electrical-electronic troubleshooting assignments to industry standards
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair circuits	(i) use tools in a safe manner to construct circuits
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair circuits	(ii) use tools in a safe manner to repair circuits
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair circuits	(iii) use laboratory equipment in a safe manner to construct circuits
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair circuits	(iv) use laboratory equipment in a safe manner to repair circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze circuits and prototypes	(i) use precision measuring instruments to analyze circuits
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze circuits and prototypes	(ii) use precision measuring instruments to analyze prototypes
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(C) describe and perform measurement techniques with analog, digital, or storage oscilloscopes	(i) describe measurement techniques with analog, digital, or storage oscilloscopes
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(C) describe and perform measurement techniques with analog, digital, or storage oscilloscopes	(ii) perform measurement techniques with analog, digital, or storage oscilloscopes
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(D) use multiple software applications to simulate circuit behavior and present concepts	(i) use multiple software applications to simulate circuit behavior
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(D) use multiple software applications to simulate circuit behavior and present concepts	(ii) use multiple software applications to present concepts

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(E) identify and describe the functions of computer hardware devices	(i) identify the functions of computer hardware devices.
(8) The student learns the function and application of the tools, equipment, and materials used in electronics through specific project-based assessments. The student is expected to:	(E) identify and describe the functions of computer hardware devices	(ii) describe the functions of computer hardware devices
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(A) interpret advanced industry standard schematics	(i) interpret advanced industry standard schematics
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(i) identify areas where quality can be designed into a product
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(ii) identify areas where reliability can be designed into a product
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(iii) identify areas where safety can be designed into a product

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(C) improve a product design to meet a specified need	(i) improve a product design to meet a specified need
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(D) produce advanced schematics to industry standards	(i) produce advanced schematics to industry standards
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(E) discuss the process of obtaining a patent	(i) discuss the process of obtaining a patent
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(F) use a variety of technologies to design components such as computer simulation software	(i) use a variety of technologies to design components
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(G) explore innovative technologies that may affect electronics	(i) explore innovative technologies that may affect electronics
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(i) identify the steps needed to produce a prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(ii) describe the steps needed to produce a prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(10) The student builds a simulated or physical prototype using the appropriate tools, materials, and techniques. The student is expected to:	(C) present the prototype using a variety of media to a panel	(i) present the prototype using a variety of media to a panel

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.407 Digital Electronics (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 10-12. Prerequisites: Algebra I and Geometry. This course satisfies a high school mathematics graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Digital Electronics is the study of electronic circuits that are used to process and control digital signals. In contrast to analog electronics, where information is represented by a continuously varying voltage, digital signals are represented by two discreet voltages or logic levels. This distinction allows for greater signal speed and storage capabilities and has revolutionized the world of electronics. Digital electronics is the foundation of modern electronic devices such as cellular phones, digital audio players, laptop computers, digital cameras, and high-definition televisions. The primary focus of Digital Electronics is to expose students to the design process of combinational and sequential logic design, teamwork, communication methods, engineering standards, and technical documentation.

(4) The mathematical process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.
(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(6) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(i) present written communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ii) present written communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iii) present written communication in a effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iv) present written communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(v) present written communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vi) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vii) present oral communication in a clear manner, including explaining actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(viii) present oral communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ix) present oral communication in a effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(x) present oral communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xi) present oral communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xii) present oral communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(i) apply mathematics to problems arising in everyday life
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(ii) apply mathematics to problems arising in society
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(iii) apply mathematics to problems arising in the workplace
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution	(i) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(i) select tools, including real objects as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(ii) select tools, including manipulatives as appropriate, to solve problems

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iii) select tools, including paper and pencil as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iv) select tools, including technology as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(v) select techniques, including mental math as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vi) select techniques including estimation as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vii) select techniques, including number sense as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(i) communicate mathematical ideas using multiple representations, including symbols as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(ii) communicate mathematical ideas using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(iii) communicate mathematical ideas using multiple representations, including graphs as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(iv) communicate mathematical ideas using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(v) communicate mathematical reasoning using multiple representations, including symbols as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(vi) communicate mathematical reasoning using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(vii) communicate mathematical reasoning using multiple representations, including graphs as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(viii) communicate mathematical reasoning using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(ix) communicate [mathematical ideas'] implications using multiple representations, including symbols as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(x) communicate [mathematical ideas'] implications using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xi) communicate [mathematical ideas'] implications using multiple representations, including graphs as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xii) communicate [mathematical ideas'] implications using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xiii) communicate [mathematical reasoning's] implications using multiple representations, including symbols as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xiv) communicate [mathematical reasoning's] implications using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xv) communicate [mathematical reasoning's] implications using multiple representations, including graphs as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;	(xvi) communicate [mathematical reasoning's] implications using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(i) create representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(ii) create representations to record mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iii) create representations to communicate mathematical ideas

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iv) use representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(v) use representations to record mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(vi) use representations to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(i) analyze mathematical relationships to connect mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(ii) analyze mathematical relationships to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(i) display mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(ii) display mathematical arguments using precise mathematical language in written or oral communication

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(iii) explain mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(iv) explain mathematical arguments using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(v) justify mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	(vi) justify mathematical arguments using precise mathematical language in written or oral communication
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) distinguish the differences between an engineering technician, engineering technologist, and engineer	(i) distinguish the differences between an engineering technician, engineering technologist, and engineer
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(C) identify industry certifications	(i) identify industry certifications
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to engineering
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) discuss ethical issues related to technology
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(iii) incorporate proper ethics in submitted projects
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(i) identify respect for diversity in the workplace
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(ii) demonstrate respect for diversity in the workplace
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(i) identify appropriate actions relating to discrimination

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(ii) identify consequences relating to discrimination
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iii) identify appropriate actions relating to harrassment
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iv) identify consequences relating to harrassment
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(v) identify appropriate actions relating to inequality
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(vi) identify consequences relating to inequality
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(vii) demonstrate appropriate actions and identify consequences relating to discrimination
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(viii) demonstrate appropriate actions relating to discrimination

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(ix) demonstrate appropriate actions relating to harrassment
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify and demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(x) demonstrate appropriate actions relating to inequality
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore electronics engineering careers and preparation programs	(i) explore electronics engineering careers
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore electronics engineering careers and preparation programs	(ii) explore electronics engineering preparation programs
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including mentoring
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including apprenticeship training

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(i) discuss Accreditation Board for Engineering and Technology (ABET) accreditation
(3) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(ii) discuss Accreditation Board for Engineering and Technology (ABET) implications
(4) The student participates in team projects in various roles. The student is expected to:	(A) explain the importance of teamwork in the field of electronics	(i) explain the importance of teamwork in the field of electronics
(4) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective problem solving in teams to practice collaboration and conflict resolution	(i) apply principles of effective problem solving in teams to practice collaboration
(4) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective problem solving in teams to practice collaboration and conflict resolution	(ii) apply principles of effective problem solving in teams to practice conflict resolution
(4) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(i) demonstrate proper attitudes as a team leader
(4) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(ii) demonstrate proper attitudes as a team member
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(5) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(5) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(5) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(5) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project
(5) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product
(6) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(i) identify governmental regulations for health in the workplace related to electronics

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(ii) identify governmental regulations for safety in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iii) identify organizational regulations for health in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(iv) identify organizational regulations for safety in the workplace related to electronics
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(i) identify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(ii) identify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment
(6) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(i) handle tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(ii) handle materials correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iii) store tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iv) store materials correctly

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(i) describe the results of improper maintenance of material
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(ii) describe the results of improper maintenance of tools
(6) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(iii) describe the results of improper maintenance of equipment
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(A) use scientific notation, engineering notation, and Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics	(i) use scientific notation to conveniently write very large or very small numbers frequently encountered when working with electronics
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(A) use scientific notation, engineering notation, and Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics	(ii) use engineering notation to conveniently write very large or very small numbers frequently encountered when working with electronics
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(A) use scientific notation, engineering notation, and Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics	(iii) use Systems International (SI) notation to conveniently write very large or very small numbers frequently encountered when working with electronics
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(B) describe the process of soldering and how it is used in the assembly of electronic components	(i) describe the process of soldering

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(B) describe the process of soldering and how it is used in the assembly of electronic components	(ii) describe how [soldering] is used in the assembly of electronic components
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(C) explain the different waveforms and distinctive characteristics of analog and digital signals	(i) explain the different waveforms of analog signals
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(C) explain the different waveforms and distinctive characteristics of analog and digital signals	(ii) explain the different waveforms of digital signals
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(C) explain the different waveforms and distinctive characteristics of analog and digital signals	(iii) explain the distinctive characteristics of analog signals
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(C) explain the different waveforms and distinctive characteristics of analog and digital signals	(iv) explain the distinctive characteristics of digital signals
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(D) identify the voltage levels of analog and digital signals	(i) identify the voltage levels of analog signals

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(D) identify the voltage levels of analog and digital signals	(ii) identify the voltage levels of digital signals
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(E) determine whether a material is a conductor, an insulator, or a semiconductor based on its atomic structure	(i) determine whether a material is a conductor, an insulator, or a semiconductor based on its atomic structure
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(F) analyze the three fundamental concepts of voltage, current, and resistance	(i) analyze the fundamental concept of voltage
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(F) analyze the three fundamental concepts of voltage, current, and resistance	(ii) analyze the fundamental concept of current
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(F) analyze the three fundamental concepts of voltage, current, and resistance	(iii) analyze the fundamental concept of resistance
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(G) define circuit design software and explain its purpose	(i) define circuit design software

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(G) define circuit design software and explain its purpose	(ii) explain [circuit design software's] purpose
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(H) identify the fundamental building block of sequential logic	(i) identify the fundamental building block of sequential logic
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(I) identify the components of a manufacturer's datasheet, including a logic gate's general description, connection diagram, and function table	(i) identify the components of a manufacturer's datasheet, including a logic gate's general description
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(I) identify the components of a manufacturer's datasheet, including a logic gate's general description, connection diagram, and function table	(ii) identify the components of a manufacturer's datasheet, including a connection diagram
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(I) identify the components of a manufacturer's datasheet, including a logic gate's general description, connection diagram, and function table	(iii) identify the components of a manufacturer's datasheet, including a function table
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(J) categorize integrated circuits by their underlying circuitry, scale of integration, and packaging style	(i) categorize integrated circuits by their underlying circuitry

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(J) categorize integrated circuits by their underlying circuitry, scale of integration, and packaging style	(ii) categorize integrated circuits by their scale of integration
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(J) categorize integrated circuits by their underlying circuitry, scale of integration, and packaging style	(iii) categorize integrated circuits by their packaging style
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(K) describe the advantages and disadvantages of the various sub-families of transistor-transistor logic (TTL) gates	(i) describe the advantages of the various sub-families of transistor-transistor logic (TTL) gates
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(K) describe the advantages and disadvantages of the various sub-families of transistor-transistor logic (TTL) gates	(ii) describe the disadvantages of the various sub-families of transistor-transistor logic (TTL) gates
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(L) explain that a logic gate is depicted by its schematic symbol, logic expression, and truth table	(i) explain that a logic gate is depicted by its schematic symbol, logic expression, and truth table
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(M) evaluate the different functions of input and output values of combinational and sequential logic	(i) evaluate the different functions of input values of combinational logic

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(M) evaluate the different functions of input and output values of combinational and sequential logic	(ii) evaluate the different functions of input values of sequential logic
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(M) evaluate the different functions of input and output values of combinational and sequential logic	(iii) evaluate the different functions of output values of combinational logic
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(M) evaluate the different functions of input and output values of combinational and sequential logic	(iv) evaluate the different functions of output values of sequential logic
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(N) explain combinational logic designs implemented with AND gates, OR gates, and INVERTER gates	(i) explain combinational logic designs implemented with AND gates
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(N) explain combinational logic designs implemented with AND gates, OR gates, and INVERTER gates	(ii) explain combinational logic designs implemented with OR gates
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(N) explain combinational logic designs implemented with AND gates, OR gates, and INVERTER gates	(iii) explain combinational logic designs implemented with INVERTER gates

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student explores the fundamentals of analog and digital electronics. The student uses appropriate notation and understands the logic of circuit design and logic gates. The student is expected to:	(O) identify the fundamental building block of sequential logic	(i) identify the fundamental building block of sequential logic
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(A) develop an understanding of the binary number system and its relationship to the decimal number system as an essential component in the combinational logic design process	(i) develop an understanding of the binary number system
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(A) develop an understanding of the binary number system and its relationship to the decimal number system as an essential component in the combinational logic design process	(ii) develop an understanding of the [binary number system's] relationship to the decimal number system as an essential component in the combinational logic design process
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(B) translate a set of design specifications into a truth table to describe the behavior of a combinational logic design by listing all possible input combinations and the desired output for each	(i) translate a set of design specifications into a truth table to describe the behavior of a combinational logic design by listing all possible input combinations
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(B) translate a set of design specifications into a truth table to describe the behavior of a combinational logic design by listing all possible input combinations and the desired output for each	(ii) translate a set of design specifications into a truth table to describe the behavior of a combinational logic design by listing the desired output for each
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(C) derive logic expressions from a given truth table	(i) derive logic expressions from a given truth table

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(D) demonstrate logic expressions in sum-of-products (SOP) form and products-of-sum (POS) form	(i) demonstrate logic expressions in sum-of-products (SOP) form
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(D) demonstrate logic expressions in sum-of-products (SOP) form and products-of-sum (POS) form	(ii) demonstrate logic expressions in products-of-sum (POS) form
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(E) explain how all logic expressions, whether simplified or not, can be implemented using AND gates and INVERTER gates or OR gates and INVERTER gates	(i) explain how all logic expressions, whether simplified or not, can be implemented using AND gates and INVERTER gates or OR gates and INVERTER gates
(8) The student understands and uses multiple forms of AND-OR-Invert (AOI) logic. The student is expected to:	(F) apply a formal design process to translate a set of design specifications into a functional combinational logic circuit	(i) apply a formal design process to translate a set of design specifications into a functional combinational logic circuit
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(A) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing two, three, and four variables	(i) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing two variables
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(A) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing two, three, and four variables	(ii) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing three variables
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(A) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing two, three, and four variables	(iii) apply the Karnaugh Mapping graphical technique to simplify logic expressions containing four variables

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(B) define a "don't care" condition and explain its significance	(i) define a "don't care" condition
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(B) define a "don't care" condition and explain its significance	(ii) explain [a "don't care" condition's] significance
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(C) explain why NAND and NOR gates are considered universal gates	(i) explain why NAND gates are considered universal gates
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(C) explain why NAND and NOR gates are considered universal gates	(ii) explain why NOR gates are considered universal gates
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(D) demonstrate implementation of a combinational logic expression using only NAND gates or only NOR gates	(i) demonstrate implementation of a combinational logic expression using only NAND gates or only NOR gates
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(E) discuss the formal design process used for translating a set of design specifications into a functional combinational logic circuit implemented with NAND or NOR gates	(i) discuss the formal design process used for translating a set of design specifications into a functional combinational logic circuit implemented with NAND or NOR gates

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands, explains, and applies NAND and NOR Logic and understands the benefits of using universal gates. The student is expected to:	(F) explain why combinational logic designs implemented with NAND gates or NOR gates will typically require fewer integrated circuits (IC) than AOI equivalent implementations	(i) explain why combinational logic designs implemented with NAND gates or NOR gates will typically require fewer integrated circuits (IC) than AOI equivalent implementations
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(A) use seven-segment displays used to display the digits 0-9 as well as some alpha characters	(i) use seven-segment displays used to display the digits 0-9 as well as some alpha characters
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(B) identify the two varieties of seven-segment displays	(i) identify the two varieties of seven-segment displays
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(C) describe the formal design process used for translating a set of design specifications into a functional combinational logic circuit	(i) describe the formal design process used for translating a set of design specifications into a functional combinational logic circuit

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(D) develop an understanding of the hexadecimal and octal number systems and their relationships to the decimal number system	(i) develop an understanding of the hexadecimal number system
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(D) develop an understanding of the hexadecimal and octal number systems and their relationships to the decimal number system	(ii) develop an understanding of the octal number system
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(D) develop an understanding of the hexadecimal and octal number systems and their relationships to the decimal number system	(iii) develop an understanding of their relationships to the decimal number system
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(E) explain the primary intended purpose of Exclusive OR (XOR) and Exclusive NOR (XNOR) gates	(i) explain the primary intended purpose of Exclusive OR (XOR) gates

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(E) explain the primary intended purpose of Exclusive OR (XOR) and Exclusive NOR (XNOR) gates	(ii) explain the primary intended purpose of Exclusive NOR (XNOR) gates
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(F) describe how to accomplish the addition of two binary numbers of any bit length	(i) describe how to accomplish the addition of two binary numbers of any bit length
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(G) explain when multiplexer/de-multiplexer pairs are most frequently used	(i) explain when multiplexer/de-multiplexer pairs are most frequently used
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(H) explain the purpose of using de-multiplexers in electronic displays that use multiple seven-segment displays	(i) explain the purpose of using de-multiplexers in electronic displays that use multiple seven-segment displays

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(I) identify the most commonly used method for handling negative numbers in digital electronics	(i) identify the most commonly used method for handling negative numbers in digital electronics
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(J) discuss the use of programmable logic devices and explain designs for which they are best suited	(i) discuss the use of programmable logic devices
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(J) discuss the use of programmable logic devices and explain designs for which they are best suited	(ii) explain designs for which [programmable logic devices] are best suited
(10) The student understands combinational logic systems, including seven-segment displays, Exclusive OR and Exclusive NOR gates, and multiplexer/de-multiplexer pairs. The student understands the relative value of various logic approaches. The student is expected to:	(K) compare and contrast circuits implemented with programmable logic devices with circuits implemented with discrete logic	(i) compare and contrast circuits implemented with programmable logic devices with circuits implemented with discrete logic

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(A) explain the capabilities of flip-flop and transparent latch logic devices	(i) explain the capabilities of flip-flop logic devices
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(A) explain the capabilities of flip-flop and transparent latch logic devices	(ii) explain the capabilities of transparent latch logic devices
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(B) discuss synchronous and asynchronous inputs of flip-flops and transparent latches	(i) discuss synchronous inputs of flip-flops
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(B) discuss synchronous and asynchronous inputs of flip-flops and transparent latches	(ii) discuss synchronous inputs of transparent latches
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(B) discuss synchronous and asynchronous inputs of flip-flops and transparent latches	(iii) discuss asynchronous inputs of flip-flops
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(B) discuss synchronous and asynchronous inputs of flip-flops and transparent latches	(iv) discuss asynchronous inputs of transparent latches
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(C) explore the use of flip-flops, including designing single event detection circuits, data synchronizers, shift registers, and frequency dividers	(i) explore the use of flip-flops, including designing single event detection circuits

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(C) explore the use of flip-flops, including designing single event detection circuits, data synchronizers, shift registers, and frequency dividers	(ii) explore the use of flip-flops, including designing data synchronizers
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(C) explore the use of flip-flops, including designing single event detection circuits, data synchronizers, shift registers, and frequency dividers	(iii) explore the use of flip-flops, including designing shift registers
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(C) explore the use of flip-flops, including designing single event detection circuits, data synchronizers, shift registers, and frequency dividers	(iv) explore the use of flip-flops, including designing frequency dividers
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(D) explain how asynchronous counters are characterized and how they can be implemented	(i) explain how asynchronous counters are characterized
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(D) explain how asynchronous counters are characterized and how they can be implemented	(ii) explain how [asynchronous counters] can be implemented
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(E) explore the use of the asynchronous counter method to implement up counters, down counters, and modulus counters	(i) explore the use of the asynchronous counter method to implement up counters

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(E) explore the use of the asynchronous counter method to implement up counters, down counters, and modulus counters	(ii) explore the use of the asynchronous counter method to implement down counters
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(E) explore the use of the asynchronous counter method to implement up counters, down counters, and modulus counters	(iii) explore the use of the asynchronous counter method to implement modulus counters
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(F) explain how synchronous counters are characterized and how they can be implemented	(i) explain how synchronous counters are characterized
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(F) explain how synchronous counters are characterized and how they can be implemented	(ii) explain how [synchronous counters] can be implemented
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(G) explore the use of the synchronous counter method to implement up counters, down counters, and modulus counters	(i) explore the use of the synchronous counter method to implement up counters
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(G) explore the use of the synchronous counter method to implement up counters, down counters, and modulus counters	(ii) explore the use of the synchronous counter method to implement down counters
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(G) explore the use of the synchronous counter method to implement up counters, down counters, and modulus counters	(iii) explore the use of the synchronous counter method to implement modules counters

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(H) describe a state machine	(i) describe a state machine
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(I) identify common everyday devices that machines are used to control such as elevator doors, traffic lights, and combinational or electronic locks	(i) identify common everyday devices that machines are used to control
(11) The student understands and describes multiple types of sequential logic and various uses of sequential logic. The student is expected to:	(J) discuss various ways state machines can be implemented	(i) discuss various ways state machines can be implemented
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(A) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians, computer programmers, engineers, and other professionals and the benefits of various flowcharting techniques	(i) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(A) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians, computer programmers, engineers, and other professionals and the benefits of various flowcharting techniques	(ii) demonstrate an understanding of the use of flowcharts as graphical organizers by computer programmers
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(A) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians, computer programmers, engineers, and other professionals and the benefits of various flowcharting techniques	(iii) demonstrate an understanding of the use of flowcharts as graphical organizers by engineers

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(A) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians, computer programmers, engineers, and other professionals and the benefits of various flowcharting techniques	(iv) demonstrate an understanding of the use of flowcharts as graphical organizers by other professionals
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(A) demonstrate an understanding of the use of flowcharts as graphical organizers by technicians, computer programmers, engineers, and other professionals and the benefits of various flowcharting techniques	(v) demonstrate an understanding of the benefits of various flowcharting techniques
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(B) develop an understanding of basic programming skills, including variable declaration, loops, and debugging	(i) develop an understanding of basic programming skills, including variable declaration
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(B) develop an understanding of basic programming skills, including variable declaration, loops, and debugging	(ii) develop an understanding of basic programming skills, including loops
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(B) develop an understanding of basic programming skills, including variable declaration, loops, and debugging	(iii) develop an understanding of basic programming skills, including debugging
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(C) identify everyday products that use microcontrollers such as robots, garage door openers, traffic lights, and home thermostats	(i) identify everyday products that use microcontrollers

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(D) describe a servo motor	(ii) describe a servo motor
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(E) explore the way microcontrollers sense and respond to outside stimuli	(i) explore the way microcontrollers sense outside stimuli
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(E) explore the way microcontrollers sense and respond to outside stimuli	(ii) explore the way microcontrollers respond to outside stimuli
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(F) explain why digital devices are only relevant if they can interact with the real world	(i) explain why digital devices are only relevant if they can interact with the real world
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(G) explain the importance of digital control devices, including microcontrollers in controlling mechanical systems	(i) explain the importance of digital control devices, including microcontrollers in controlling mechanical systems
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(H) demonstrate an understanding that realistic problem solving with a control system requires the ability to interface analog inputs and outputs with a digital device	(i) demonstrate an understanding that realistic problem solving with a control system requires the ability to interface analog inputs with a digital device

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student explores microcontrollers, specifically their usefulness in real-world applications. The student is expected to:	(H) demonstrate an understanding that realistic problem solving with a control system requires the ability to interface analog inputs and outputs with a digital device	(ii) demonstrate an understanding that realistic problem solving with a control system requires the ability to interface analog outputs with a digital device

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.408. Robotics I (One Credit), Adopted 2015.**
(a) General Requirements. TThis course is recommended for students in Grades 9 and 10. Recommended prerequisite: Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.	
(b) Introduction.	
(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. (2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services. (3) In Robotics I, students will transfer academic skills to component designs in a project-based environment through implementation of the design process. Students will build prototypes or use simulation software to test their designs. Additionally, students will explore career opportunities, employer expectations, and educational needs in the robotic and automation industry. (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations. (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) demonstrate the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) demonstrate the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) demonstrate the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(i) present written communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ii) present written communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iii) present written communication in a effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iv) present written communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(v) present written communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vi) present written communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vii) present oral communication in a clear manner, including explaining actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(viii) present oral communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ix) present oral communication in a effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(x) present oral communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xi) present oral communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xii) present oral communication in a effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(A) distinguish the differences between an engineering technician, engineering technologist, and engineer	(i) distinguish the differences between an engineering technician, engineering technologist, and engineer
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(C) identify industry certifications	(i) identify industry certifications
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to engineering and technology
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(D) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) incorporate proper ethics in submitted projects
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(i) identify respect for diversity in the workplace

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(E) identify and demonstrate respect for diversity in the workplace	(ii) demonstrate respect for diversity in the workplace
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(i) identify appropriate actions relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(ii) identify appropriate actions relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(iii) identify appropriate actions relating to inequality
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(iv) identify appropriate consequences relating to discrimination
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(v) identify appropriate consequences relating to harassment
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(F) identify appropriate actions and consequences relating to discrimination, harassment, and inequality	(vi) identify appropriate consequences relating to inequality

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore robotic engineering careers and preparation programs	(i) explore robotic engineering careers
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(G) explore robotic engineering careers and preparation programs	(ii) explore robotic engineering preparation programs
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including mentoring
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(H) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including apprenticeship training
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(i) discuss Accreditation Board for Engineering and Technology (ABET) accreditation
(2) The student demonstrates the skills necessary for success in a technical career. The student is expected to:	(I) discuss Accreditation Board for Engineering and Technology (ABET) accreditation and implications	(ii) discuss Accreditation Board for Engineering and Technology (ABET) implications

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student participates in team projects in various roles. The student is expected to:	(A) explain the importance of teamwork in the field of robotics	(i) explain the importance of teamwork in the field of robotics
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective problem solving in teams to collaboration and conflict resolution	(i) apply principles of effective problem solving in teams to collaboration
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply principles of effective problem solving in teams to collaboration and conflict resolution	(ii) apply principles of effective problem solving in teams to conflict resolution
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(i) demonstrate proper attitudes as a team leader
(3) The student participates in team projects in various roles. The student is expected to:	(C) demonstrate proper attitudes as a team leader and team member	(ii) demonstrate proper attitudes as a team member
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(i) identify governmental regulations for health and safety in the workplace related to electronics
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify governmental and organizational regulations for health and safety in the workplace related to electronics	(ii) identify organizational regulations for health and safety in the workplace related to electronics
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(i) identify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(ii) identify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(D) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(E) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment
(5) The student practices safe and proper work habits. The student is expected to:	(F) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(i) handle tools correctly

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(ii) handle materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iii) store tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) handle and store tools and materials correctly	(iv) store materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(i) describe the results of improper maintenance of material
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(ii) describe the results of improper maintenance of tools
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of improper maintenance of material, tools, and equipment	(iii) describe the results of improper maintenance of equipment
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(A) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems	(i) demonstrate the use of computers to manipulate a robotic or automated system
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(A) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems	(ii) demonstrate the use of computers to manipulate subsystems [associated with robotic or automated systems]

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) maintain systems to ensure safe and proper function and precision operation	(i) maintain systems to ensure safe function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) maintain systems to ensure safe and proper function and precision operation	(ii) maintain systems to ensure proper function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) maintain systems to ensure safe and proper function and precision operation	(iii) maintain systems to ensure precision operation
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(C) describe feedback control loops used to provide information	(i) describe feedback control loops used to provide information
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(D) describe types and functions of sensors used in robotic systems	(i) describe types of sensors used in robotic systems
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(D) describe types and functions of sensors used in robotic systems	(ii) describe functions of sensors used in robotic systems
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(A) demonstrate knowledge of Newton's Laws as applied to robotics such as rotational dynamics, torque, weight, friction, and traction factors required for the operation of robotic systems	(i) demonstrate knowledge of Newton's Laws as applied to robotics

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems	(i) demonstrate knowledge of motors used in the robotic systems
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems	(ii) demonstrate knowledge of gears used in the robotic systems
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems	(iii) demonstrate knowledge of gear ratios used in the robotic systems
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(B) demonstrate knowledge of motors, gears, gear ratios, and gear trains used in the robotic systems	(iv) demonstrate knowledge of gear trains used in the robotic systems
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(C) describe the application of the six simple machines to robotics	(i) describe the application of the six simple machines to robotics
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(D) describe the operation of direct current (DC) motors, including control, speed, and torque	(i) describe the operation of direct current (DC) motors, including control
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(D) describe the operation of direct current (DC) motors, including control, speed, and torque	(ii) describe the operation of direct current (DC) motors, including speed

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(D) describe the operation of direct current (DC) motors, including control, speed, and torque	(iii) describe the operation of direct current (DC) motors, including torque
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(E) describe the operation of servo motors, including control, angle, and torque	(i) describe the operation of servo motors, including control
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(E) describe the operation of servo motors, including control, angle, and torque	(ii) describe the operation of servo motors, including angle
(7) The student develops an understanding of engineering principles and fundamental physics. The student is expected to:	(E) describe the operation of servo motors, including control, angle, and torque	(iii) describe the operation of servo motors, including torque
(8) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(A) describe the relationship between robotic arm construction and robot stability	(i) describe the relationship between robotic arm construction and robot stability
(8) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) describe the relationship between torque and gear ratio to weight of payload in a robotic arm operation	(i) describe the relationship between torque and gear ratio to weight of payload in a robotic arm operation

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate knowledge of linkages and gearing in end effectors used in a robotic arm system	(i) demonstrate knowledge of linkages in end effectors used in a robotic arm system
(8) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate knowledge of linkages and gearing in end effectors used in a robotic arm system	(ii) demonstrate knowledge of gearing in end effectors used in a robotic arm system
(9) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss the design process	(i) demonstrate an understanding of the design process
(9) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss the design process	(ii) discuss the design process
(9) The student uses engineering design methodologies. The student is expected to:	(B) think critically, identify the system constraints, and make fact-based decisions	(i) think critically
(9) The student uses engineering design methodologies. The student is expected to:	(B) think critically, identify the system constraints, and make fact-based decisions	(ii) identify system constraints
(9) The student uses engineering design methodologies. The student is expected to:	(B) think critically, identify the system constraints, and make fact-based decisions	(iii) make fact-based decisions

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student uses engineering design methodologies. The student is expected to:	(C) apply testing and reiteration strategies to develop or improve a product	(i) apply testing strategies to develop or improve a product
(9) The student uses engineering design methodologies. The student is expected to:	(C) apply testing and reiteration strategies to develop or improve a product	(ii) apply reiteration strategies to develop or improve a product
(9) The student uses engineering design methodologies. The student is expected to:	(D) apply decision-making strategies when developing solutions	(i) apply decision-making strategies when developing solutions
(9) The student uses engineering design methodologies. The student is expected to:	(E) identify quality-control issues in engineering design and production	(i) identify quality-control issues in engineering design
(9) The student uses engineering design methodologies. The student is expected to:	(E) identify quality-control issues in engineering design and production	(ii) identify quality-control issues in engineering production
(9) The student uses engineering design methodologies. The student is expected to:	(F) describe perceptions of the quality of products and how they affect engineering decisions	(i) describe perceptions of the quality of products
(9) The student uses engineering design methodologies. The student is expected to:	(F) describe perceptions of the quality of products and how they affect engineering decisions	(ii) describe how [perceptions of the quality of products] affect engineering decisions
(9) The student uses engineering design methodologies. The student is expected to:	(G) use an engineering notebook to document the project design process as a legal document	(i) use an engineering notebook to document the project design process as a legal document
(9) The student uses engineering design methodologies. The student is expected to:	(H) interpret industry standard system schematics	(i) interpret industry standard system schematics

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair systems	(i) use tools in a safe manner to construct systems
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair systems	(ii) use tools in a safe manner to repair systems
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair systems	(iii) use laboratory equipment in a safe manner to construct systems
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use tools and laboratory equipment in a safe manner to construct and repair systems	(iv) use laboratory equipment in a safe manner to repair systems
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze systems and prototypes	(i) use precision measuring instruments to analyze systems
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze systems and prototypes	(ii) use precision measuring instruments to analyze prototypes

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) use multiple software applications to simulate robot behavior and present concepts	(i) use multiple software applications to simulate robot behavior
(10) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) use multiple software applications to simulate robot behavior and present concepts	(ii) use multiple software applications to present concepts
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(i) identify the steps needed to produce a prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(ii) describe the steps needed to produce a prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(C) construct a robotic or automated system to perform specified operations using the design process	(i) construct a robotic or automated system to perform specified operations using the design process

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(D) test and evaluate the design in relation to pre-established requirements such as criteria and constraints	(i) test the design in relation to pre-established requirements
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(D) test and evaluate the design in relation to pre-established requirements such as criteria and constraints	(ii) evaluate the design in relation to pre-established requirements
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(E) refine the design of a robotic or automated system to ensure quality, efficiency, and manufacturability of the final product	(i) refine the design of a robotic or automated system to ensure quality of the final product
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(E) refine the design of a robotic or automated system to ensure quality, efficiency, and manufacturability of the final product	(ii) refine the design of a robotic or automated system to ensure efficiency of the final product
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(E) refine the design of a robotic or automated system to ensure quality, efficiency, and manufacturability of the final product	(iii) refine the design of a robotic or automated system to ensure manufacturability of the final product
(11) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(F) present the final product using a variety of media	(i) present the final product using a variety of media

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.409. Robotics II (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 10-12. Prerequisite: Robotics I. This course satisfies a high school mathematics graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) In Robotics II, students will explore artificial intelligence and programming in the robotic and automation industry. Through implementation of the design process, students will transfer academic skills to component designs in a project-based environment. Students will build prototypes and use software to test their designs.
(4) The mathematical process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.
(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(6) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) distinguish the differences among an engineering technician, engineering technologist, and engineer	(i) distinguish the differences among an engineering technician, engineering technologist, and engineer
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) identify industry certifications	(i) identify industry certifications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) recognize the principles of teamwork related to engineering and technology	(i) recognize the principles of teamwork related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) recognize the principles of teamwork related to engineering and technology	(ii) recognize the principles of teamwork related to technology

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) identify and use appropriate work habits	(i) identify appropriate work habits
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) identify and use appropriate work habits	(ii) use appropriate work habits
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(i) locate governmental regulations, including health codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(ii) locate governmental regulations, including safety codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(iii) locate governmental regulations, labor codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(iv) locate laws, including health codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(v) locate laws, including safety codes related to engineering

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(vi) locate laws, including labor codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(vii) report on governmental regulations, including health codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(viii) report on governmental regulations, including safety codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(ix) report on governmental regulations, labor codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(x) report on laws, including health codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(xi) report on laws, including safety codes related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) locate and report on governmental regulations and laws, including health, safety, and labor codes related to engineering	(xii) report on laws, including labor codes related to engineering

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to engineering
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) discuss ethical issues related to technology
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(iii) incorporate proper ethics in submitted projects
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) demonstrate respect for diversity in the workplace	(i) demonstrate respect for diversity in the workplace
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(i) demonstrate appropriate actions relating to discrimination
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(ii) demonstrate appropriate actions relating to harassment
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iii) demonstrate appropriate actions relating to inequality

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iv) identify consequences relating to discrimination
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(v) identify consequences relating to harassment
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(vi) identify consequences relating to inequality
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(i) demonstrate effective oral communication skills using a variety of software applications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(ii) demonstrate effective oral communication skills using a variety of media
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iii) demonstrate effective written communication skills using a variety of software applications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iv) demonstrate effective written communication skills using a variety of media

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(K) explore robotic engineering careers and preparation programs	(i) explore robotic engineering careers
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(K) explore robotic engineering careers and preparation programs	(ii) explore robotic engineering preparation programs
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(i) apply mathematics to problems arising in everyday life
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(ii) apply mathematics to problems arising in society
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(iii) apply mathematics to problems arising in the workplace
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution	(i) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution	(ii) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the reasonableness of the solution
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(i) select tools, including real objects as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(ii) select tools, including manipulatives as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iii) select tools, including paper and pencil as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iv) select tools, including technology as appropriate, to solve problems

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(v) select techniques, including mental math as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vi) select techniques including estimation as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vii) select techniques, including number sense as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(i) communicate mathematical ideas using multiple representations, including symbols as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(ii) communicate mathematical ideas using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(iii) communicate mathematical ideas using multiple representations, including graphs as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(iv) communicate mathematical ideas using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(v) communicate mathematical reasoning using multiple representations, including symbols as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(vi) communicate mathematical reasoning using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(vii) communicate mathematical reasoning using multiple representations, including graphs as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(viii) communicate mathematical reasoning using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(ix) communicate [mathematical ideas'] implications using multiple representations, including symbols as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(x) communicate [mathematical ideas'] implications using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xi) communicate [mathematical ideas'] implications using multiple representations, including graphs as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xii) communicate [mathematical ideas'] implications using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xiii) communicate [mathematical reasoning's] implications using multiple representations, including symbols as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xiv) communicate [mathematical reasoning's] implications using multiple representations, including diagrams as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xv) communicate [mathematical reasoning's] implications using multiple representations, including graphs as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate	(xvi) communicate [mathematical reasoning's] implications using multiple representations, including language as appropriate
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(i) create representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(ii) create representations to record mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iii) create representations to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iv) use representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(v) use representations to record mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(vi) use representations to communicate mathematical ideas

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(i) analyze mathematical relationships to connect mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(ii) analyze mathematical relationships to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(i) display mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(ii) display mathematical arguments using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(iii) explain mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(iv) explain mathematical arguments using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(v) justify mathematical ideas using precise mathematical language in written or oral communication

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(vi) justify mathematical arguments using precise mathematical language in written or oral communication
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(i) demonstrate an understanding of how teams function
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(ii) discuss how teams function
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(B) apply teamwork to solve problems	(i) apply teamwork to solve problems
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(C) follow directions and decisions of responsible individuals of the project team	(i) follow directions of responsible individuals of the project team
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(C) follow directions and decisions of responsible individuals of the project team	(ii) follow decisions of responsible individuals of the project team
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(D) participate in establishing team procedures and team norms	(i) participate in establishing team procedures

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(D) participate in establishing team procedures and team norms	(ii) participate in establishing team norms
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(E) work cooperatively with others to set and accomplish goals in both competitive and non-competitive situations	(i) work cooperatively with others to set goals in competitive situations
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(E) work cooperatively with others to set and accomplish goals in both competitive and non-competitive situations	(ii) work cooperatively with others to set goals in non-competive situations
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(E) work cooperatively with others to set and accomplish goals in both competitive and non-competitive situations	(iii) work cooperatively with others to accomplish goals in competitive situations
(3) The student learns and contributes productively as an individual and as a member of a project team. The student is expected to:	(E) work cooperatively with others to set and accomplish goals in both competitive and non-competitive situations	(iv) work cooperatively with others to accomplish goals in non-competitive situations
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(4) The student develops skills of project management. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(4) The student develops skills of project management. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(4) The student develops skills of project management. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria
(4) The student develops skills of project management. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(4) The student develops skills of project management. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills of project management. The student is expected to:	(D) translate and employ a Project Management Plan for production of a product	(i) translate a Project Management Plan for production of a product
(4) The student develops skills of project management. The student is expected to:	(D) translate and employ a Project Management Plan for production of a product	(ii) employ a Project Management Plan for production of a product
(5) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(i) identify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(ii) identify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(E) comply with established guidelines for working in a lab environment	(i) comply with established guidelines for working in a lab environment
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(i) handle tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(ii) handle materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iii) store tools correctly

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iv) store materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(G) employ established inventory control and organization procedures	(i) employ established inventory control procedures
(5) The student practices safe and proper work habits. The student is expected to:	(G) employ established inventory control and organization procedures	(ii) employ established inventory organization procedures
(5) The student practices safe and proper work habits. The student is expected to:	(H) describe the results of negligent or improper maintenance	(i) describe the results of negligent or improper maintenance
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(A) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems	(i) demonstrate the use of computers to manipulate a robotic or automated system and associated subsystems
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(i) troubleshoot systems to ensure safe function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(ii) troubleshoot systems to ensure proper function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(iii) troubleshoot systems to ensure precision operation

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(iv) troubleshoot subsystems to ensure safe function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(v) troubleshoot subsystems to ensure proper function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(vi) troubleshoot subsystems to ensure precision operation
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(vii) maintain systems to ensure safe function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(viii) maintain systems to ensure proper function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(ix) maintain systems to ensure precision operation
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(x) maintain subsystems to ensure safe function

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(xi) maintain subsystems to ensure proper function
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(B) troubleshoot and maintain systems and subsystems to ensure safe and proper function and precision operation	(xii) maintain subsystems to ensure precision operation
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(C) implement feedback control loops used to provide information	(i) implement feedback control loops used to provide information
(6) The student develops the ability to use and maintain technological products, processes, and systems. The student is expected to:	(D) implement different types of sensors used in robotic or automated systems and their operations	(i) implement different types of sensors used in robotic or automated systems and their operations
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(A) apply the concepts of acceleration and velocity as they relate to robotic and automated systems	(i) apply the concepts of acceleration as they relate to robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(A) apply the concepts of acceleration and velocity as they relate to robotic and automated systems	(ii) apply the concepts of acceleration as they relate to automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(A) apply the concepts of acceleration and velocity as they relate to robotic and automated systems	(iii) apply the concepts of velocity as they relate to robotic systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(A) apply the concepts of acceleration and velocity as they relate to robotic and automated systems	(iv) apply the concepts of velocity as they relate to automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(B) describe the term degrees of freedom and apply it to the design of joints used in robotic and automated systems	(i) describe the term degrees of freedom
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(B) describe the term degrees of freedom and apply it to the design of joints used in robotic and automated systems	(ii) apply the term [degrees of freedom] to the design of joints used in robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(B) describe the term degrees of freedom and apply it to the design of joints used in robotic and automated systems	(iii) apply the term [degrees of freedom] to the design of joints used in automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(C) describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility	(i) describe angular momentum
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(C) describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility	(ii) integrate [angular momentum] in the design of robotic joint motion
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(C) describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility	(iii) integrate [angular momentum] in the design of robotic joint stability

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(C) describe angular momentum and integrate it in the design of robotic joint motion, stability, and mobility	(iv) integrate [angular momentum] in the design of robotic joint mobility
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(D) use the impulse-momentum theory in the design of robotic and automated systems	(i) use the impulse-momentum theory in the design of robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(D) use the impulse-momentum theory in the design of robotic and automated systems	(ii) use the impulse-momentum theory in the design of automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(i) explain translational motion in the design of robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(ii) explain rotational motion in the design of robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(iii) explain oscillatory motion in the design of robotic systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(iv) explain translational motion in the design of automated systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(v) explain rotational motion in the design of automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(E) explain translational, rotational, and oscillatory motion in the design of robotic and automated systems	(vi) explain oscillatory motion in the design of automated systems
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(F) apply the operation of direct current (DC) motors, including control, speed, and torque	(i) apply the operation of direct current (DC) motors, including control
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(F) apply the operation of direct current (DC) motors, including control, speed, and torque	(ii) apply the operation of direct current (DC) motors, including speed
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(F) apply the operation of direct current (DC) motors, including control, speed, and torque	(iii) apply the operation of direct current (DC) motors, including torque
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(G) apply the operation of servo motors, including control, angle, and torque	(i) apply the operation of servo motors, including control
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(G) apply the operation of servo motors, including control, angle, and torque	(ii) apply the operation of servo motors, including angle

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(G) apply the operation of servo motors, including control, angle, and torque	(iii) apply the operation of servo motors, including torque
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(H) interpret sensor feedback and calculate threshold values	(i) interpret sensor feedback
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(H) interpret sensor feedback and calculate threshold values	(ii) calculate threshold values
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(I) apply measurement and geometry to calculate robot navigation	(i) apply measurement to calculate robot navigation
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(I) apply measurement and geometry to calculate robot navigation	(ii) apply geometry to calculate robot navigation
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(J) implement movement control using encoders	(i) implement movement control using encoders
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(K) implement path planning using geometry and multiple sensor feedback	(i) implement path planning using geometry

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student demonstrates an understanding of advanced mathematics and physics in robotic and automated systems. The student is expected to:	(K) implement path planning using geometry and multiple sensor feedback	(ii) implement path planning using multiple sensor feedback
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(A) use coding languages and proper syntax	(i) use coding languages
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(A) use coding languages and proper syntax	(ii) use proper syntax
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(B) use programming best practices for commenting and documentation	(i) use programming best practices for commenting
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(B) use programming best practices for commenting and documentation	(ii) use programming best practices for documentation
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(C) describe how and why logic is used to control the flow of the program	(i) describe how logic is used to control the flow of the program
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(C) describe how and why logic is used to control the flow of the program	(ii) describe why logic is used to control the flow of the program
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(D) create a program flowchart and write the pseudocode for a program to perform an operation	(i) create a program flowchart

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(D) create a program flowchart and write the pseudocode for a program to perform an operation	(ii) write the pseudocode for a program to perform an operation
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(E) create algorithms for evaluating a condition and performing an appropriate action using decisions	(i) create algorithms for evaluating a condition
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(E) create algorithms for evaluating a condition and performing an appropriate action using decisions	(ii) create algorithms for performing an appropriate action using decisions
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(F) create algorithms that loop through a series of actions for a specified increment and for as long as a given condition exists	(i) create algorithms that loop through a series of actions for a specified increment
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(F) create algorithms that loop through a series of actions for a specified increment and for as long as a given condition exists	(ii) create algorithms that loop through a series of actions for as long as a given condition exists
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(G) create algorithms that evaluate sensor data as variables to provide feedback control	(i) create algorithms that evaluate sensor data as variables to provide feedback control
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(H) use output commands and variables	(i) use output commands
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(H) use output commands and variables	(ii) use output variables

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(I) use selection programming structures such as jumps, loops, switch, and case	(i) use selection programming structures
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(J) implement subroutines and functions	(i) implement subroutines
(8) The student creates a program to control a robotic or automated system. The student is expected to:	(J) implement subroutines and functions	(ii) implement functions
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(A) demonstrate knowledge of robotic or automated system arm construction	(i) demonstrate knowledge of robotic or automated system arm construction
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(i) demonstrate an understanding of torque in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(ii) demonstrate an understanding of gear ratio in a robotic or automated system arm operation

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(iii) demonstrate an understanding of stability in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(iv) demonstrate an understanding of weight of payload in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(v) apply the concepts of torque in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(vi) apply the concepts of gear ratio in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(vii) apply the concepts of stability in a robotic or automated system arm operation

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(B) demonstrate an understanding and apply the concepts of torque, gear ratio, stability, and weight of payload in a robotic or automated system arm operation	(viii) apply the concepts of weight of payload in a robotic or automated system arm operation
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(i) demonstrate an understanding of linkages in end effectors in a robotic or an automated arm system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(ii) demonstrate an understanding of gearing in end effectors in a robotic or an automated arm system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(iii) demonstrate an understanding of [linkages'] use in a robotic or an automated system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(iv) demonstrate an understanding of [gearing's] use in a robotic or an automated system

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(v) apply the concepts of linkages in end effectors in a robotic or an automated arm system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(vi) apply the concepts of gearing in end effectors in a robotic or an automated arm system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(vii) apply the concepts of [linkages'] use in a robotic or an automated system
(9) The student develops an understanding of the characteristics and scope of manipulators, accumulators, and end effectors required for a robotic or automated system to function. The student is expected to:	(C) demonstrate an understanding and apply the concepts of linkages and gearing in end effectors and their use in a robotic or an automated arm system	(viii) apply the concepts of [gearing's] use in a robotic or an automated system
(10) The student uses engineering design methodologies. The student is expected to:	(A) implement the design process	(i) implement the design process
(10) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(i) demonstrate critical thinking

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(ii) identify the system constraints
(10) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(iii) make fact-based decisions
(10) The student uses engineering design methodologies. The student is expected to:	(C) apply formal testing and reiteration strategies to develop or improve a product	(i) apply formal testing strategies to develop or improve a product
(10) The student uses engineering design methodologies. The student is expected to:	(C) apply formal testing and reiteration strategies to develop or improve a product	(ii) apply reiteration strategies to develop or improve a product
(10) The student uses engineering design methodologies. The student is expected to:	(D) apply and defend decision-making strategies when developing solutions	(i) apply decision-making strategies when developing solutions
(10) The student uses engineering design methodologies. The student is expected to:	(D) apply and defend decision-making strategies when developing solutions	(ii) defend decision-making strategies when developing solutions
(10) The student uses engineering design methodologies. The student is expected to:	(E) identify and improve quality-control issues in engineering design and production	(i) identify quality-control issues in engineering design
(10) The student uses engineering design methodologies. The student is expected to:	(E) identify and improve quality-control issues in engineering design and production	(ii) identify quality-control issues in production
(10) The student uses engineering design methodologies. The student is expected to:	(E) identify and improve quality-control issues in engineering design and production	(iii) improve quality-control issues in engineering design

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student uses engineering design methodologies. The student is expected to:	(E) identify and improve quality-control issues in engineering design and production	(iv) improve quality-control issues in production
(10) The student uses engineering design methodologies. The student is expected to:	(F) apply Six Sigma to analyze the quality of products and how it affects engineering decisions	(i) apply Six Sigma to analyze the quality of products
(10) The student uses engineering design methodologies. The student is expected to:	(F) apply Six Sigma to analyze the quality of products and how it affects engineering decisions	(ii) apply Six Sigma to analyze how [quality] affects engineering decisions
(10) The student uses engineering design methodologies. The student is expected to:	(G) use an engineering notebook to document the project design process as a legal document	(i) use an engineering notebook to document the project design process as a legal document

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student uses engineering design methodologies. The student is expected to:	(H) create and interpret industry standard system schematics	(i) create industry standard system schematics
(10) The student uses engineering design methodologies. The student is expected to:	(H) create and interpret industry standard system schematics	(ii) interpret industry standard system schematics
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(i) use tools in a safe manner to construct systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(ii) use tools in a safe manner to repair systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(iii) use laboratory equipment in a safe manner to construct systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(iv) use laboratory equipment in a safe manner to repair systems

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(v) maintain tools in a safe manner to construct systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(vi) maintain tools in a safe manner to repair systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(vii) maintain laboratory equipment in a safe manner to construct systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(A) use and maintain tools and laboratory equipment in a safe manner to construct and repair systems	(viii) maintain laboratory equipment in a safe manner to repair systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze systems and prototypes	(i) use precision measuring instruments to analyze systems
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(B) use precision measuring instruments to analyze systems and prototypes	(ii) use precision measuring instruments to analyze prototypes

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(i) implement a system to identify all components of the robotic or automated system
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(ii) implement a system to track all components of the robotic or automated system
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(iii) implement a system to identify all elements involved with operation
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(iv) implement a system to identify all elements involved with construction
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(v) implement a system to identify all elements involved with manipulative functions
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(vi) implement a system to track all elements involved with operation

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(vii) implement a system to track all elements involved with construction
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(C) implement a system to identify and track all components of the robotic or automated system and all elements involved with the operation, construction, and manipulative functions	(viii) implement a system to track all elements involved with manipulative functions
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(D) use multiple software applications to simulate robot behavior and present concepts	(i) use multiple software applications to simulate robot behavior
(11) The student learns the function and application of the tools, equipment, and materials used in robotic and automated systems through specific project-based assessments. The student is expected to:	(D) use multiple software applications to simulate robot behavior and present concepts	(ii) use multiple software applications to present concepts
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(A) use the design process to design a robotic or automated system that meets pre-established criteria and constraints	(i) use the design process to design a robotic or automated system that meets pre-established criteria
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(A) use the design process to design a robotic or automated system that meets pre-established criteria and constraints	(ii) use the design process to design a robotic or automated system that meets pre-established constraints

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(C) implement sensors in the robotic or automated system	(i) implement sensors in the robotic or automated system
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(D) construct the robotic or automated system	(i) construct the robotic or automated system
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(E) use the design process to evaluate and formally test the design	(i) use the design process to evaluate the design
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(E) use the design process to evaluate and formally test the design	(ii) use the design process to formally test the design
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(F) refine the design of the robotic or automated system to ensure quality, efficiency, and manufacturability of the final robotic or automated system	(i) refine the design of the robotic or automated system to ensure quality of the final robotic or automated system

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(F) refine the design of the robotic or automated system to ensure quality, efficiency, and manufacturability of the final robotic or automated system	(ii) refine the design of the robotic or automated system to ensure efficiency of the final robotic or automated system
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(F) refine the design of the robotic or automated system to ensure quality, efficiency, and manufacturability of the final robotic or automated system	(iii) refine the design of the robotic or automated system to ensure manufacturability of the final robotic or automated system
(12) The student produces a product using the appropriate tools, materials, and techniques. The student is expected to:	(G) present the final product using a variety of media	(i) present the final product using a variety of media

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.410. Engineering Design and Presentation I (One Credit), Adopted 2015.**
(a) General Requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I Recommended prerequisite: Principles of Applied Engineering. Students shall be awarded one credit for successful completion of this course.	
(b) Introduction.	
(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. (2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services. (3) Engineering Design and Presentation I is a continuation of knowledge and skills learned in Principles of Applied Engineering. Students enrolled in this course will demonstrate knowledge and skills of the design process as it applies to engineering fields using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Students will use a variety of computer hardware and software applications to complete assignments and projects. Through implementation of the design process, students will transfer advanced academic skills to component designs. Additionally, students explore career opportunities in engineering, technology, and drafting and what is required to gain and maintain employment in these areas. (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations. (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession and work site	(iv) demonstrate knowledge of how to conduct oneself in a manner appropriate for the work site
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(i) cooperate as a member of a group in an effort to attain agreement
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(ii) contribute as a member of a group in an effort to attain agreement

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(iii) collaborate as a member of a group in an effort to attain agreement
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(iv) cooperate as a member of a group in an effort to achieve a collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(v) contribute as a member of a group in an effort to achieve a collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) cooperate, contribute, and collaborate as a member of a group in an effort to attain agreement and achieve a collective outcome	(vi) collaborate as a member of a group in an effort to achieve a collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(i) present written communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ii) present written communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iii) present written communication in a[n] effective manner, including explaining actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(iv) present written communication in a clear manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(v) present written communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vi) present written communication in a[n] effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(vii) present oral communication in a clear manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(viii) present oral communication in a concise manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(ix) present oral communication in a[n] effective manner, including explaining actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(x) present oral communication in a clear manner, including justifying actions

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xi) present oral communication in a concise manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner, including explaining and justifying actions	(xii) present oral communication in a[n] effective manner, including justifying actions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(i) use time-management skills in prioritizing tasks in a way that optimizes efficiency
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(ii) use time-management skills in following schedules in a way that optimizes efficiency
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(iii) use time-management skills in tending to goal-relevant activities in a way that optimizes efficiency
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(iv) use time-management skills in prioritizing tasks in a way that optimizes results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(v) use time-management skills in following schedules in a way that optimizes results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) use time-management skills in prioritizing tasks, following schedules, and tending to goal-relevant activities in a way that optimizes efficiency and results	(vi) use time-management skills in tending to goal-relevant activities in a way that optimizes results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(i) complete a consistent demonstration of punctuality in reporting for duty
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(ii) complete a consistent demonstration of dependability in reporting for duty
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(iii) complete a consistent demonstration of reliability in reporting for duty
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(iv) complete a consistent demonstration of responsibility in reporting for duty
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(v) complete a consistent demonstration of punctuality in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(vi) complete a consistent demonstration of dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(vii) complete a consistent demonstration of reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) complete a consistent demonstration of punctuality, dependability, reliability, and responsibility in reporting for duty and performing assigned tasks as directed	(viii) complete a consistent demonstration of responsibility in performing assigned tasks as directed
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(A) distinguish the differences between an engineering technician, engineering technologist, and engineer	(i) distinguish the differences between an engineering technician, engineering technologist, and engineer
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(C) investigate and work toward industry certifications	(i) investigate industry certifications
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(C) investigate and work toward industry certifications	(ii) work toward industry certifications
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(D) demonstrate the principles of teamwork related to engineering and technology	(i) demonstrate the principles of teamwork related to engineering
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(D) demonstrate the principles of teamwork related to engineering and technology	(ii) demonstrate the principles of teamwork related to technology
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(E) identify and use appropriate work habits	(i) identify appropriate work habits
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(E) identify and use appropriate work habits	(ii) use appropriate work habits
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(F) demonstrate knowledge related to governmental regulations, including health and safety	(i) demonstrate knowledge related to governmental regulations, including health and safety

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to engineering
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) discuss ethical issues related to technology
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(iii) incorporate proper ethics in submitted projects
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) discuss ethical issues related to technology
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(H) demonstrate respect for diversity in the workplace	(i) demonstrate respect for diversity in the workplace
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(i) demonstrate appropriate actions relating to discrimination
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(ii) demonstrate appropriate actions relating to harassment

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iii) demonstrate appropriate actions relating to inequality
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iv) identify consequences relating to discrimination
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(v) identify consequences relating to harassment
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(vi) identify consequences relating to inequality
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(i) demonstrate effective oral communication skills using a variety of software applications
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(ii) demonstrate effective oral communication skills using a variety of media
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iii) demonstrate effective written communication skills using a variety of software applications

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iv) demonstrate effective written communication skills using a variety of media
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including mentoring
(2) The student gains knowledge of and demonstrates the skills necessary for success in the workplace. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including apprenticeship training
(3) The student participates in team projects in various roles. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(i) demonstrate an understanding of how teams function
(3) The student participates in team projects in various roles. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(ii) discuss how teams function
(3) The student participates in team projects in various roles. The student is expected to:	(B) apply teamwork to solve problems	(i) apply teamwork to solve problems

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student participates in team projects in various roles. The student is expected to:	(C) serve as both a team leader and member and demonstrate appropriate attitudes while participating in team projects	(i) serve as a team leader
(3) The student participates in team projects in various roles. The student is expected to:	(C) serve as both a team leader and member and demonstrate appropriate attitudes while participating in team projects	(ii) serve as a team member
(3) The student participates in team projects in various roles. The student is expected to:	(C) serve as both a team leader and member and demonstrate appropriate attitudes while participating in team projects	(iii) demonstrate appropriate attitudes while participating in team projects
(3) The student participates in team projects in various roles. The student is expected to:	(C) serve as both a team leader and member and demonstrate appropriate attitudes while participating in team projects	(ii) serve as a team member
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(4) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(i) develop a project schedule
(4) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete work according to established criteria	(ii) complete work according to established criteria
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(ii) participate in the operation of a real or simulated engineering project
(4) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions
(5) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(i) identify hazardous materials
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(ii) identify wastes
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(5) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(5) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools
(5) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment
(5) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(i) handle tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(ii) handle materials correctly
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iii) store tools correctly
(5) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iv) store materials correctly

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student practices safe and proper work habits. The student is expected to:	(G) describe the results of negligent or improper maintenance	(i) describe the results of negligent or improper maintenance
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(A) use single- and multi-view projections	(i) use single-view projections
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(A) use single and multi-view projections	(ii) use multi-view projections
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(B) use orthographic and pictorial views	(i) use orthographic views
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(B) use orthographic and pictorial views	(ii) use pictorial views
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(C) use auxiliary views	(i) use auxiliary views
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(D) use section views	(i) use section views

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(E) use advanced construction techniques	(i) use advanced construction techniques
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(F) prepare and revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards	(i) prepare annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(F) prepare and revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards	(ii) revise annotated multi-dimensional production drawings in computer-aided drafting and design to industry standards
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(G) demonstrate knowledge of effective file structure and management	(i) demonstrate knowledge of effective file structure
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(G) demonstrate knowledge of effective file structure and management	(ii) demonstrate knowledge of effective file management
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(H) use advanced dimensioning techniques	(i) use advanced dimensioning techniques
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(I) construct and use basic 3D parametric drawings	(i) construct basic 3D parametric drawings

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(I) construct and use basic 3D parametric drawings	(ii) use basic 3D parametric drawings
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(J) develop and use prototype drawings for presentation	(i) develop prototype drawings for presentation
(6) The student applies the concepts of sketching and skills associated with computer-aided drafting and design. The student is expected to:	(J) develop and use prototype drawings for presentation	(ii) use prototype drawings for presentation
(7) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss principles of ideation	(i) demonstrate an understanding of principles of ideation
(7) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss principles of ideation	(ii) discuss principles of ideation
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(i) demonstrate critical thinking
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(ii) identify the system constraints
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(iii) make fact-based decisions

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student uses engineering design methodologies. The student is expected to:	(C) use rational thinking to develop or improve a product	(i) use rational thinking to develop or improve a product
(7) The student uses engineering design methodologies. The student is expected to:	(D) apply decision-making strategies when developing solutions	(i) apply decision-making strategies when developing solutions
(7) The student uses engineering design methodologies. The student is expected to:	(E) use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process	(i) use an engineering notebook to record record prototypes, corrections, and/or mistakes in the design process
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(i) use an engineering notebook to record the final design of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(ii) use an engineering notebook to record the construction of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(iii) use an engineering notebook to record the manipulation of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(iv) use [a] portfolio to record the final design of finished projects

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(v) use [a] portfolio to record the construction of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(F) use an engineering notebook and portfolio to record the final design, construction, and manipulation of finished projects	(vi) use [a] portfolio to record the final manipulation of finished projects
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(A) use a variety of technologies to design components	(i) use a variety of technologies to design components
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(i) use tools to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(ii) use laboratory equipment to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(iii) use precision measuring instruments to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(C) research applications of different types of computer-aided drafting and design software	(i) research applications of different types of computer-aided drafting and design software
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(D) use multiple software applications for concept presentations	(i) use multiple software applications for concept presentations

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(A) interpret engineering drawings	(i) interpret engineering drawings
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(i) identify areas where quality can be designed into a product
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(ii) identify areas where reliability can be designed into a product
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a product	(iii) identify areas where safety can be designed into a product
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(C) improve a product design to meet a specified need	(i) improve a product design to meet a specified need
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(D) produce engineering drawings to industry standards	(i) produce engineering drawings to industry standards
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(E) describe potential patents and the patenting process	(i) describe potential patents

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student designs products using appropriate design processes and techniques. The student is expected to:	(E) describe potential patents and the patenting process	(ii) describe the patenting process
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(i) identify the steps needed to produce a prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(ii) describe the steps needed to produce a prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(C) present the prototype using a variety of media	(i) present the prototype using a variety of media

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.411. Engineering Design and Presentation II (Two Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Algebra I and Geometry. Recommended prerequisite: Principles of Applied Engineering or Engineering Design and Presentation I. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Engineering Design and Presentation II is a continuation of knowledge and skills learned in Engineering Design and Presentation I. Students enrolled in this course will demonstrate knowledge and skills of the design process as it applies to engineering fields using multiple software applications and tools necessary to produce and present working drawings, solid model renderings, and prototypes. Students will use a variety of computer hardware and software applications to complete assignments and projects. Through implementation of the design process, students will transfer advanced academic skills to component designs. Emphasis will be placed on using skills from ideation through prototyping.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) distinguish the differences between an engineering technician, engineering technologist, and engineer	(i) distinguish the differences between an engineering technician, engineering technologist, and engineer
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) identify employment and career opportunities	(i) identify employment opportunities
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) identify employment and career opportunities	(ii) identify career opportunities
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) investigate and work toward industry certifications	(i) investigate industry certifications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) investigate and work toward industry certifications	(ii) work toward industry certifications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate the principles of teamwork related to engineering and technology	(i) demonstrate the principles of teamwork related to engineering

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate the principles of teamwork related to engineering and technology	(ii) demonstrate the principles of teamwork related to technology
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) identify and use appropriate work habits	(i) identify appropriate work habits
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) identify and use appropriate work habits	(ii) use appropriate work habits
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) demonstrate knowledge related to governmental regulations, including health and safety	(i) demonstrate knowledge related to governmental regulations, including health and safety
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(i) discuss ethical issues related to engineering and technology
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) incorporate proper ethics in submitted projects
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) discuss ethical issues related to engineering and technology and incorporate proper ethics in submitted projects	(ii) discuss ethical issues related to technology

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) demonstrate respect for diversity in the workplace	(i) demonstrate respect for diversity in the workplace
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(i) demonstrate appropriate actions relating to discrimination
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(ii) demonstrate appropriate actions relating to harassment
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iii) demonstrate appropriate actions relating to inequality
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(iv) identify consequences relating to discrimination
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(v) identify consequences relating to harassment
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(I) demonstrate appropriate actions and identify consequences relating to discrimination, harassment, and inequality	(vi) identify consequences relating to inequality

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(i) demonstrate effective oral communication skills using a variety of software applications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(ii) demonstrate effective oral communication skills using a variety of media
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iii) demonstrate effective written communication skills using a variety of software applications
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(J) demonstrate effective oral and written communication skills using a variety of software applications and media	(iv) demonstrate effective written communication skills using a variety of media
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(i) explore career preparation learning experiences, including job shadowing
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(ii) explore career preparation learning experiences, including mentoring
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(K) explore career preparation learning experiences, including job shadowing, mentoring, and apprenticeship training	(iii) explore career preparation learning experiences, including apprenticeship training

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student participates in team projects in various roles. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(i) demonstrate an understanding of how teams function
(2) The student participates in team projects in various roles. The student is expected to:	(A) demonstrate an understanding of and discuss how teams function	(ii) discuss how teams function
(2) The student participates in team projects in various roles. The student is expected to:	(B) apply teamwork to solve problems	(i) apply teamwork to solve problems
(2) The student participates in team projects in various roles. The student is expected to:	(C) serve as a team leader and member and demonstrate appropriate attitudes while participating in team projects	(i) serve as a team leader
(2) The student participates in team projects in various roles. The student is expected to:	(C) serve as a team leader and member and demonstrate appropriate attitudes while participating in team projects	(ii) serve as a team member
(2) The student participates in team projects in various roles. The student is expected to:	(C) serve as a team leader and member and demonstrate appropriate attitudes while participating in team projects	(iii) demonstrate appropriate attitudes while participating in team projects
(2) The student participates in team projects in various roles. The student is expected to:	(C) serve as a team leader and member and demonstrate appropriate attitudes while participating in team projects	(ii) serve as a team member
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) implement project management methodologies, including initiating a project

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) implement project management methodologies, including planning a project
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) implement project management methodologies, including executing a project
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) implement project management methodologies, including monitoring a project
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) implement project management methodologies, including controlling a project
(3) The student develops skills for managing a project. The student is expected to:	(A) implement project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) implement project management methodologies, including closing a project
(3) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete projects according to established criteria	(i) develop a project schedule
(3) The student develops skills for managing a project. The student is expected to:	(B) develop a project schedule and complete projects according to established criteria	(ii) complete projects according to established criteria

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the organization of a real or simulated engineering project
(3) The student develops skills for managing a project. The student is expected to:	(C) participate in the organization and operation of a real or simulated engineering project	(i) participate in the operation of a real or simulated engineering project
(3) The student develops skills for managing a project. The student is expected to:	(D) develop a plan for production of an individual product	(i) develop a plan for production of an individual product
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(A) complete work orders and related documentation	(i) complete work orders
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(A) complete work orders and related documentation	(ii) complete related documentation
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(B) identify factors affecting cost and strategies to minimize costs	(i) identify factors affecting cost
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(B) identify factors affecting cost and strategies to minimize costs	(ii) identify strategies to minimize costs

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(C) prepare a project budget	(i) prepare a project budget
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(D) prepare a production schedule	(i) prepare a production schedule
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(E) identify intellectual property and other legal restrictions	(i) identify intellectual property
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(E) identify intellectual property and other legal restrictions	(ii) identify other legal restrictions
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(i) read technical drawings
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(ii) read techncal manuals
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(iii) read technical bulletins

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(iv) interpret technical drawings
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(v) interpret technical manuals
(4) The student demonstrates principles of project documentation and work flow. The student is expected to:	(F) read and interpret technical drawings, manuals, and bulletins	(vi) interpret technical bulletins
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(A) prepare drawings to American National Standards Institute (ANSI) and International Organization for Standardization (ISO) graphic standards	(i) prepare drawings to American National Standards Institute (ANSI) and International Organization for Standardization (ISO) graphic standards
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(B) customize software user interface	(i) customize software user interface
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(C) prepare and use advanced views such as auxiliary, section, and break-away	(i) prepare advanced views

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(C) prepare and use advanced views such as auxiliary, section, and break-away	(ii) use advanced views
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(D) draw detailed parts, assembly diagrams, and sub-assembly diagrams	(i) draw detailed parts
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(D) draw detailed parts, assembly diagrams, and sub-assembly diagrams	(ii) draw assembly diagrams
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(D) draw detailed parts, assembly diagrams, and sub-assembly diagrams	(iii) draw sub-assembly diagrams
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(E) indicate tolerances and standard fittings using appropriate library functions	(i) indicate tolerances using appropriate library functions
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(E) indicate tolerances and standard fittings using appropriate library functions	(ii) indicate standard fittings using appropriate library functions

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(F) demonstrate understanding of annotation styles and setup by defining units, fonts, dimension styles, notes, and leader lines	(i) demonstrate understanding of annotation styles and setup by defining units, fonts, dimension styles, notes, and leader lines
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(G) identify and incorporate the use of advanced layout techniques and viewports using paper-space and modeling areas	(i) identify the use of advanced layout techniques and viewports using paper-space and modeling areas
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(G) identify and incorporate the use of advanced layout techniques and viewports using paper-space and modeling areas	(ii) incorporate the use of advanced layout techniques and viewports using paper-space and modeling areas
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(H) use management techniques by setting up properties to define and control individual layers	(i) use management techniques by setting up properties to define individual layers
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(H) use management techniques by setting up properties to define and control individual layers	(ii) use management techniques by setting up properties to control individual layers
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(I) create and use custom templates for advanced project management	(i) create custom templates for advanced project management

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(I) create and use custom templates for advanced project management	(ii) use custom templates for advanced project management
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(J) prepare and use advanced development drawings	(i) prepare advanced development drawings
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(J) prepare and use advanced development drawings	(ii) use advanced development drawings
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(K) use advanced polar tracking and blocking techniques to increase drawing efficiency	(i) use advanced polar tracking to increase drawing efficiency
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(K) use advanced polar tracking and blocking techniques to increase drawing efficiency	(ii) use blocking techniques to increase drawing efficiency
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(L) create drawings that incorporate external referencing	(i) create drawings that incorporate external referencing

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(M) create and render objects using parametric modeling tools	(i) create objects using parametric modeling tools
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(M) create and render objects using parametric modeling tools	(ii) render objects using parametric modeling tools
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(N) model individual parts or assemblies and produce rendered or animated output	(i) model individual parts or assemblies
(5) The student applies the concepts and skills of computer-aided drafting and design software to perform the following tasks. The student is expected to:	(N) model individual parts or assemblies and produce rendered or animated output	(i) produce rendered or animated output
(6) The student practices safe and proper work habits. The student is expected to:	(A) master relevant safety tests	(i) master relevant safety tests
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(i) comply with safety guidelines as described in various manuals
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(ii) comply with safety guidelines as described in various instructions

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(B) comply with safety guidelines as described in various manuals, instructions, and regulations	(iii) comply with safety guidelines as described in various regulations
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(i) identify hazardous materials
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(ii) identify hazardous wastes
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iii) classify hazardous materials according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(C) identify and classify hazardous materials and wastes according to Occupational Safety and Health Administration (OSHA) regulations	(iv) classify hazardous wastes according to Occupational Safety and Health Administration (OSHA) regulations
(6) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(i) dispose of hazardous materials appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(D) dispose of hazardous materials and wastes appropriately	(ii) dispose of hazardous wastes appropriately
(6) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(i) perform maintenance on selected tools

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(ii) perform maintenance on selected equipment
(6) The student practices safe and proper work habits. The student is expected to:	(E) perform maintenance on selected tools, equipment, and machines	(iii) perform maintenance on selected machines
(6) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(i) handle tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(ii) handle materials correctly
(6) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iii) store tools correctly
(6) The student practices safe and proper work habits. The student is expected to:	(F) handle and store tools and materials correctly	(iv) store materials correctly
(6) The student practices safe and proper work habits. The student is expected to:	(G) describe the results of negligent or improper maintenance	(i) describe the results of negligent or improper maintenance
(7) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss principles of system ideation	(i) demonstrate an understanding of principles of system ideation
(7) The student uses engineering design methodologies. The student is expected to:	(A) demonstrate an understanding of and discuss principles of system ideation	(ii) discuss principles of system ideation

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(i) demonstrate critical thinking
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(ii) identify the system constraints
(7) The student uses engineering design methodologies. The student is expected to:	(B) demonstrate critical thinking, identify the system constraints, and make fact-based decisions	(iii) make fact-based decisions
(7) The student uses engineering design methodologies. The student is expected to:	(C) use rational thinking to develop or improve a system	(i) use rational thinking to develop or improve a system
(7) The student uses engineering design methodologies. The student is expected to:	(D) apply decision-making strategies when developing solutions	(i) apply decision-making strategies when developing solutions
(7) The student uses engineering design methodologies. The student is expected to:	(E) identify quality-control issues in engineering design and production	(i) identify quality-control issues in engineering design
(7) The student uses engineering design methodologies. The student is expected to:	(E) identify quality-control issues in engineering design and production	(ii) identify quality-control issues in engineering production
(7) The student uses engineering design methodologies. The student is expected to:	(F) describe perceptions of the quality of products and how they affect engineering decisions	(i) describe perceptions of the quality of products and how they affect engineering decisions
(7) The student uses engineering design methodologies. The student is expected to:	(F) describe perceptions of the quality of products and how they affect engineering decisions	(ii) describe how [perceptions of the quality of products] affect engineering decisions

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student uses engineering design methodologies. The student is expected to:	(G) use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process	(i) use an engineering notebook to record prototypes
(7) The student uses engineering design methodologies. The student is expected to:	(G) use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process	(ii) use an engineering notebook to record corrections
(7) The student uses engineering design methodologies. The student is expected to:	(G) use an engineering notebook to record prototypes, corrections, and/or mistakes in the design process	(iii) use an engineering notebook to record mistakes in the design process
(7) The student uses engineering design methodologies. The student is expected to:	(H) use an engineering notebook to record the final design, construction, and manipulation of finished projects	(i) use an engineering notebook to record the final design of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(H) use an engineering notebook to record the final design, construction, and manipulation of finished projects	(ii) use an engineering notebook to record the construction of finished projects
(7) The student uses engineering design methodologies. The student is expected to:	(H) use an engineering notebook to record the final design, construction, and manipulation of finished projects	(iii) use an engineering notebook to record the manipulation of finished projects
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(A) use a variety of technologies to design systems	(i) use a variety of technologies to design systems

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(i) use tools to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(ii) use laboratory equipment to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(B) use tools, laboratory equipment, and precision measuring instruments to develop prototypes	(iii) useprecision measuring instruments to develop prototypes
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(C) research applications of different types of computer-aided drafting and design software	(i) research applications of different types of computer-aided drafting and design software
(8) The student applies concepts of engineering to specific problems. The student is expected to:	(D) use multiple software applications for concept presentations	(i) use multiple software applications for concept presentations
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(A) interpret engineering drawings	(i) interpret engineering drawings
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a system	(i) identify areas where quality can be designed into a system
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a system	(ii) identify areas where reliability can be designed into a system

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(B) identify areas where quality, reliability, and safety can be designed into a system	(iii) identify areas where safety can be designed into a system
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(C) improve a system design to meet a specified need, including properties of materials selected	(i) improve a system design to meet a specified need, including properties of materials selected
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(D) produce engineering drawings to industry standards	(i) produce engineering drawings to industry standards
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(E) describe potential patents and the patenting process	(i) describe potential patents
(9) The student designs systems using appropriate design processes and techniques. The student is expected to:	(E) describe potential patents and the patenting process	(ii) describe the patenting process
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(i) identify the steps needed to produce a prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(A) identify and describe the steps needed to produce a prototype	(ii) describe the steps needed to produce a prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(i) identify appropriate tools to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(ii) identify appropriate equipment to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iii) identify appropriate machines to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(iv) identify appropriate materials to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(v) use appropriate tools to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vi) use appropriate equipment to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(vii) use appropriate machines to produce the prototype

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(B) identify and use appropriate tools, equipment, machines, and materials to produce the prototype	(viii) use appropriate materials to produce the prototype
(10) The student builds a prototype using the appropriate tools, materials, and techniques. The student is expected to:	(C) present the prototype using a variety of media	(i) present the prototype using a variety of media

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.412. Engineering Design and Problem Solving (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Algebra I and Geometry. Recommended prerequisites: two Science, Technology, Engineering, and Mathematics (STEM) Career Cluster credits. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) The Engineering Design and Problem Solving course is the creative process of solving problems by identifying needs and then devising solutions. The solution may be a product, technique, structure, or process depending on the problem. Science aims to understand the natural world, while engineering seeks to shape this world to meet human needs and wants. Engineering design takes into consideration limiting factors or "design under constraint." Various engineering disciplines address a broad spectrum of design problems using specific concepts from the sciences and mathematics to derive a solution. The design process and problem solving are inherent to all engineering disciplines.
(4) Engineering Design and Problem Solving reinforces and integrates skills learned in previous mathematics and science courses. This course emphasizes solving problems, moving from well-defined toward more open-ended, with real-world application. Students will apply critical-thinking skills to justify a solution from multiple design options. Additionally, the course promotes interest in and understanding of career opportunities in engineering.

(5) This course is intended to stimulate students' ingenuity, intellectual talents, and practical skills in devising solutions to engineering design problems. Students use the engineering design process cycle to investigate, design, plan, create, and evaluate solutions. At the same time, this course fosters awareness of the social and ethical implications of technological development.
(6) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(7) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(8) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
(9) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(10) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(11) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in a[n] effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a[n] effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts engineering laboratory and field activities using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during engineering laboratory and field investigations	(i) demonstrate safe practices during engineering laboratory investigations
(2) The student, for at least 40% of instructional time, conducts engineering laboratory and field activities using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during engineering laboratory and field investigations	(ii) demonstrate safe practices during field investigations
(2) The student, for at least 40% of instructional time, conducts engineering laboratory and field activities using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources
(2) The student, for at least 40% of instructional time, conducts engineering laboratory and field activities using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources
(2) The student, for at least 40% of instructional time, conducts engineering laboratory and field activities using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(iii) demonstrate an understanding of the proper disposal or recycling of materials
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(6) of this section	(i) know the definition of science, as specified in subsection (b)(6) [above]

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(6) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(6) [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories	(i) know that hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories	(ii) know that hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories	(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(i) know [that] scientific theories are based on natural and physical phenomena
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(ii) know [that] scientific theories are capable of being tested by multiple independent researchers
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iii) [know that] unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iv) [know that], unlike hypotheses, scientific theories are highly-reliable explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(v) [know that] scientific theories may be subject to change as new areas of science are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(vi) [know that] scientific theories may be subject to change as new technologies are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(i) plan descriptive investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(iii) plan descriptive investigations, including selecting equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(iv) plan descriptive investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(v) implement descriptive investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(vii) implement descriptive investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(viii) implement descriptive investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(ix) plan comparative investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(x) plan comparative investigations, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xi) plan comparative investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xii) plan comparative investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xiii) implement comparative investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xiv) implement comparative investigations, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xv) implement comparative investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xvi) implement comparative investigations, including selecting technology

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xvii) plan experimental investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xviii) plan experimental investigations, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xix) plan experimental investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xx) plan experimental investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxi) implement experimental investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxii) implement experimental investigations, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxiii) implement experimental investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxiv) implement experimental investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(i) collect qualitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(ii) organize qualitative data using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(iii) collect quantitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(iv) organize quantitative data using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(v) make measurements with accuracy using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures	(vi) make measurements with precision using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(i) analyze data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(ii) evaluate data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iii) make inferences
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iv) predict trends from data

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions supported by the data through [various] methods
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(i) in all fields of science, analyze scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(ii) in all fields of science, analyze scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(iii) in all fields of science, analyze scientific explanations by using experimental testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(iv) in all fields of science, analyze scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(vi) in all fields of science, evaluate scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(vii) in all fields of science, evaluate scientific explanations by using logical reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(viii) in all fields of science, evaluate scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(ix) in all fields of science, evaluate scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(xi) in all fields of science, critique scientific explanations by using empirical evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(xii) in all fields of science, critique scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(xiii) in all fields of science, critique scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(xiv) in all fields of science, critique scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student	(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of scientific research on society and the environment	(i) evaluate the impact of scientific research on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of scientific research on society and the environment	(ii) evaluate the impact of scientific research on the environment

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) evaluate models according to their limitations in representing biological objects or events	(i) evaluate models according to their limitations in representing biological objects or events
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the history of biology and contributions of scientists	(i) research the history of biology
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the history of biology and contributions of scientists	(ii) research contributions of scientists
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the history of biology and contributions of scientists	(iii) describe the history of biology
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the history of biology and contributions of scientists	(iv) describe the contributions of scientists
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(A) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology, Chemistry, or Physics relevant to engineering design problems	(i) apply scientific processes outlined in the Texas essential knowledge and skills (TEKS) for Biology, Chemistry, or Physics relevant to engineering design problems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(A) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology, Chemistry, or Physics relevant to engineering design problems	(ii) apply scientific concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology, Chemistry, or Physics relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(i) apply concepts outlined in the TEKS for Algebra I relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(ii) apply procedures outlined in the TEKS for Algebra I relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(iii) apply functions outlined in the TEKS for Algebra I relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(iv) apply concepts outlined in the TEKS for Geometry relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(v) apply procedures outlined in the TEKS for Geometry relevant to engineering design problems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(vi) apply functions outlined in the TEKS for Geometry relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(vii) apply concepts outlined in the TEKS for Algebra II relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(viii) apply procedures outlined in the TEKS for Algebra II relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(B) apply concepts, procedures, and functions outlined in the TEKS for Algebra I, Geometry, and Algebra II relevant to engineering design problems	(ix) apply functions outlined in the TEKS for Algebra II relevant to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(C) select appropriate mathematical models to develop solutions to engineering design problems	(i) select appropriate mathematical models to develop solutions to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(D) integrate advanced mathematics and science skills as necessary to develop solutions to engineering design problems	(i) integrate advanced mathematics skills as necessary to develop solutions to engineering design problems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(D) integrate advanced mathematics and science skills as necessary to develop solutions to engineering design problems	(ii) integrate advanced science skills as necessary to develop solutions to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(E) judge the reasonableness of mathematical models and solutions	(i) judge the reasonableness of mathematical models
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(E) judge the reasonableness of mathematical models and solutions	(ii) judge the reasonableness of mathematical solutions
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(i) investigate relevant chemical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(ii) investigate relevant mechanical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(iii) investigate relevant biological properties of materials to engineering design problems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(iv) investigate relevant electrical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(v) investigate relevant physical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(vi) apply relevant chemical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(vii) apply relevant mechanical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(viii) apply relevant biological properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(ix) apply relevant electrical properties of materials to engineering design problems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(F) investigate and apply relevant chemical, mechanical, biological, electrical, and physical properties of materials to engineering design problems	(x) apply relevant physical properties of materials to engineering design problems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(i) identify the inputs associated with open systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(ii) identify the processes associated with open systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(iii) identify the outputs associated with open systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(iv) identify the control associated with open systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(v) identify the feedback associated with open systems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(vi) identify the inputs associated with closed systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(vii) identify the processes associated with closed systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(viii) identify the outputs associated with closed systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(ix) identify the control associated with closed systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(G) identify the inputs, processes, outputs, control, and feedback associated with open and closed systems	(x) identify the feedback associated with closed systems
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(H) describe the difference between open-loop and closed-loop control systems	(i) describe the difference between open-loop and closed-loop control systems

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(I) make measurements with accuracy and precision and specify tolerances	(i) make measurements with accuracy
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(I) make measurements with accuracy and precision and specify tolerances	(ii) make measurements with precision
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(I) make measurements with accuracy and precision and specify tolerances	(iii) specify tolerances
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(J) use appropriate measurement systems, including customary and International System (SI) of units	(i) use appropriate measurement systems, including customary
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(J) use appropriate measurement systems, including customary and International System (SI) of units	(ii) use appropriate measurement systems, including International System (SI) of units
(5) The student applies knowledge of science and mathematics and the tools of technology to solve engineering design problems. The student is expected to:	(K) use conversions between measurement systems to solve real-world problems	(i) use conversions between measurement systems to solve real-world problems

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(i) communicate visually by sketching technical drawings using established engineering graphic tools
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(ii) communicate visually by sketching technical drawings using established engineering techniques
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(iii) communicate visually by sketching technical drawings using established engineering standards
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(iv) communicate visually by creating technical drawings using established engineering graphic tools
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(v) communicate visually by creating technical drawings using established engineering techniques
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(A) communicate visually by sketching and creating technical drawings using established engineering graphic tools, techniques, and standards	(vi) communicate visually by creating technical drawings using established engineering standards

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(B) read and comprehend technical documents, including specifications and procedures	(i) read technical documents, including specifications
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(B) read and comprehend technical documents, including specifications and procedures	(ii) read technical documents, including procedures
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(B) read and comprehend technical documents, including specifications and procedures	(iii) comprehend technical documents, including specifications
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(B) read and comprehend technical documents, including specifications and procedures	(iv) comprehend technical documents, including procedures
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(C) prepare written documents such as memorandums, emails, design proposals, procedural directions, letters, and technical reports using the formatting and terminology conventions of technical documentation	(i) prepare written documents using the formatting conventions of technical documentation

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(C) prepare written documents such as memorandums, emails, design proposals, procedural directions, letters, and technical reports using the formatting and terminology conventions of technical documentation	(ii) prepare written documents using the terminology conventions of technical documentation
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(D) organize information for visual display and analysis using appropriate formats for various audiences, including graphs and tables	(i) organize information for visual display using appropriate formats for various audiences, including graphs
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(D) organize information for visual display and analysis using appropriate formats for various audiences, including graphs and tables	(ii) organize information for visual display using appropriate formats for various audiences, including tables
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(D) organize information for visual display and analysis using appropriate formats for various audiences, including graphs and tables	(iii) organize information for analysis using appropriate formats for various audiences, including graphs
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(D) organize information for visual display and analysis using appropriate formats for various audiences, including graphs and tables	(iv) organize information for analysis using appropriate formats for various audiences, including tables
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(E) evaluate the quality and relevance of sources and cite appropriately	(i) evaluate the quality of sources

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(E) evaluate the quality and relevance of sources and cite appropriately	(ii) evaluate the relevance of sources
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(E) evaluate the quality and relevance of sources and cite appropriately	(iii) cite [sources] appropriately
(6) The student communicates through written documents, presentations, and graphic representations using the tools and techniques of professional engineers. The student is expected to:	(F) defend a design solution in a presentation	(i) defend a design solution in a presentation
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(i) identify career options of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(ii) identify working conditions of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(iii) identify earnings of various engineering disciplines

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(iv) identify educational requirements of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(v) describe career options of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(vi) describe working conditions of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(vii) describe earnings of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(A) identify and describe career options, working conditions, earnings, and educational requirements of various engineering disciplines such as those listed by the Texas Board of Professional Engineers	(viii) identify educational requirements of various engineering disciplines
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(B) recognize that engineers are guided by established codes emphasizing high ethical standards	(i) recognize that engineers are guided by established codes emphasizing high ethical standards

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(i) explore the differences among engineers
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(ii) explore the differences among scientists
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(iii) explore the differences among mathematicians
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(iv) explore the similarities among engineers
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(v) explore the similarities among scientists
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(vi) explore the similarities among mathematicians
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(vii) explore the interactions among engineers

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(viii) explore the interactions among scientists
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(C) explore the differences, similarities, and interactions among engineers, scientists, and mathematicians	(ix) explore the interactions among mathematicians
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(D) describe how technology has evolved in the field of engineering and consider how it will continue to be a useful tool in solving engineering problems	(i) describe how technology has evolved in the field of engineering
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(D) describe how technology has evolved in the field of engineering and consider how it will continue to be a useful tool in solving engineering problems	(ii) consider how [technology] will continue to be a useful tool in solving engineering problems
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(E) discuss the history and importance of engineering innovation on the U.S. economy and quality of life	(i) discuss the history of engineering innovation on the U.S. economy
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(E) discuss the history and importance of engineering innovation on the U.S. economy and quality of life	(ii) discuss the history of engineering innovation on the U.S. quality of life

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(E) discuss the history and importance of engineering innovation on the U.S. economy and quality of life	(iii) discuss the importance of engineering innovation on the U.S. economy
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(E) discuss the history and importance of engineering innovation on the U.S. economy and quality of life	(iv) discuss the importance of engineering innovation on the U.S. quality of life
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(F) describe the importance of patents and the protection of intellectual property rights	(i) describe the importance of patents
(7) The student recognizes the history, development, and practices of the engineering professions. The student is expected to:	(F) describe the importance of patents and the protection of intellectual property rights	(ii) describe the protection of intellectual property rights
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(A) identify and define an engineering problem	(i) identify an engineering problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(A) identify and define an engineering problem	(ii) define an engineering problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(B) formulate goals, objectives, and requirements to solve an engineering problem	(i) formulate goals to solve an engineering problem

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(B) formulate goals, objectives, and requirements to solve an engineering problem	(ii) formulate objectives to solve an engineering problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(B) formulate goals, objectives, and requirements to solve an engineering problem	(iii) formulate requirements to solve an engineering problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(C) determine the design parameters associated with an engineering problem such as materials, personnel, resources, funding, manufacturability, feasibility, and time	(i) determine the design parameters associated with an engineering problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(i) establish constraints pertaining to a problem, including health
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(ii) establish constraints pertaining to a problem, including safety
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(iii) establish constraints pertaining to a problem, including social
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(iv) establish constraints pertaining to a problem, including environmental

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(v) establish constraints pertaining to a problem, including ethical
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(vi) establish constraints pertaining to a problem, including political
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(vii) establish constraints pertaining to a problem, including regulatory
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(viii) establish constraints pertaining to a problem, including legal
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(ix) evaluate constraints pertaining to a problem, including health
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(x) evaluate constraints pertaining to a problem, including safety
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xi) evaluate constraints pertaining to a problem, including social

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xii) evaluate constraints pertaining to a problem, including environmental
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xiii) evaluate constraints pertaining to a problem, including ethical
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xiv) evaluate constraints pertaining to a problem, including political
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xv) evaluate constraints pertaining to a problem, including regulatory
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(D) establish and evaluate constraints pertaining to a problem, including health, safety, social, environmental, ethical, political, regulatory, and legal	(xvi) evaluate constraints pertaining to a problem, including legal
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(E) identify or create alternative solutions to a problem using a variety of techniques such as brainstorming, reverse engineering, and researching engineered and natural solutions	(i) identify or create alternative solutions to a problem using a variety of techniques

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(F) test and evaluate proposed solutions using methods such as models, prototypes, mock-ups, simulations, critical design review, statistical analysis, or experiments	(i) test proposed solutions using methods
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(F) test and evaluate proposed solutions using methods such as models, prototypes, mock-ups, simulations, critical design review, statistical analysis, or experiments	(ii) evaluate proposed solutions using methods
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(G) apply structured techniques to select and justify a preferred solution to a problem such as a decision tree, design matrix, or cost-benefit analysis	(i) apply structured techniques to select a preferred solution to a problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(G) apply structured techniques to select and justify a preferred solution to a problem such as a decision tree, design matrix, or cost-benefit analysis	(ii) apply structured techniques to justify a preferred solution to a problem
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(H) predict performance, failure modes, and reliability of a design solution	(i) predict performance of a design solution
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(H) predict performance, failure modes, and reliability of a design solution	(ii) predict failure modes of a design solution
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(H) predict performance, failure modes, and reliability of a design solution	(iii) predict reliability of a design solution

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process	(i) prepare a project report that clearly documents the designs during each phase of the engineering design process
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process	(ii) prepare a project report that clearly documents the decisions during each phase of the engineering design process
(8) The student creates justifiable solutions to open-ended real-world problems using engineering design practices and processes. The student is expected to:	(I) prepare a project report that clearly documents the designs, decisions, and activities during each phase of the engineering design process	(iii) prepare a project report that clearly documents the activities during each phase of the engineering design process
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(i) participate in the design of a real-world or simulated engineering project using project management methodologies, including initiating a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ii) participate in the design of a real-world or simulated engineering project using project management methodologies, including planning a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iii) participate in the design of a real-world or simulated engineering project using project management methodologies, including executing a project

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(iv) participate in the design of a real-world or simulated engineering project using project management methodologies, including monitoring a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(v) participate in the design of a real-world or simulated engineering project using project management methodologies, including controlling a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vi) participate in the design of a real-world or simulated engineering project using project management methodologies, including closing a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(vii) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including initiating a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(viii) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including planning a project

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(ix) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including executing a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(x) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including monitoring a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(xi) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including controlling a project
(9) The student manages an engineering design project. The student is expected to:	(A) participate in the design and implementation of a real-world or simulated engineering project using project management methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project	(xii) participate in the implementation of a real-world or simulated engineering project using project management methodologies, including closing a project
(9) The student manages an engineering design project. The student is expected to:	(B) develop a plan and project schedule timeline for completion of a project	(i) develop a plan for completion of a project
(9) The student manages an engineering design project. The student is expected to:	(B) develop a plan and project schedule for completion of a project	(ii) develop a project schedule for completion of a project

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student manages an engineering design project. The student is expected to:	(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members	(i) work in teams
(9) The student manages an engineering design project. The student is expected to:	(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members	(ii) share responsibilities of all team members
(9) The student manages an engineering design project. The student is expected to:	(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members	(iii) share acknowledging of all team members
(9) The student manages an engineering design project. The student is expected to:	(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members	(iv) share encouraging of all team members
(9) The student manages an engineering design project. The student is expected to:	(C) work in teams and share responsibilities, acknowledging, encouraging, and valuing contributions of all team members	(v) share valuing contributions of all team members
(9) The student manages an engineering design project. The student is expected to:	(D) compare and contrast the roles of a team leader and other team responsibilities	(i) compare and contrast the roles of a team leader and other team responsibilities
(9) The student manages an engineering design project. The student is expected to:	(E) identify and manage the resources needed to complete a project	(i) identify the resources needed to complete a project
(9) The student manages an engineering design project. The student is expected to:	(E) identify and manage the resources needed to complete a project	(ii) manage the resources needed to complete a project

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student manages an engineering design project. The student is expected to:	(F) use a budget to determine effective strategies to meet cost constraints	(i) use a budget to determine effective strategies to meet cost constraints
(9) The student manages an engineering design project. The student is expected to:	(G) create a risk assessment for an engineering design project	(i) create a risk assessment for an engineering design project
(9) The student manages an engineering design project. The student is expected to:	(H) analyze and critique the results of an engineering design project	(i) analyze the results of an engineering design project
(9) The student manages an engineering design project. The student is expected to:	(H) analyze and critique the results of an engineering design project	(ii) critique the results of an engineering design project
(9) The student manages an engineering design project. The student is expected to:	(I) maintain an engineering notebook that chronicles work such as ideas, concepts, inventions, sketches, and experiments	(i) maintain an engineering notebook that chronicles work

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.413. Engineering Mathematics (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Algebra II. This course satisfies a high school mathematics graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Engineering Mathematics is a course where students solve and model design problems. Students will use a variety of mathematical methods and models to represent and analyze problems that represent a range of real-world engineering applications such as robotics, data acquisition, spatial applications, electrical measurement, manufacturing processes, materials engineering, mechanical drives, pneumatics, process control systems, quality control, and computer programming.
(4) The mathematical process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.
(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevent activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(i) apply mathematics to problems arising in everyday life
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(ii) apply mathematics to problems arising in society
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(A) apply mathematics to problems arising in everyday life, society, and the workplace	(iii) apply mathematics to problems arising in the workplace
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution	(i) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution	(ii) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the reasonableness of the solution
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(i) select tools, including real objects as appropriate, to solve problems

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(ii) select tools, including manipulatives as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iii) select tools, including paper and pencil as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(iv) select tools, including technology as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(v) select techniques, including mental math as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vi) select techniques including estimation as appropriate, to solve problems
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems	(vii) select techniques, including number sense as appropriate, to solve problems

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(i) communicate mathematical ideas using multiple representations, including symbols
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(ii) communicate mathematical ideas using multiple representations, including diagrams
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(iii) communicate mathematical ideas using multiple representations, including graphs
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(iv) communicate mathematical ideas using multiple representations, including language
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(v) communicate mathematical reasoning using multiple representations, including symbols
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(vi) communicate mathematical reasoning using multiple representations, including diagrams
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(vii) communicate mathematical reasoning using multiple representations, including graphs

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(viii) communicate mathematical reasoning using multiple representations, including language
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(ix) communicate [mathematical ideas'] implications using multiple representations, including symbols
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(x) communicate [mathematical ideas'] implications using multiple representations, including diagrams
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xi) communicate [mathematical ideas'] implications using multiple representations, including graphs
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xii) communicate [mathematical ideas'] implications using multiple representations, including language
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xiii) communicate [mathematical reasoning's] implications using multiple representations, including symbols
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xiv) communicate [mathematical reasoning's] implications using multiple representations, including diagrams

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xv) communicate [mathematical reasoning's] implications using multiple representations, including graphs
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language	(xvi) communicate [mathematical reasoning's] implications using multiple representations, including language
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(i) create representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(ii) create representations to record mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iii) create representations to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(iv) use representations to organize mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(v) use representations to record mathematical ideas

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(E) create and use representations to organize, record, and communicate mathematical ideas	(vi) use representations to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(i) analyze mathematical relationships to connect mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(F) analyze mathematical relationships to connect and communicate mathematical ideas	(ii) analyze mathematical relationships to communicate mathematical ideas
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(i) display mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(ii) display mathematical arguments using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(iii) explain mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(iv) explain mathematical arguments using precise mathematical language in written or oral communication

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(v) justify mathematical ideas using precise mathematical language in written or oral communication
(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:	(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication	(vi) justify mathematical arguments using precise mathematical language in written or oral communication
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(A) explain how flow rate can be measured in gallons per minute and liters per minute	(i) explain how flow rate can be measured in gallons per minute
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(A) explain how flow rate can be measured in gallons per minute and liters per minute	(ii) explain how flow rate can be measured in liters per minute
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(B) calculate and record data using actual flow rates from a flow meter chart	(i) calculate data using actual flow rates from a flow meter chart

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(B) calculate and record data using actual flow rates from a flow meter chart	(ii) record data using actual flow rates from a flow meter chart
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(i) calculate the force output of an extending and retracting cylinder
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(ii) measure the force output of an extending and retracting cylinder
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(iii) illustrate the force output of an extending and retracting cylinder
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(iv) calculate the speed of an extending and retracting cylinder

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(v) measure the speed of an extending and retracting cylinder
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(C) calculate, measure, and illustrate the force output and speed of an extending and retracting cylinder	(vi) illustrate the speed of an extending and retracting cylinder
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(D) determine and depict the stroke time of a cylinder in gallons per minute	(i) determine the stroke time of a cylinder in gallons per minute
(3) The student uses mathematically based hydraulics concepts to measure and find pump output, understand pressure versus cylinder force, and understand flow rate verses cylinder speed. The student is expected to:	(D) determine and depict the stroke time of a cylinder in gallons per minute	(ii) depict the stroke time of a cylinder in gallons per minute
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(A) calculate a resultant force	(i) calculate a resultant force

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(B) apply the concept of equilibrium to force calculations	(i) apply the concept of equilibrium to force calculations
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(C) calculate a force using a free-body diagram	(i) calculate a force using a free-body diagram
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(D) develop an application of strain gauges that determines mathematically and experimentally the force on a structural element	(i) develop an application of strain gauges that determines mathematically the force on a structural element
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(D) develop an application of strain gauges that determines mathematically and experimentally the force on a structural element	(ii) develop an application of strain gauges that determines experimentally the force on a structural element
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(E) calculate the magnitude of force applied to a rotational system	(i) calculate the magnitude of force applied to a rotational system

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(F) apply the moment equilibrium equation to force calculations	(i) apply the moment equilibrium equation to force calculations
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(G) calculate, measure, and illustrate a bending moment on a beam	(i) calculate a bending moment on a beam
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(G) calculate, measure, and illustrate a bending moment on a beam	(ii) measure a bending moment on a beam
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(G) calculate, measure, and illustrate a bending moment on a beam	(iii) illustrate a bending moment on a beam
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(H) determine and depict the bending stress in a beam	(i) determine the bending stress in a beam

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(H) determine and depict the bending stress in a beam	(ii) depict the bending stress in a beam
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(I) calculate forces in truss using a six-step problem-solving method	(i) calculate forces in truss using a six-step problem-solving method
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(J) apply modulus of elasticity to the deflection of beams	(i) apply modulus of elasticity to the deflection of beams
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(K) calculate a beam deflection for a given load	(i) calculate a beam deflection for a given load
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(L) determine and depict the critical load for buckling using Euler's formula	(i) determine the critical load for buckling using Euler's formula

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(L) determine and depict the critical load for buckling using Euler's formula	(ii) depict the critical load for buckling using Euler's formula
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(M) design and apply factors of safety to column and beam design	(i) design factors of safety to column design
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(M) design and apply factors of safety to column and beam design	(ii) design factors of safety to beam design
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(M) design and apply factors of safety to column and beam design	(iii) apply factors of safety to column design
(4) The student uses mathematical concepts of structure design to define and describe statics, acquire data, apply concepts of moments and bending stress, and apply concepts of truss design and analysis. The student is expected to:	(M) design and apply factors of safety to column and beam design	(iv) apply factors of safety to beam design

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student understands the role of trigonometry in spatial applications. The student is expected to:	(A) apply trigonometric ratios, including sine, cosine, and tangent, to spatial problems	(i) apply trigonometric ratios, including sine, to spatial problems
(5) The student understands the role of trigonometry in spatial applications. The student is expected to:	(A) apply trigonometric ratios, including sine, cosine, and tangent, to spatial problems	(ii) apply trigonometric ratios, including cosine, to spatial problems
(5) The student understands the role of trigonometry in spatial applications. The student is expected to:	(A) apply trigonometric ratios, including sine, cosine, and tangent, to spatial problems	(iii) apply trigonometric ratios, including tangen,t to spatial problems
(5) The student understands the role of trigonometry in spatial applications. The student is expected to:	(B) determine the distance and height of remote objects using trigonometry	(i) determine the distance of remote objects using trigonometry
(5) The student understands the role of trigonometry in spatial applications. The student is expected to:	(B) determine the distance and height of remote objects using trigonometry	(ii) determine the height of remote objects using trigonometry
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(A) determine a dimension of an object given a scaled drawing having no dimensions	(i) determine a dimension of an object given a scaled drawing having no dimensions

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(B) compare and contrast the function of production time and production rate	(i) compare and contrast the function of production time and production rate
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(C) calculate and apply the proper cycle time and analyze machines required to meet a specified production rate	(i) calculate the proper cycle time required to meet a specified production rate
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(C) calculate and apply the proper cycle time and analyze machines required to meet a specified production rate	(ii) apply the proper cycle time required to meet a specified production rate

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(C) calculate and apply the proper cycle time and analyze machines required to meet a specified production rate	(iii) analyze machines required to meet a specified production rate
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(D) demonstrate the calculation and application of output shaft speed and torque in a gear train	(i) demonstrate the calculaton of output shaft speed in a gear train
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(D) demonstrate the calculation and application of output shaft speed and torque in a gear train	(ii) demonstrate the calculation of torque in a gear train

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(D) demonstrate the calculation and application of output shaft speed and torque in a gear train	(iii) demonstrate the application of output shaft speed in a gear train
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(D) demonstrate the calculation and application of output shaft speed and torque in a gear train	(iv) demonstrate the application of torque in a gear train
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(E) create a method to determine the direction of a gear train's output shaft	(i) create a method to determine the direction of a gear train's output shaft

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(F) design a spur gear train given speed and torque requirements	(i) design a spur gear train given speed and torque requirements
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(G) calculate and apply the proper spacing between the centers of gears in a gear train to a specified tolerance	(i) calculate the proper spacing between the centers of gears in a gear train to a specified tolerance
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(G) calculate and apply the proper spacing between the centers of gears in a gear train to a specified tolerance	(ii) apply the proper spacing between the centers of gears in a gear train to a specified tolerance

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(H) apply positional tolerances to assembled parts	(i) apply positional tolerances to assembled parts
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(I) predict the production cost of a product given process information and a bill of materials	(i) predict the production cost of a product given process information and a bill of materials
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(J) apply the correct spindle speed for a computer-aided manufacturing device by calculation	(i) apply the correct spindle speed for a computer-aided manufacturing device by calculation

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(K) apply the correct feed rate for a computer-aided manufacturing device by using calculation	(i) apply the correct feed rate for a computer-aided manufacturing device by using calculation
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(L) calculate the pressure drop in an injection mold system	(i) calculate the pressure drop in an injection mold system
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(M) design a gate size in an injection mold system using the gate width and depth formulas	(i) design a gate size in an injection mold system using the gate width and depth formulas

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(N) determine the size of a mold	(i) determine the size of a mold
(6) The student understands the concepts of design processes with multi-view computer-aided drafting and design drawings for facilities layouts, precision part design, process design, injection mold design, and computer-aided manufacturing, as applied to processes using 3D printing, laser cutting, and computer numerical control. The student is expected to:	(O) create size runners for a multi-cavity mold	(i) create size runners for a multi-cavity mold
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(A) apply common electronic formulas to solve problems	(i) apply common electronic formulas to solve problems
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(B) use engineering notation to properly describe calculated and measured values	(i) use engineering notation to properly describe calculated values

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(B) use engineering notation to properly describe calculated and measured values	(ii) use engineering notation to properly describe measured values
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(C) compare and contrast the mathematical differences between a direct current and alternating current	(i) compare and contrast the mathematical differences between a direct current and alternating current
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(D) show the effect and give an application of an inductor in an alternating current circuit	(i) show the effect of an inductor in an alternating current circuit
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(D) show the effect and give an application of an inductor in an alternating current circuit	(ii) give an application of an inductor in an alternating current circuit
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(E) show the effect and give an application of a capacitor in an alternating current circuit	(i) show the effect of a capacitor in an alternating current circuit
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(E) show the effect and give an application of a capacitor in an alternating current circuit	(ii) give an application of a capacitor in an alternating current circuit

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(F) create a resistive capacitive timing circuit in a time-delay circuit	(i) create a resistive capacitive timing circuit in a time-delay circuit
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(G) calculate the output voltage and current load of a transformer	(i) calculate the output voltage load of a transformer
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(G) calculate the output voltage and current load of a transformer	(ii) calculate the output current load of a transformer
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(H) calculate the effective alternating current voltage root mean square given the peak alternating current voltage and the peak alternating current voltage given the root mean square value	(i) calculate the effective alternating current voltage root mean square given the peak alternating current voltage
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(H) calculate the effective alternating current voltage root mean square given the peak alternating current voltage and the peak alternating current voltage given the root mean square value	(ii) calculate the peak alternating current voltage given the root mean square value
(7) The student calculates electronic quantities and uses electrical measuring instruments to experimentally test their calculations. The student is expected to:	(I) calculate the cost of operating an electric motor	(i) calculate the cost of operating an electric motor

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(A) calculate the force output of a cylinder in retraction and extension	(i) calculate the force output of a cylinder in retraction
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(A) calculate the force output of a cylinder in retraction and extension	(ii) calculate the force output of a cylinder in extension
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(B) explain how gage pressure and absolute pressure are different	(i) explain how gage pressure and absolute pressure are different

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(C) explain the individual gas laws and use the ideal gas law to solve problems	(i) explain the individual gas laws
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(C) explain the individual gas laws and use the ideal gas law to solve problems	(ii) use the ideal gas law to solve problems
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(D) convert air volumes at pressures to free air volumes	(i) convert air volumes at pressures to free air volumes

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(E) compare dew point and relative humidity to explain their importance	(i) compare dew point and relative humidity to explain their importance
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(F) explain the importance of the two units of pump flow rate measurement	(i) explain the importance of the two units of pump flow rate measurement
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(G) convert between mass and volumetric flow rate	(i) convert between mass and volumetric flow rate

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(H) differentiate between unit analysis such as converting units of pressure between English and SI units and dimensional analysis such as Force and Pressure	(i) differentiate between unit analysis and dimensional analysis
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(I) convert between units of head and pressure	(i) convert between units of head and pressure
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(J) explain the importance of total dynamic head in terms of suction and discharge head	(i) explain the importance of total dynamic head in terms of suction

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(J) explain the importance of total dynamic head in terms of suction and discharge head	(ii) explain the importance of total dynamic head in terms of discharge head
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(K) demonstrate the measurement of the total head of a centrifugal pump	(i) demonstrate the measurement of the total head of a centrifugal pump
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(L) calculate Reynolds number and determine the type of fluid flow in a pipe, including laminar flow, transitional flow, and turbulent flow	(i) calculate Reynolds number

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(L) calculate Reynolds number and determine the type of fluid flow in a pipe, including laminar flow, transitional flow, and turbulent flow	(ii) determine the type of fluid flow in a pipe, including laminar flow
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(L) calculate Reynolds number and determine the type of fluid flow in a pipe, including laminar flow, transitional flow, and turbulent flow	(iii) determine the type of fluid flow in a pipe, including transitional flow
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(L) calculate Reynolds number and determine the type of fluid flow in a pipe, including laminar flow, transitional flow, and turbulent flow	(iv) determine the type of fluid flow in a pipe, including turbulent flow

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(M) calculate friction head loss in a given pipe length using head loss tables or charts	(i) calculate friction head loss in a given pipe length using head loss tables or charts
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(N) calculate total suction lift, total suction head, total discharge head, and the total dynamic head of a system for a given flow rate	(i) calculate total suction lift of a system for a given flow rate
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(N) calculate total suction lift, total suction head, total discharge head, and the total dynamic head of a system for a given flow rate	(ii) calculate total suction head of a system for a given flow rate

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(N) calculate total suction lift, total suction head, total discharge head, and the total dynamic head of a system for a given flow rate	(iii) calculate total discharge head of a system for a given flow rate
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(N) calculate total suction lift, total suction head, total discharge head, and the total dynamic head of a system for a given flow rate	(iv) calculate the total dynamic head of a system for a given flow rate
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(O) calculate hydraulic power	(i) calculate hydraulic power

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(P) calculate centrifugal pump brake horsepower given pump efficiency and hydraulic power	(i) calculate centrifugal pump brake horsepower given pump efficiency and hydraulic power
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(Q) calculate the effect of impeller diameter and speed on the flow rate of a centrifugal pump and pump head	(i) calculate the effect of impeller diameter on the flow rate of a centrifugal pump
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(Q) calculate the effect of impeller diameter and speed on the flow rate of a centrifugal pump and pump head	(ii) calculate the effect of impeller diameter on the flow rate of a pump head

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(Q) calculate the effect of impeller diameter and speed on the flow rate of a centrifugal pump and pump head	(iii) calculate the effect of impeller speed on the flow rate of a centrifugal pump
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(Q) calculate the effect of impeller diameter and speed on the flow rate of a centrifugal pump and pump head	(iv) calculate the effect of impeller speed on the flow rate of a pump head
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(R) predict the effect of impeller diameter on a pump head capacity curve	(i) predict the effect of impeller diameter on a pump head capacity curve

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student applies mathematical principles of pneumatic pressure and flow to explain pressure versus cylinder force, apply and manipulate pneumatic speed control circuits, and describe maintenance of pneumatic equipment, centrifugal pump operation and characteristics, data acquisition systems, pump power, and pump system design. The student is expected to:	(S) calculate net positive suction head	(i) calculate net positive suction head
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(A) calculate stress, strain, and elongation using the modulus of elasticity for a material or model with a given set of data	(i) calculate stress using the modulus of elasticity for a material or model with a given set of data
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(A) calculate stress, strain, and elongation using the modulus of elasticity for a material or model with a given set of data	(ii) calculate strain using the modulus of elasticity for a material or model with a given set of data
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(A) calculate stress, strain, and elongation using the modulus of elasticity for a material or model with a given set of data	(iii) calculate elongation using the modulus of elasticity for a material or model with a given set of data

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(B) analyze and explain the importance of sensitivity in relation to material engineering	(i) analyze the importance of sensitivity in relation to material engineering
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(B) analyze and explain the importance of sensitivity in relation to material engineering	(ii) explain the importance of sensitivity in relation to material engineering
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(C) analyze the operation of a data-acquisition application or program	(i) analyze the operation of a data-acquisition application or program
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(D) mathematically analyze a part for stress and strain under a compression load	(i) mathematically analyze a part for stress under a compression load

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(D) mathematically analyze a part for stress and strain under a compression load	(ii) mathematically analyze a part for strain under a compression load
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(E) calculate shear stress for a material with a given set of data	(i) calculate shear stress for a material with a given set of data
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(F) use the Brinell hardness number to determine the ultimate tensile strength of a material	(i) use the Brinell hardness number to determine the ultimate tensile strength of a material
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(G) apply factors of safety to material engineering designs	(i) apply factors of safety to material engineering designs

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student applies mathematical principles of material engineering, including tensile strength analysis, data acquisition systems, compression testing and analysis, shear and hardness testing and analysis, and design evaluation. The student is expected to:	(H) create material testing conditions for a model using equipment such as a polariscope	(i) create material testing conditions for a model using equipment
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(A) calculate the weight of an object for a given mass	(i) calculate the weight of an object for a given mass
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(B) analyze and calculate torque for a given application using the proper units of measurement	(i) analyze torque for a given application using the proper units of measurement
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(B) analyze and calculate torque for a given application using the proper units of measurement	(ii) calculate torque for a given application using the proper units of measurement
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(C) calculate the magnitude of force applied to a rotational system	(i) calculate the magnitude of force applied to a rotational system

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(D) calculate the mechanical advantage of first-, second-, and third-class levers	(i) calculate the mechanical advantage of first-class levers
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(D) calculate the mechanical advantage of first-, second-, and third-class levers	(ii) calculate the mechanical advantage of second-class levers
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(D) calculate the mechanical advantage of first-, second-, and third-class levers	(iii) calculate the mechanical advantage of thrid-class levers
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(E) compare the advantages and disadvantages of the three classes of levers for different applications	(i) compare the advantages and disadvantages of the three classes of levers for different applications
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(F) calculate and analyze the coefficient of friction in its proper units of measurement	(i) calculate the coefficient of friction in its proper units of measurement

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(F) calculate and analyze the coefficient of friction in its proper units of measurement	(ii) analyze the coefficient of friction in its proper units of measurement
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(G) analyze and calculate mechanical advantage for simple machines using proper units of measurement	(i) analyze mechanical advantage for simple machines using proper units of measurement
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(G) analyze and calculate mechanical advantage for simple machines using proper units of measurement	(ii) calculate mechanical advantage for simple machines using proper units of measurement
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(H) calculate the mechanical advantage of gear drive systems	(i) calculate the mechanical advantage of gear drive systems
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(I) compare and contrast at least two methods of loading a mechanical drive system	(i) compare and contrast at least two methods of loading a mechanical drive system

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(J) calculate rotary mechanical power applied to an application	(i) calculate rotary mechanical power applied to an application
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(K) analyze the mechanical efficiency of a given application	(i) analyze the mechanical efficiency of a given application
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(L) demonstrate various examples of pitch and analyze its proper application	(i) demonstrate various examples of pitch
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(L) demonstrate various examples of pitch and analyze its proper application	(ii) analyze [the] proper application [of pitch].
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(M) calculate the shaft speed and torque of a belt drive and chain drive system	(i) calculate the shaft speed of a belt drive system

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(M) calculate the shaft speed and torque of a belt drive and chain drive system	(ii) calculate the shaft speed of a chain drive system
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(M) calculate the shaft speed and torque of a belt drive and chain drive system	(iii) calculate the torque of a belt drive system
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(M) calculate the shaft speed and torque of a belt drive and chain drive system	(iv) calculate the torque of a chain drive system
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(N) calculate sprocket ratio and analyze its importance to various applications	(i) calculate sprocket ratio to various applications
(10) The student applies mathematical principles for mechanical drives, including levers, linkages, cams, turnbuckles, pulley systems, gear drives, key fasteners, v-belt drives, and chain drives. The student is expected to:	(N) calculate sprocket ratio and analyze its importance to various applications	(ii) analyze [sprocket ratio's] importance to various applications

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(A) evaluate the readings of dial calipers and micrometers to make precise measurements	(i) evaluate the readings of dial calipers to make precise measurements
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(A) evaluate the readings of dial calipers and micrometers to make precise measurements	(ii) evaluate the readings of micrometers to make precise measurements
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(B) use at least three measures of central tendency to analyze the quality of a product	(i) use at least three measures of central tendency to analyze the quality of a product
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(C) use a manually constructed histogram to analyze a given set of data	(i) use a manually constructed histogram to analyze a given set of data

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(D) construct and use a mean-value-and-range chart to determine if a process remains constant over a specified range of time	(i) construct a mean-value-and-range chart to determine if a process remains constant over a specified range of time
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(D) construct and use a mean-value-and-range chart to determine if a process remains constant over a specified range of time	(ii) use a mean-value-and-range chart to determine if a process remains constant over a specified range of time
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(E) examine the maximum and minimum limits of a dimension given its tolerance	(i) examine the maximum limits of a dimension given its tolerance
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(E) examine the maximum and minimum limits of a dimension given its tolerance	(ii) examine the minimum limits of a dimension given its tolerance

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student applies mathematical principles of quality assurance, including using precision measurement tools, statistical process control, control chart operation, analysis of quality assurance control charts, geometric dimensioning and tolerancing, and location, orientation, and form tolerances. The student is expected to:	(F) use position tolerance to calculate the location of a hole	(i) use position tolerance to calculate the location of a hole

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.414. Engineering Science (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 10-12. Prerequisite: Algebra I and Biology, Chemistry, Integrated Physics and Chemistry (IPC), or Physics. Recommended prerequisite: Geometry. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Engineering Science is an engineering course designed to expose students to some of the major concepts and technologies that they will encounter in a postsecondary program of study in any engineering domain. Students will have an opportunity to investigate engineering and high-tech careers. In Engineering Science, students will employ science, technology, engineering, and mathematical concepts in the solution of real-world challenge situations. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also learn how to document their work and communicate their solutions to their peers and members of the professional community.
(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to dress speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsability in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(i) demonstrate safe practices during laboratory investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(ii) demonstrate safe practices during field investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(iii) demonstrate an understanding of the proper disposal or recycling of materials
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(i) know the definition of science, as specified in subsection (b)(4) [above]

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(4) [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(i) know that hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(ii) know that hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(i) know [that] scientific theories are based on natural and physical phenomena
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(ii) know [that] scientific theories are capable of being tested by multiple independent researchers
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iii) [know that] unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iv) [know that], unlike hypotheses, scientific theories are highly-reliable explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(v) [know that] scientific theories may be subject to change as new areas of science are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(vi) [know that] scientific theories may be subject to change as new technologies are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(i) plan descriptive investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(ii) plan descriptive investigations, including selecting equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(iii) plan descriptive investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(iv) implement descriptive investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(v) implement descriptive investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(vi) implement descriptive investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(vii) plan comparative investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(viii) plan comparative investigations, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(ix) plan comparative investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(x) plan comparative investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xi) implement comparative investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xii) implement comparative investigations, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xiii) implement comparative investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xiv) implement comparative investigations, including selecting technology

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xv) plan experimental investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xvi) plan experimental investigations, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xvii) plan experimental investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xviii) plan experimental investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xix) implement experimental investigations, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xx) implement experimental investigations, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxi) implement experimental investigations, including selecting equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology	(xxii) implement experimental investigations, including selecting technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(i) collect qualitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(ii) organize qualitative data using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(iii) collect quantitative data using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(iv) organize quantitative data using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(v) make measurements with accuracy using [various] tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, electronic balances, micropipettors, hand lenses, surgical and imagining equipment, thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, and models, diagrams, or samples of biological specimens or structures	(vi) make measurements with precision using [various] tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(i) analyze data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(ii) evaluate data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iii) make inferences from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iv) predict trends from data

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions supported by the data through [various] methods
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(i) in all fields of science, analyze scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ii) in all fields of science, analyze scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iii) in all fields of science, analyze scientific explanations by using experimental testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iv) in all fields of science, analyze scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vi) in all fields of science, evaluate scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vii) in all fields of science, evaluate scientific explanations by using logical reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(viii) in all fields of science, evaluate scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ix) in all fields of science, evaluate scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xi) in all fields of science, critique scientific explanations by using empirical evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xii) in all fields of science, critique scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiii) in all fields of science, critique scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiv) in all fields of science, critique scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of scientific research on society and the environment	(i) evaluate the impact of scientific research on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of scientific research on society and the environment	(ii) evaluate the impact of scientific research on the environment

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) evaluate models according to their limitations in representing objects or events	(i) evaluate models according to their limitations in representing objects or events
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(A) differentiate between engineering and engineering technology	(i) differentiate between engineering and engineering technology
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(B) compare the roles or job descriptions for career opportunities in the fields of pure science, engineering, and engineering technology	(i) compare the roles or job descriptions for career opportunities in the field of pure science
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(B) compare the roles or job descriptions for career opportunities in the fields of pure science, engineering, and engineering technology	(ii) compare the roles or job descriptions for career opportunities in the field of engineering
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(B) compare the roles or job descriptions for career opportunities in the fields of pure science, engineering, and engineering technology	(iii) compare the roles or job descriptions for career opportunities in the field of engineering technology
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(C) identify and differentiate between the different engineering disciplines	(i) identify the different engineering disciplines
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(C) identify and differentiate between the different engineering disciplines	(ii) differentiate between the different engineering disciplines

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(D) demonstrate appropriate oral, written, and visual forms of technical communication	(i) demonstrate appropriate oral forms of technical communication
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(D) demonstrate appropriate oral, written, and visual forms of technical communication	(ii) demonstrate appropriate written forms of technical communication
(5) The student investigates engineering-related fields and career opportunities. The student is expected to:	(D) demonstrate appropriate oral, written, and visual forms of technical communication	(iii) demonstrate appropriate visual forms of technical communication
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(A) solve design problems individually and in a team	(i) solve design problems individually
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(A) solve design problems individually and in a team	(ii) solve design problems in a team
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(B) create solutions to existing problems using a design process	(i) create solutions to existing problems using a design process
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(C) use a design brief to identify problem specifications and establish project constraints	(i) use a design brief to identify problem specifications

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(C) use a design brief to identify problem specifications and establish project constraints	(ii) use a design brief to establish project constraints
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(D) use communication to achieve a desired goal within a team	(i) use communication to achieve a desired goal within a team
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(E) work as a member of a team to conduct research to develop a knowledge base, stimulate creative ideas, and make informed decisions	(i) work as a member of a team to conduct research to develop a knowledge base
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(E) work as a member of a team to conduct research to develop a knowledge base, stimulate creative ideas, and make informed decisions	(ii) work as a member of a team to conduct research to stimulate creative ideas
(6) The student demonstrates an understanding of design problems and works individually and as a member of a team to solve design problems. The student is expected to:	(E) work as a member of a team to conduct research to develop a knowledge base, stimulate creative ideas, and make informed decisions	(iii) work as a member of a team to make informed decisions
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(i) explain the purpose of components, including gears

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(ii) explain the purpose of components, including sprockets
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(iii) explain the purpose of components, including pulley systems
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(iv) explain the purpose of components, including simple machines
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(v) explain the operation of components, including gears
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(vi) explain the operation of components, including sprockets
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(vii) explain the operation of components, including pulley systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(A) explain the purpose and operation of components, inlcuding gears, sprockets, pulley systems, and simple machines	(viii) explain the operation of components, including simple machines
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(B) explain how components, including gears, sprockets, pulley systems, and simple machines, make up mechanisms	(i) explain how components, including gears, make up mechanisms
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(B) explain how components, including gears, sprockets, pulley systems, and simple machines, make up mechanisms	(ii) explain how components, including sprockets, make up mechanisms
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(B) explain how components, including gears, sprockets, pulley systems, and simple machines, make up mechanisms	(iii) explain how components, including pulley systems, make up mechanisms
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(B) explain how components, including gears, sprockets, pulley systems, and simple machines, make up mechanisms	(iv) explain how components, including simple machines, make up mechanisms
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(C) distinguish between the six simple machines and their attributes and components	(i) distinguish between the six simple machines

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(C) distinguish between the six simple machines and their attributes and components	(ii) distinguish between [the six simple machines'] attributes
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(C) distinguish between the six simple machines and their attributes and components	(iii) distinguish between [the six simple machines'] components
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(D) measure forces and distances related to a mechanism	(i) measure forces related to a mechanism
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(D) measure forces and distances related to a mechanism	(ii) measure distances related to a mechanism
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(E) calculate work and power in mechanical systems	(i) calculate work in mechanical systems
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(E) calculate work and power in mechanical systems	(ii) calculate power in mechanical systems

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(F) determine experimentally the efficiency of mechanical systems	(i) determine experimentally the efficiency of mechanical systems
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(G) calculate mechanical advantage and drive ratios of mechanisms	(i) calculate mechanical advantage of mechanisms
(7) The student understands mechanisms, including simple and compound machines, and performs calculations related to mechanical advantage, drive ratios, work, and power. The student is expected to:	(G) calculate mechanical advantage and drive ratios of mechanisms	(ii) calculate drive ratios of mechanisms
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(A) identify and categorize energy sources as nonrenewable, renewable, or inexhaustible	(i) identify energy sources
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(A) identify and categorize energy sources as nonrenewable, renewable, or inexhaustible	(ii) categorize energy sources as nonrenewable, renewable, or inexhaustible
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(B) define and calculate work and power in electrical systems	(i) define work in electrical systems

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(B) define and calculate work and power in electrical systems	(ii) define power in electrical systems
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(B) define and calculate work and power in electrical systems	(iii) calculate work in electrical systems
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(B) define and calculate work and power in electrical systems	(iv) calculate power in electrical systems
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(C) calculate power in a system that converts energy from electrical to mechanical	(i) calculate power in a system that converts energy from electrical to mechanical
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(i) define voltage
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(ii) define current
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(iii) define resistance

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(iv) calculate [voltage] in series electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(v) calculate [current] in series electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(vi) calculate [resistance] in series electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(vii) calculate [voltage] in parallel electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(viii) calculate [current] in parallel electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(ix) calculate [resistance] in parallel electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(x) calculate [voltage] in combination electrical circuits using Ohm's law

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(xi) calculate [current] in combination electrical circuits using Ohm's law
(8) The student understands energy sources, energy conversion, and circuits and performs calculations related to work and power. The student is expected to:	(D) define voltage, current, and resistance and calculate each quantity in series, parallel, and combination electrical circuits using Ohm's law	(xii) calculate [resistance] in combination electrical circuits using Ohm's law
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(A) explain the purpose of energy management	(i) explain the purpose of energy management
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(B) evaluate system energy requirements in order to select the proper energy source	(i) evaluate system energy requirements in order to select the proper energy source

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(C) explain how multiple energy sources can be combined to convert energy into useful forms	(i) explain how multiple energy sources can be combined to convert energy into useful forms
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(D) describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity	(i) describe how hydrogen fuel cells create electricity
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(D) describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity	(ii) describe how hydrogen fuel cells create heat
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(D) describe how hydrogen fuel cells create electricity and heat and how solar cells create electricity	(iii) describe how solar cells create electricity

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(i) measure how thermal energy is transferred via convection
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(ii) measure how thermal energy is transferred via conduction
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(iii) measure how thermal energy is transferred via radiation
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(iv) analyze how thermal energy is transferred via convection

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(v) analyze how thermal energy is transferred via conduction
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(E) measure and analyze how thermal energy is transferred via convection, conduction, and radiation	(vi) analyze how thermal energy is transferred via radiation
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(F) analyze how thermal energy transfer is affected by conduction, thermal resistance values, convection, and radiation	(i) analyze how thermal energy transfer is affected by conduction
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(F) analyze how thermal energy transfer is affected by conduction, R-values, and radiation	(ii) analyze how thermal energy transfer is affected by thermal resistance values

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(F) analyze how thermal energy transfer is affected by conduction, R-values, and radiation	(iii) analyze how thermal energy transfer is affected by convection
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(F) analyze how thermal energy transfer is affected by conduction, R-values, and radiation	(iv) analyze how thermal energy transfer is affected by radiation
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(i) calculate resistance in power transmission applications for various material properties
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(ii) calculate efficiency in power transmission applications for various material properties

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(iii) calculate power transfer in power transmission applications for various material properties
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(iv) calculate resistance in power distribution applications for various material properties
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(v) calculate efficiency in power distribution applications for various material properties
(9) The student understands system energy requirements and how energy sources can be combined to convert energy into useful forms. The student understands the relationships among material conductivity, resistance, and geometry in order to calculate energy transfer and determine power loss and efficiency. The student is expected to:	(G) calculate resistance, efficiency, and power transfer in power transmission and distribution applications for various material properties	(vi) calculate power transfer in power distribution applications for various material properties

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(A) illustrate, calculate, and experimentally measure all forces acting upon a given body	(i) llustrate all forces acting upon a given body
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(A) illustrate, calculate, and experimentally measure all forces acting upon a given body	(ii) calculate all forces acting upon a given body
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(A) illustrate, calculate, and experimentally measure all forces acting upon a given body	(iii) measure all forces acting upon a given body
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(B) locate the centroid of structural members mathematically or experimentally	(i) locate the centroid of structural members mathematically or experimentally
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(C) calculate moment of inertia of structural members	(i) calculate moment of inertia of structural members
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(D) define and calculate static equilibrium	(i) define static equilibrium
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(D) define and calculate static equilibrium	(ii) calculate static equilibrium

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(E) differentiate between scalar and vector quantities	(i) differentiate between scalar and vector quantities
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(F) identify properties of a vector, including magnitude and direction	(i) identify properties of a vector, including magnitude
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(F) identify properties of a vector, including magnitude and direction	(ii) identify properties of a vector, including direction
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(G) calculate the X and Y components given a vector	(i) calculate the X components given a vector
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(G) calculate the X and Y components given a vector	(ii) calculate the Y components given a vector
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(H) calculate moment forces given a specified axis	(i) calculate moment forces given a specified axis
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(I) calculate unknown forces using equations of equilibrium	(i) calculate unknown forces using equations of equilibrium

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(J) calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations	(i) calculate external forces in a statically determinate truss using translational equilibrium equations
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(J) calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations	(ii) calculate external forces in a statically determinate truss using rotational equilibrium equations
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(J) calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations	(iii) calculate internal forces in a statically determinate truss using translational equilibrium equations
(10) The student understands the interaction of forces acting on a body and performs calculations related to structural design. The student is expected to:	(J) calculate external and internal forces in a statically determinate truss using translational and rotational equilibrium equations	(iv) calculate internal forces in a statically determinate truss using rotational equilibrium equations
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(A) conduct investigative non-destructive material property tests on selected common household products	(i) conduct investigative non-destructive material property tests on selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(i) calculate the weight of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(ii) calculate the volume of selected common household products

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(iii) calculate the mass of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(iv) calculate the density of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(v) calculate the surface area of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(vi) measure the weight of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(vii) measure the volume of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(viii) measure the mass of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(ix) measure the density of selected common household products

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(B) calculate and measure the weight, volume, mass, density, and surface area of selected common household products	(x) measure the surface area of selected common household products
(11) The student understands material properties and the importance of choosing appropriate materials for design. The student is expected to:	(C) identify the manufacturing processes used to create selected common household products	(i) identify the manufacturing processes used to create selected common household products
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(A) use a design process and mathematical formulas to solve and document design problems	(i) use a design process to solve design problems
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(A) use a design process and mathematical formulas to solve and document design problems	(ii) use a design process to document design problems
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(A) use a design process and mathematical formulas to solve and document design problems	(iii) use mathematical formulas to solve design problems
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(A) use a design process and mathematical formulas to solve and document design problems	(iv) use a mathematical formulas to document design problems
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(B) obtain measurements of material samples such as length, width, height, and mass	(i) obtain measurements of material samples

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(C) use material testing to determine a product's reliability, safety, and predictability in function	(i) use material testing to determine a product's reliability in function
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(C) use material testing to determine a product's reliability, safety, and predictability in function	(ii) use material testing to determine a product's safety in function
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(C) use material testing to determine a product's reliability, safety, and predictability in function	(iii) use material testing to determine a product's predictability in function
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(D) identify and calculate test sample material properties using a stress-strain curve	(i) identify test sample material properties using a stress-strain curve
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(D) identify and calculate test sample material properties using a stress-strain curve	(ii) calculate test sample material properties using a stress-strain curve
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points	(i) identify measurements of sample material properties using stress-strain data points

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points	(ii) identify calculations of sample material properties using stress-strain data points
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points	(iii) compare measurements of sample material properties using stress-strain data points
(12) The student uses material testing to determine a product's function and performance. The student is expected to:	(E) identify and compare measurements and calculations of sample material properties such as elastic range, proportional limit, modulus of elasticity, elastic limit, resilience, yield point, plastic deformation, ultimate strength, failure, and ductility using stress-strain data points	(iv) compare calculations of sample material properties using stress-strain data points
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(A) create detailed flowcharts using a computer software application	(i) create detailed flowcharts using a computer software application

Knowledge and Skill Statement	Student Expectation	Breakout
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(B) create control system operating programs using computer software	(i) create control system operating programs using computer software
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(C) create system control programs that use flowchart logic	(i) create system control programs that use flowchart logic
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(D) select appropriate input and output devices based on the need of a technological system	(i) select appropriate input devices based on the need of a technological system
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(D) select appropriate input and output devices based on the need of a technological system	(ii) select appropriate output devices based on the need of a technological system
(13) The student understands that control systems are designed to provide consentient process control and reliability and uses computer software to create flowcharts and control system operating programs. The student is expected to:	(E) judge between open- and closed-loop systems in order to select the most appropriate system for a given technological problem	(i) judge between open- and closed-loop systems in order to select the most appropriate system for a given technological problem

Knowledge and Skill Statement	Student Expectation	Breakout
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(A) identify and explain basic components and functions of fluid power devices	(i) identify basic components of fluid power devices
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(A) identify and explain basic components and functions of fluid power devices	(ii) identify basic functions of fluid power devices
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(A) identify and explain basic components and functions of fluid power devices	(iii) explain basic components of fluid power devices
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(A) identify and explain basic components and functions of fluid power devices	(iv) explain basic functions of fluid power devices
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(B) differentiate between pneumatic and hydraulic systems and between hydrodynamic and hydrostatic systems	(i) differentiate between pneumatic and hydraulic systems
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(B) differentiate between pneumatic and hydraulic systems and between hydrodynamic and hydrostatic systems	(ii) differentiate between hydrodynamic and hydrostatic systems

Knowledge and Skill Statement	Student Expectation	Breakout
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(C) use Pascal's Law to calculate values in a fluid power system	(i) use Pascal's Law to calculate values in a fluid power system
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(D) distinguish between gauge pressure and absolute pressure and between temperature and absolute temperature	(i) distinguish between gauge pressure and absolute pressure
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(D) distinguish between gauge pressure and absolute pressure and between temperature and absolute temperature	(ii) distinguish between temperature and absolute temperature
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(E) calculate values in a pneumatic system using the ideal gas laws	(i) calculate values in a pneumatic system using the ideal gas laws
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(F) calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system	(i) calculate flow rate in a hydraulic system
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(F) calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system	(ii) calculate flow velocity in a hydraulic system
(14) The student demonstrates an understanding of fluid power systems and calculates values in a variety of systems. The student is expected to:	(F) calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system	(iii) calculate mechanical advantage in a hydraulic system

Knowledge and Skill Statement	Student Expectation	Breakout
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate the theoretical probability that an event will occur	(i) calculate the theoretical probability that an event will occur
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(B) calculate the experimental frequency distribution of an event occurring	(i) calculate the experimental frequency distribution of an event occurring
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(C) apply the Bernoulli process to events that only have two distinct possible outcomes	(i) apply the Bernoulli process to events that only have two distinct possible outcomes
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(D) apply AND, OR, and NOT logic to solve complex probability scenarios	(i) apply AND logic to solve complex probability scenarios
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(D) apply AND, OR, and NOT logic to solve complex probability scenarios	(ii) apply OR logic to solve complex probability scenarios
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(D) apply AND, OR, and NOT logic to solve complex probability scenarios	(iii) apply NOT logic to solve complex probability scenarios

Knowledge and Skill Statement	Student Expectation	Breakout
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(E) apply Bayes's theorem to calculate the probability of multiple events occurring	(i) apply Bayes's theorem to calculate the probability of multiple events occurring
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(F) calculate the central tendency of a data array, including mean, median, and mode	(i) calculate the central tendency of a data array, including mean
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(F) calculate the central tendency of a data array, including mean, median, and mode	(ii) calculate the central tendency of a data array, including median
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(F) calculate the central tendency of a data array, including mean, median, and mode	(iii) calculate the central tendency of a data array, including mode
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(G) calculate data variation, including range, standard deviation, and variance	(i) calculate data variation, including range
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(G) calculate data variation, including range, standard deviation, and variance	(ii) calculate data variation, including standard deviation

Knowledge and Skill Statement	Student Expectation	Breakout
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(G) calculate data variation, including range, standard deviation, and variance	(iii) calculate data variation, including variance
(15) The student demonstrates an understanding of statistics and applies the concepts to real-world engineering design problems. The student is expected to:	(H) create a histogram to illustrate frequency distribution	(i) create a histogram to illustrate frequency distribution
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate distance, displacement, speed, velocity, and acceleration from data	(i) calculate distance from data
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate distance, displacement, speed, velocity, and acceleration from data	(ii) calculate displacement from data
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate distance, displacement, speed, velocity, and acceleration from data	(iii) calculate speed from data
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate distance, displacement, speed, velocity, and acceleration from data	(iv) calculate velocity from data

Knowledge and Skill Statement	Student Expectation	Breakout
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(A) calculate distance, displacement, speed, velocity, and acceleration from data	(v) calculate acceleration from data
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(B) calculate experimentally the acceleration due to gravity given data from a free-fall device	(i) calculate experimentally the acceleration due to gravity given data from a free-fall device
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(C) calculate the X and Y components of an object in projectile motion	(i) calculate the X components of an object in projectile motion
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(C) calculate the X and Y components of a projectile motion	(ii) calculate the Y components of an object in projectile motion
(16) The student demonstrates an understanding of kinematics in one and two dimensions and applies the concepts to real-world engineering design problems. The student is expected to:	(D) determine the angle needed to launch a projectile a specific range given the projectile's initial velocity	(i) determine the angle needed to launch a projectile a specific range given the projectile's initial velocity

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.415. Biotechnology I (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biology and Chemistry. Recommended prerequisite: Principles of Biosciences. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) In Biotechnology I, students will apply advanced academic knowledge and skills to the emerging fields of biotechnology such as agricultural, medical, regulatory, and forensics. Students will have the opportunity to use sophisticated laboratory equipment, perform statistical analysis, and practice quality-control techniques. Students will conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Biotechnology I will study a variety of topics that include structures and functions of cells, nucleic acids, proteins, and genetics.
(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation can be experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (science methods) and ethical and social decisions that involve science (the application of scientific information).
(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) Show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) Show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) Show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear, concise, and effective manner

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present oral communication in a clear, concise, and effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(i) demonstrate safe practices during laboratory investigations, including chemical safety
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(ii) demonstrate safe practices during laboratory investigations, including electrical safety
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(iii) demonstrate safe practices during laboratory investigations, including fire safety

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(iv) demonstrate safe practices during laboratory investigations, including safe handling of live organisms
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(v) demonstrate safe practices during laboratory investigations, including safe handling of preserved organisms
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(vi) demonstrate safe practices during field investigations, including chemical safety

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(vii) demonstrate safe practices during field investigations, including electrical safety
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(viii) demonstrate safe practices during field investigations, including fire safety
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(ix) demonstrate safe practices during field investigations, including safe handling of live organisms

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations, including chemical, electrical, and fire safety, and safe handling of live and preserved organisms	(x) demonstrate safe practices during field investigations, including safe handling of preserved organisms
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(iii) demonstrate an understanding of the proper disposal or recycling of materials
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(C) demonstrate appropriate safety procedures, guidelines, and chemical hygiene plan	(i) demonstrate appropriate safety procedures
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(C) demonstrate appropriate safety procedures, guidelines, and chemical hygiene plan	(ii) demonstrate appropriate safety guidelines

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(C) demonstrate appropriate safety procedures, guidelines, and chemical hygiene plan	(iii) demonstrate appropriate safety chemical hygiene plan
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(D) maintain required safety training, including location and understanding of interpretation of safety data sheets	(i) maintain required safety training, including location of safety data sheets
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(D) maintain required safety training, including location and understanding of interpretation of safety data sheets	(i) maintain required safety training, including understanding of interpretation of safety data sheets

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(E) comply with federal and state safety regulations as specified by Occupational Safety and Health Administration (OSHA) and other regulatory agencies as appropriate	(i) comply with federal safety regulations as specified by Occupational Safety and Health Administration (OSHA)
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(E) comply with federal and state safety regulations as specified by Occupational Safety and Health Administration (OSHA) and other regulatory agencies as appropriate	(ii) comply with state safety regulations as specified by Occupational Safety and Health Administration (OSHA)
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(E) comply with federal and state safety regulations as specified by Occupational Safety and Health Administration (OSHA) and other regulatory agencies as appropriate	(iii) comply with other regulatory agencies as appropriate

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(F) identify and obey safety symbols and signs	(i) identify safety symbols
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(F) identify and obey safety symbols and signs	(ii) identify safety signs
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(F) identify and obey safety symbols and signs	(iii) obey safety symbols

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(F) identify and obey safety symbols and signs	(iv) obey safety signs
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(G) maintain clean and well organized work areas	(i) maintain clean work areas
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(G) maintain clean and well organized work areas	(ii) maintain well organized work areas

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(H) dispose of equipment, glassware, and biologics according to laboratory policies	(i) dispose of equipment according to laboratory policies
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(H) dispose of equipment, glassware, and biologics according to laboratory policies	(ii) dispose of glassware according to laboratory policies
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(H) dispose of equipment, glassware, and biologics according to laboratory policies	(iii) dispose of biologics according to laboratory policies

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(I) recognize common laboratory hazards	(i) recognize common laboratory hazards
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(J) observe procedures for the safe use of instruments, gas cylinders, and chemicals	(i) observe procedures for the safe use of instruments
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(J) observe procedures for the safe use of instruments, gas cylinders, and chemicals	(i) observe procedures for the safe use of gas cylinders

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(J) observe procedures for the safe use of instruments, gas cylinders, and chemicals	(i) observe procedures for the safe use of chemicals
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(K) maintain safety and personal protection equipment	(i) maintain safety equipment
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(K) maintain safety and personal protection equipment	(i) maintain personal protection equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(i) know the definition of science as specified in subsection (b)(4) of this section [above]

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(4) of this section [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(i) know that hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(ii) know that hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(iii) know that hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(i) know that scientific theories are based on natural and physical phenomena

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(ii) know that scientific theories are capable of being tested by multiple independent researchers
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iii) know that unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(iv) know that, unlike hypotheses, scientific theories are highly-reliable explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(v) know that scientific theories may be subject to change as new areas of science are developed

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed	(vi) know that scientific theories may be subject to change as new technologies are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(i) plan investigative procedures, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(ii) plan investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(iii) plan investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(iv) plan investigative procedures, including handling appropriate equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(v) plan investigative procedures, including maintaining appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(vi) implement investigative procedures, including asking questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(vii) implement investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(viii) implement investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(ix) implement investigative procedures, including handling appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology	(x) implement investigative procedures, including maintaining appropriate technology

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(i) collect data individually or collaboratively to describe data, including mean
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(ii) collect data individually or collaboratively, to describe data, including median
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(iii) collect data individually or collaboratively, to describe data, including range
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(iv) make measurements with precision to describe data, including mean
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(v) make measurements with precision to describe data, including median

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(vi) make measurements with precision to describe data, including range
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(vii) make measurements with accuracy to describe data, including mean
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(viii) make measurements with accuracy to describe data, including median
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(ix) make measurements with accuracy to describe data, including range
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(x) record values using appropriate units, to describe data, including mean

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(xi) record values using appropriate units, to describe data, including median
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(xii) record values using appropriate units, to describe data, including range
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(xiii) calculate statistically relevant quantities to describe data, including mean
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(xiv) calculate statistically relevant quantities to describe data, including median
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range	(xv) calculate statistically relevant quantities to describe data, including range

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) demonstrate the use of course apparatus, equipment, techniques, and procedures	(i) demonstrate the use of course apparatus
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) demonstrate the use of course apparatus, equipment, techniques, and procedures	(ii) demonstrate the use of course equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) demonstrate the use of course apparatus, equipment, techniques, and procedures	(iii) demonstrate the use of course techniques
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) demonstrate the use of course apparatus, equipment, techniques, and procedures	(iv) demonstrate the use of course procedures
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) organize, analyze, evaluate, build models, make inferences, and predict trends from data	(i) organize and predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) organize, analyze, evaluate, build models, make inferences, and predict trends from data	(ii) analyze and predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) organize, analyze, evaluate, build models, make inferences, and predict trends from data	(iii) evaluate and predict trends from data

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) organize, analyze, evaluate, build models, make inferences, and predict trends from data	(iv) build models and predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) organize, analyze, evaluate, build models, make inferences, and predict trends from data	(v) make inferences and predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) perform calculations using dimensional analysis, significant digits, and scientific notation	(i) perform calculations using dimensional analysis
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) perform calculations using dimensional analysis, significant digits, and scientific notation	(ii) perform calculations using significant digits
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) perform calculations using dimensional analysis, significant digits, and scientific notation	(iii) perform calculations using scientific notation
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) communicate valid conclusions using essential vocabulary and multiple modes of expression such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions using essential vocabulary

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) communicate valid conclusions using essential vocabulary and multiple modes of expression such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(ii) communicate valid conclusions using multiple modes of expression
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(i) in all fields of science, analyze scientific explanations by using empirical evidence including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ii) in all fields of science evaluate scientific explanations by using empirical evidence including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iii) in all fields of science critique scientific explanations by using empirical evidence including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iv) in all fields of science, analyze logical reasoning including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(v) in all fields of science evaluate logical reasoning including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vi) in all fields of science critique logical reasoning including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vii) in all fields of science, analyze experimental testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(viii) in all fields of science, evaluate experimental testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ix) in all fields of science, critique experimental testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(x) in all fields of science, analyze observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xi) in all fields of science, evaluate observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xii) in all fields of science, critique observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(i) evaluate the impact of research on scientific thought

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(ii) evaluate the impact of research on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(iii) evaluate the impact of research on the environment
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(iv) evaluate the impact of technology on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(v) evaluate the impact of technology on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) evaluate the impact of research and technology on scientific thought, society, and the environment	(vi) evaluate the impact of technology on the environment
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) evaluate models according to their limitations in representing biological objects or events	(i) evaluate models according to their limitations in representing biological objects or events

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) describe the connection between biotechnology and future careers	(i) describe the connection between biotechnology and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) research and describe the history of biotechnology and contributions of scientists	(i) research the history of biotechnology
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) research and describe the history of biotechnology and contributions of scientists	(ii) describe the history of biotechnology
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) research and describe the history of biotechnology and contributions of scientists	(iii) research the contributions of scientists
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) research and describe the history of biotechnology and contributions of scientists	(iv) describe the contributions of scientists
(5)The student explores the emerging field of biotechnology. The student is expected to:	(A) define biotechnology and provide examples of biotechnology products such as recombinant proteins, fermented foods, biopharmaceuticals, and genetically modified foods	(i) define biotechnology

Knowledge and Skill Statement	Student Expectation	Breakout
(5)The student explores the emerging field of biotechnology. The student is expected to:	(A) define biotechnology and provide examples of biotechnology products such as recombinant proteins, fermented foods, biopharmaceuticals, and genetically modified foods	(ii) provide examples of biotechnology products
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(i) apply scientific processes outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(ii) apply scientific processes outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including cellular structures
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(iii) apply scientific processes outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including cellular functions
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(iv) apply scientific processes outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including viruses
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(v) apply scientific concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells

Knowledge and Skill Statement	Student Expectation	Breakout
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(vi) apply scientific concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including cellular structures
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(vii) apply scientific concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including cellular functions
(5)The student explores the emerging field of biotechnology. The student is expected to:	(B) apply scientific processes and concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including all types of cells; cellular structures and functions; and viruses	(viii) apply scientific concepts outlined in the Texas essential knowledge and skills (TEKS) for Biology relevant to biotechnology, including viruses
(5)The student explores the emerging field of biotechnology. The student is expected to:	(C) explore applications of bioinformatics such as deoxyribonucleic acid (DNA) barcoding, phylogenetic relationships, and the use of online databases	(i) explore applications of bioinformatics
(5)The student explores the emerging field of biotechnology. The student is expected to:	(D) research career opportunities in fields such as molecular, forensic, medical, regulatory, and agricultural biotechnology	(i) research career opportunities in fields
(5)The student explores the emerging field of biotechnology. The student is expected to:	(E) research the history of biotechnology and contributions of scientists	(i) research the history of biotechnology
(5)The student explores the emerging field of biotechnology. The student is expected to:	(E) research the history of biotechnology and contributions of scientists	(ii) research the contributions of scientists

Knowledge and Skill Statement	Student Expectation	Breakout
(5)The student explores the emerging field of biotechnology. The student is expected to:	(F) define bioethics and research applications of bioethics	(i) define bioethics
(5)The student explores the emerging field of biotechnology. The student is expected to:	(F) define bioethics and research applications of bioethics	(ii) research applications of bioethics
(5)The student explores the emerging field of biotechnology. The student is expected to:	(G) research applications in agricultural biotechnology such as tissue culturing, genetically modified foods, plant propagation, and hydroponics	(i) research applications in agricultural biotechnology
(5)The student explores the emerging field of biotechnology. The student is expected to:	(H) research applications in medical biotechnology such as vaccines, stem cells, microarrays, and pharmaceutical production	(i) research applications in medical biotechnology
(6) The student summarizes biotechnology laboratory procedures and their applications in the biotechnology industry. The student is expected to:	(A) identify the major sectors of the biotechnology industry	(i) identify the major sectors of the biotechnology industry
(6) The student summarizes biotechnology laboratory procedures and their applications in the biotechnology industry. The student is expected to:	(B) categorize the biotechnology laboratory procedures included in each sector	(i) categorize the biotechnology laboratory procedures included in each sector
(6) The student summarizes biotechnology laboratory procedures and their applications in the biotechnology industry. The student is expected to:	(C) compare the different applications used in biotechnology laboratory procedures of each sector	(i) compare the different applications used in biotechnology laboratory procedures of each sector

Knowledge and Skill Statement	Student Expectation	Breakout
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(i) explain terms realted to molecular biology, including nucleis acids
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(ii) explain terms realted to molecular biology, including nitrogen base
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(iii) explain terms realted to molecular biology, including amino acids
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(iv) explain terms realted to molecular biology, including transcription
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(v) explain terms realted to molecular biology, including translation
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(vii) explain terms realted to molecular biology, including polymerase

Knowledge and Skill Statement	Student Expectation	Breakout
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(A) explain terms related to molecular biology including nucleic acids, nitrogen bases, amino acids, transcription, translation, polymerase, and protein synthesis	(viii) explain terms realted to molecular biology, including protein synthesis
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(i) describe the structure of deoxyribonucleic acid (DNA) in cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(ii) describe the structure of deoxyribonucleic acid (DNA) in viruses
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(iii) describe the function of deoxyribonucleic acid (DNA) cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(iv) describe the function of deoxyribonucleic acid (DNA) in viruses
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(v) describe the structure ribonucleic acid (RNA) in cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(vi) describe the structure of ribonucleic acid (RNA) in viruses

Knowledge and Skill Statement	Student Expectation	Breakout
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(vii) describe the function of ribonucleic acid (RNA) in cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(B) describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses	(viii) describe the function of ribonucleic acid (RNA) in viruses
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(C) compare and contrast the nitrogen bases of DNA and RNA	(i) compare and contrast the nitrogen bases of DNA and RNA
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(D) explain how nucleotides join together to form a DNA double helix	(i) explain how nucleotides join together to form a DNA double helix
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(E) describe the DNA replication process in eukaryotic and prokaryotic cells	(i) describe the DNA replication process in eukaryotic cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(E) describe the DNA replication process in eukaryotic and prokaryotic cells	(ii) describe the DNA replication process in prokaryotic cells
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(F) illustrate the process of protein synthesis	(i) illustrate the process of protein synthesis
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(i) describe the structure of proteins, including 3D folding
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(ii) describe the structure of proteins, including enzymes

Knowledge and Skill Statement	Student Expectation	Breakout
(7)The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(iii) describe the structure of proteins, including antibodies
(7) The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(iv) describe the function of proteins, including 3D folding
(7) The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(v) describe the function of proteins, including enzymes
(7) The student understands the role of genetics in the biotechnology industry. The student is expected to:	(G) describe the structure and function of proteins, including 3D folding, enzymes, and antibodies	(vi) describe the function of proteins, including antibodies
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(A) describe the fundamental steps in recombinant DNA technology	(i) describe the fundamental steps in recombinant DNA technology
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(B) explain how recombinant DNA technology is used to clone genes and create recombinant proteins	(i) explain how recombinant DNA technology is used to clone genes
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(B) explain how recombinant DNA technology is used to clone genes and create recombinant proteins	(ii) explain how recombinant DNA technology is used to create recombinant proteins
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(C) explain the role of tissue cultures to genetic modification procedures	(i) explain the role of tissue cultures to genetic modification procedures

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(D) describe plant- and animal-tissue culture procedures	(i) describe plant-tissue culture procedures
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(D) describe plant- and animal-tissue culture procedures	(ii) describe animal-tissue culture procedures
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(E) compare and contrast proper growing conditions for plant and animal tissue cultures	(i) compare and contrast proper growing conditions for plant and animal tissue cultures
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(F) explain the role of restriction enzymes	(i) explain the role of restriction enzymes
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(G) distinguish among vectors commonly used in biotechnology for DNA insertion, including plasmids, retroviruses, and bacteriophages	(i) distinguish among vectors commonly used in biotechnology for DNA insertion, including plasmids
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(G) distinguish among vectors commonly used in biotechnology for DNA insertion, including plasmids, retroviruses, and bacteriophages	(ii) distinguish among vectors commonly used in biotechnology for DNA insertion, including retroviruses
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(G) distinguish among vectors commonly used in biotechnology for DNA insertion, including plasmids, retroviruses, and bacteriophages	(iii) distinguish among vectors commonly used in biotechnology for DNA insertion, including bacteriophages

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(H) explain the steps and components of the polymerase chain reaction	(i) explain the steps of the polymerase chain reaction
(8) The student analyzes the importance of recombinant DNA technology and genetic engineering. The student is expected to:	(H) explain the steps and components of the polymerase chain reaction	(ii) explain the components of the polymerase chain reaction
(9) The student examines federal, state, local, and industry regulations as related to biotechnology. The student is expected to:	(A) discuss the relationship between the local, state, and federal agencies responsible for regulation of the biotechnology industry	(i) discuss the relationships between the local, state, and federal agencies responsible for regulation of the biotechnology industry
(9) The student examines federal, state, local, and industry regulations as related to biotechnology. The student is expected to:	(B) analyze policies and procedures used in the biotechnology industry such as quality assurance, standard operating procedures (SOPs), Good Manufacturing Practices (GMPs), and International Organization for Standardization (ISO) quality systems	(i) analyze policies used in the biotechnology industry
(9) The student examines federal, state, local, and industry regulations as related to biotechnology. The student is expected to:	(B) analyze policies and procedures used in the biotechnology industry such as quality assurance, standard operating procedures (SOPs), Good Manufacturing Practices (GMPs), and International Organization for Standardization (ISO) quality systems	(ii) analyze procedures used in the biotechnology industry
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(i) identify laboratory equipment, including a microscope

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(ii) identify laboratory equipment, including a thermocycler
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(iii) identify laboratory equipment, including a hood
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(iv) identify laboratory equipment, including a pH meter
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(v) identify laboratory equipment, including a hot plate stirrer
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(vi) identify laboratory equipment, including a balance
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(vii) identify laboratory equipment, including a mixers

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(viii) identify laboratory equipment, including a autoclave
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(ix) identify laboratory equipment, including a power supply
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(x) identify laboratory equipment, including a micropipette
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xi) identify laboratory equipment, including a centrifuge
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xii) identify laboratory equipment, including a electrophoresis unit
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xiii) operate laboratory equipment, including a microscope

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xiv) operate laboratory equipment, including a thermocycler
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xv) operate laboratory equipment, including a hood
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xvi) operate laboratory equipment, including a pH meter
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xvii) operate laboratory equipment, including a hot plate stirrer
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xviii) operate laboratory equipment, including a balance
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xix) operate laboratory equipment, including a mixers

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xx) operate laboratory equipment, including a autoclave

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xxi) operate laboratory equipment, including a power supply
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xxii) operate laboratory equipment, including a micropipette
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xxiii) operate laboratory equipment, including a centrifuge
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(A) identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit	(xiv) operate laboratory equipment, including a electrophoresis unit
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(B) practice measuring volumes and weights to industry standards	(i) practice measuring volumes to industry standards
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(B) practice measuring volumes and weights to industry standards	(ii) practice measuring weights to industry standards
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(C) analyze data and perform calculations and statistical analysis as it relates to biotechnology laboratory experiments	(i) analyze data as it relates to biotechnology laboratory experiments

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(C) analyze data and perform calculations and statistical analysis as it relates to biotechnology laboratory experiments	(ii) perform calculations as it relates to biotechnology laboratory experiments
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(C) analyze data and perform calculations and statistical analysis as it relates to biotechnology laboratory experiments	(iii) perform statistical analysis as it relates to biotechnology laboratory experiments
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(D) demonstrate proficiency pipetting techniques	(i) demonstrate proficiency pipetting techniques
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(E) identify microorganisms using staining methods such as the Gram stain, methylene-blue stain, and acid-fast staining	(i) identify microorganisms using staining methods
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(F) document laboratory results	(i) document laboratory results
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(G) prepare a restriction digest and analyze results using gel electrophoresis	(i) prepare a restriction digest using gel electrophoresis
(10) The student performs standard biotechnology laboratory procedures. The student is expected to:	(G) prepare a restriction digest and analyze results using gel electrophoresis	(ii) analyze results using gel electrophoresis
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(A) demonstrate techniques for establishing and maintaining a sterile work area	(i) demonstrate techniques for establishing a sterile work area

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(A) demonstrate techniques for establishing and maintaining a sterile work area	(ii) demonstrate techniques for maintaining a sterile work area
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(i) prepare physical properties of stock reagents
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(ii) prepare physical properties of stock buffers
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(iii) prepare physical properties of stock media
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(iv) prepare physical properties of stock solutions
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(v) dispense physical properties of stock reagents
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(vi) dispense physical properties of stock buffers

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(vii) prepare physical properties of stock media
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(viii) prepare physical properties of stock solutions
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(ix) monitor physical properties of stock reagents
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(x) monitor physical properties of stock buffers
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(xi) monitor physical properties of stock reagents media
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(xii) monitor physical properties of stock solutions
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(C) calculate and prepare a dilution series	(i) calculate a dilution series

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(C) calculate and prepare a dilution series	(ii) prepare a dilution series
(11) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(D) determine optimum conditions of reagents for experimentation	(i) determine optimum conditions of reagents for experimentation
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(A) explain the importance of media components to the outcome of cultures	(i) explain the importance of media components to the outcome of cultures
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(B) isolate, maintain, and store microbial cultures safely	(i) isolate microbial cultures safely
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(B) isolate, maintain, and store microbial cultures safely	(ii) maintain microbial cultures safely
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(B) isolate, maintain, and store microbial cultures safely	(iii) store microbial cultures safely
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(C) prepare seed inoculum	(i) prepare seed inoculum
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(D) perform plating techniques such as the Kirby-Bauer method	(i) perform plating techniques

Knowledge and Skill Statement	Student Expectation	Breakout
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(E) analyze proteins using techniques such as enzyme-linked immunosorbent assay (ELISA), spectrophotometry, and sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE)	(i) analyze proteins using techniques
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(F) isolate a specific protein from a biological sample using chromatography	(i) isolate a specific protein from a biological sample using chromatography
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(G) isolate nucleic acids and interpret gel electrophoresis results	(i) isolate nucleic acids
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(G) isolate nucleic acids and interpret gel electrophoresis results	(ii) interpret gel electrophoresis results
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(H) perform a bacterial transformation and analyze gene expression	(i) perform a bacterial transformation
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(H) perform a bacterial transformation and analyze gene expression	(ii) analyze gene expression
(12) The student performs advanced biotechnology laboratory procedures. The student is expected to:	(I) amplify a DNA sequence using the polymerase chain reactions	(i) amplify a DNA sequence using the polymerase chain reactions
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(A) perform validation testing on laboratory reagents and equipment	(i) perform validation testing on laboratory reagents

Knowledge and Skill Statement	Student Expectation	Breakout
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(A) perform validation testing on laboratory reagents and equipment	(ii) perform validation testing on laboratory equipment
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(i) analyze data
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(ii) perform calculations on results of quality-control samples
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(iii) perform statistical analysis on results of quality-control samples

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.416. Biotechnology II (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biotechnology I and Chemistry. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Biotechnology II has the components of any rigorous scientific or bioengineering program of study from the problem identification, investigation design, data collection, data analysis, and formulation and presentation of the conclusions. This course applies the standard skills mastered in Biotechnology I and includes assay design. After taking this course, students should be prepared for entry-level lab technician jobs.
(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) Show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) Show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) Show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in [an] effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in [an] effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) Demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) Demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) Demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) Demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(i) demonstrate safe practices during laboratory investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(ii) demonstrate safe practices during field investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(iii) demonstrate an understanding of the proper disposal or recycling of materials
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(i) know the definition of science as specified in subsection (b)(4) of this section [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(4) [above]

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(i) know that scientific hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(ii) know that scientific hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(i) know that scientific theories are based on natural and physical phenomena

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(ii) know that scientific theories are capable of being tested by multiple independent researchers
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(iii) know that unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(iv) know that, unlike hypotheses, scientific theories are highly-reliable explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(v) know that scientific theories may be subject to change as new areas of science are developed

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(vi) know that scientific theories may be subject to change as new technologies are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(i) plan investigative procedures, including making observations,
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ii) plan investigative procedures, including asking well-defined questions

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iii) plan investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iv) plan investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(v) plan investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vi) plan investigative procedures, including selecting appropriate technology

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vii) plan investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(viii) implement investigative procedures, including making observations,
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ix) implement investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(x) implement investigative procedures, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xi) implement investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xii) implement investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiii) implement investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiv) implement investigative procedures, including evaluating numerical answers for reasonableness

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(i) collect qualitative data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(ii) organize qualitative data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(iii) collect quantitative data

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(iv) organize quantitative data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(v) make measurements with accuracy using tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(vi) make measurements with precision using tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(i) analyze trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(ii) evaluate trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iii) make inferences trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iv) predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(i) identify causes and effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(ii) quantify causes and effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(i) organize data including the use of tables

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(ii) organize data including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(iii) organize data including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(iv) evaluate data including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(v) evaluate data including the use charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(vi) evaluate data including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(vii) make inferences from data, including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(viii) make inferences from data, including the use of charts

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(ix) make inferences from data, including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions supported by the data through various methods
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(i) in all fields of science, analyze scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ii) in all fields of science, analyze scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iii) in all fields of science, analyze scientific explanations by using experimental testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iv) in all fields of science, analyze scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vi) in all fields of science, evaluate scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vii) in all fields of science, evaluate scientific explanations by using logical reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(viii) in all fields of science, evaluate scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ix) in all fields of science, evaluate scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xi) in all fields of science, critique scientific explanations by using empirical evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xii) in all fields of science, critique scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiii) in all fields of science, critique scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiv) in all fields of science, critique scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(i) explain the impacts of the scientific contributions of a variety of historical scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(ii) explain the impacts of the scientific contributions of a variety of historical scientists on society

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iii) explain the impacts of the scientific contributions of a variety of contemporary scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iv) explain the impacts of the scientific contributions of a variety of contemporary scientists on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) evaluate models according to their limitations in representing biological objects or events	(i) evaluate models according to their limitations in representing biological objects or events
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the connections between science and future careers	(i) research the connections between science and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the connections between science and future careers	(ii) describe the connections between science and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(i) express relationships symbolically to make predictions, including problems requiring proportional reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(ii) express relationships symbolically to make predictions, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iii) express relationships symbolically to solve problems mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iv) express relationships symbolically to solve problems mathematically, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(v) interpret relationships symbolically to make predictions, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vi) interpret relationships symbolically to make predictions, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vii) interpret relationships symbolically to solve problems mathematically, including problems requiring proportional reasoning

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(viii) interpret relationships symbolically to solve problems mathematically, including problems requiring graphical vector addition
(5) The student formulates hypotheses to guide investigation and data collection. The student is expected to:	(A) perform background research with respect to an investigative problem	(i) perform background research with respect to an investigative problem
(5) The student formulates hypotheses to guide investigation and data collection. The student is expected to:	(B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses	(i) examine hypotheses generated to guide a research process by evaluating the merits of the hypotheses
(5) The student formulates hypotheses to guide investigation and data collection. The student is expected to:	(B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses	(ii) examine hypotheses generated to guide a research process by evaluating the feasibility of the hypotheses
(6) The student analyzes published research. The student is expected to:	(A) identify the scientific methodology used by a researcher	(i) identify the scientific methodology used by a researcher
(6) The student analyzes published research. The student is expected to:	(B) examine a prescribed research design and identify dependent and independent variables	(i) examine a prescribed research design
(6) The student analyzes published research. The student is expected to:	(B) examine a prescribed research design and identify dependent and independent variables	(ii) identify dependent variables

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student analyzes published research. The student is expected to:	(B) examine a prescribed research design and identify dependent and independent variables	(iii) identify independent variables
(6) The student analyzes published research. The student is expected to:	(C) evaluate a prescribed research design to determine the purpose for each of the procedures performed	(i) evaluate a prescribed research design to determine the purpose for each of the procedures performed
(6) The student analyzes published research. The student is expected to:	(D) determine if the data and conclusion support the hypothesis	(i) determine if the data support the hypothesis
(6) The student analyzes published research. The student is expected to:	(D) determine if the data and conclusion support the hypothesis	(ii) determine if the conclusion support the hypothesis
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(A) interact and collaborate with scientific researchers or other members of the scientific community to complete a research project	(i) interact with scientific researchers or other members of the scientific community to complete a research project
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(A) interact and collaborate with scientific researchers or other members of the scientific community to complete a research project	(ii) collaborate with scientific researchers or other members of the scientific community to complete a research project
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(B) identify and manipulate relevant variables within research situations	(i) identify relevant variables within research situations

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(B) identify and manipulate relevant variables within research situations	(ii) manipulate relevant variables within research situations
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(C) use a control in an experimental process	(i) use a control in an experimental process
(7) The student develops and implements appropriate investigative designs. The student is expected to:	(D) design procedures to test hypotheses	(i) design procedures to test hypotheses
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(A) differentiate between qualitative and quantitative data	(i) differentiate between qualitative and quantitative data
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(i) acquire data using appropriate equipment following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(ii) manipulate data using appropriate equipment following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(iii) analyze data using appropriate equipment following the rules of significant digits

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(iv) acquire data using appropriate technology following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(v) manipulate data using appropriate technology, following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) acquire, manipulate, and analyze data using appropriate equipment and technology, following the rules of significant digits	(vi) analyze data using appropriate technology following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) identify sources of random error and systematic error and differentiate between both types of error	(i) identify sources of random error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) identify sources of random error and systematic error and differentiate between both types of error	(ii) identify sources of systematic error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) identify sources of random error and systematic error and differentiate between both types of error	(iii) differentiate between [random error and systematic] error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(D) report error of a set of measured data in various formats, including standard deviation and percent error	(i) report error of a set of measured data in various formats, including standard deviation

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(D) report error of a set of measured data in various formats, including standard deviation and percent error	(ii) report error of a set of measured data in various formats, including percent error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(E) construct data tables to organize information collected in an experiment	(i) construct data tables to organize information collected in an experiment
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(F) record observations as they occur within an investigation	(i) record observations as they occur within an investigation
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(i) evaluate data using statistical methods to recognize patterns
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(ii) evaluate data using statistical methods to recognize trends
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(iii) evaluate data using statistical methods to recognize proportional relationships
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(A) synthesize and justify conclusions supported by research data	(i) synthesize conclusions supported by research data

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(A) synthesize and justify conclusions supported by research data	(ii) justify conclusions supported by research data
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(i) consider alternative explanations for observations
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(ii) consider alternative explanations for results
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(iii) communicate alternative explanations for observations
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(iv) communicate alternative explanations for results
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(C) identify limitations within the research process and provide recommendations for additional research	(i) identify limitations within the research process
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(C) identify limitations within the research process and provide recommendations for additional research	(ii) provide recommendations for additional research

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of peers and professionals	(i) communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of peers and professionals
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(B) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel	(i) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(A) define assay requirements and optimizations	(i) define assay requirements
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(A) define assay requirements and optimizations	(ii) define assay optimizations
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(B) perform statistical analysis on assay design and experimental data such as linearity, system sustainability, limit of detection, and R2 values	(i) perform statistical analysis on assay design
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(B) perform statistical analysis on assay design and experimental data such as linearity, system sustainability, limit of detection, and R2 values	(ii) perform statistical analysis on experimental data
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(C) determine an unknown protein concentration using techniques such as a standard curve and a spectrophotometer	(i) determine an unknown protein concentration using techniques

Knowledge and Skill Statement	Student Expectation	Breakout
(11) The student explores assay design in the field of biotechnology. The student is expected to:	(D) use a colorimetric assay to evaluate enzyme kinetics	(i) use a colorimetric assay to evaluate enzyme kinetics
(12) The student explores protein expression systems in the field of biotechnology. The student is expected to:	(A) perform a recombinant protein production such as green fluorescent protein (GFP)	(i) perform a recombinant protein production
(12) The student explores protein expression systems in the field of biotechnology. The student is expected to:	(B) isolate a protein from a biological sample using hydrophobic interaction column chromatography	(i) isolate a protein from a biological sample using hydrophobic interaction column chromatography
(12) The student explores protein expression systems in the field of biotechnology. The student is expected to:	(C) analyze protein purification methods using spectrophotometry, sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and Western blotting	(i) analyze protein purification methods using spectrophotometry
(12) The student explores protein expression systems in the field of biotechnology. The student is expected to:	(C) analyze protein purification methods using spectrophotometry, sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and Western blotting	(ii) analyze protein purification methods using sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE)
(12) The student explores protein expression systems in the field of biotechnology. The student is expected to:	(C) analyze protein purification methods using spectrophotometry, sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and Western blotting	(iii) analyze protein purification methods using Western blotting

Knowledge and Skill Statement	Student Expectation	Breakout
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(A) perform validation testing on laboratory reagents and equipment	(i) perform validation testing on laboratory reagents
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(A) perform validation testing on laboratory reagents and equipment	(ii) perform validation testing on laboratory equipment
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(i) analyze data
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(ii) perform calculations on results of quality-control samples
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(B) analyze data and perform calculations and statistical analysis on results of quality-control samples such as trending of data	(iii) perform statistical analysis on results of quality-control samples
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(C) apply and create industry protocols such as standard operating procedures (SOPs) and validation forms	(i) apply industry protocols
(13) The student conducts quality-control analysis while performing biotechnology laboratory procedures. The student is expected to:	(C) apply and create industry protocols such as standard operating procedures (SOPs) and validation forms	(ii) create industry protocols

Knowledge and Skill Statement	Student Expectation	Breakout
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(A) demonstrate techniques for establishing and maintaining a sterile work area	(i) demonstrate techniques for establishing a sterile work area
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(A) demonstrate techniques for establishing and maintaining a sterile work area	(ii) demonstrate techniques for maintaining a sterile work area
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(i) prepare stock reagents
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(ii) prepare stock buffers
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(iii) prepare stock media
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(iv) prepare stock solutions
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(v) dispense stock reagents

Knowledge and Skill Statement	Student Expectation	Breakout
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(vi) dispense stock buffers
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(vii) dispense stock media
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(viii) dispense stock solutions
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(ix) monitor physical properties of stock reagents
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(x) monitor physical properties of stock buffers
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(xi) monitor physical properties of stock media
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(B) prepare, dispense, and monitor physical properties of stock reagents, buffers, media, and solutions	(xii) monitor physical properties of stock solutions

Knowledge and Skill Statement	Student Expectation	Breakout
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(C) calculate and prepare a dilution series	(i) calculate a dilution series
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(C) calculate and prepare a dilution series	(ii) prepare a dilution series
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(D) determine acceptability and optimum conditions of reagents for experimentation	(i) determine acceptability of reagents for experimentation
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(D) determine acceptability and optimum conditions of reagents for experimentation	(ii) determine optimum conditions of reagents for experimentation
(14) The student prepares solutions and reagents for the biotechnology laboratory. The student is expected to:	(E) prepare multi-component solutions of given molarity or concentration and volume	(i) prepare multi-component solutions of given molarity or concentration and volume

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.417. Scientific Research and Design (One Credit), Adopted 2015**

(a) General Requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Biology, Chemistry, Integrated Physics and Chemistry (IPC), or Physics. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Scientific Research and Design is a broad-based course designed to allow districts and schools considerable flexibility to develop local curriculum to supplement any program of study or coherent sequence. The course has the components of any rigorous scientific or engineering program of study from the problem identification, investigation design, data collection, data analysis, formulation, and presentation of the conclusions. All of these components are integrated with the career and technical education emphasis of helping students gain entry-level employment in high-skill, high-wage jobs and/or continue their education.
(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.
(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).
(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.
(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present written communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iii) present written communication in an effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(iv) present oral communication in a clear manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(v) present oral communication in a concise manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(vi) present oral communication in a effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iii) demonstrate reliability in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(i) demonstrate safe practices during laboratory investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(A) demonstrate safe practices during laboratory and field investigations	(ii) demonstrate safe practices during field investigations
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(i) demonstrate an understanding of the use of resources and the proper disposal or recycling of materials
(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:	(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials	(ii) demonstrate an understanding of the conservation of resources and the proper disposal or recycling of materials
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(i) know the definition of science as specified in subsection (b)(4) of this section [above]
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section	(ii) understand that [science] has limitations, as specified in subsection (b)(4) [above]

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(i) know that scientific hypotheses are tentative statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(ii) know that scientific hypotheses are testable statements that must be capable of being supported or not supported by observational evidence
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories	(iii) [know that] hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(i) know that scientific theories are based on natural and physical phenomena

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(ii) know that scientific theories are capable of being tested by multiple independent researchers
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(iii) know that, unlike hypotheses, scientific theories are well-established explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(iv) know that, unlike hypotheses, scientific theories are highly-reliable explanations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(v) know that scientific theories may be subject to change as new areas of science are developed

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly reliable explanations, but may be subject to change as new areas of science and new technologies are developed	(vi) know that scientific theories may be subject to change as new technologies are developed
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(D) distinguish between scientific hypotheses and scientific theories	(i) distinguish between scientific hypotheses and scientific theories
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(i) plan descriptive investigative procedures, including making observations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ii) plan descriptive investigative procedures, including asking well-defined questions

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iv) plan descriptive investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(v) plan descriptive investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vi) plan descriptive investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vii) plan descriptive investigative procedures, including evaluating numerical answers for reasonableness

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(viii) implement descriptive investigative procedures, including making observations,
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ix) implement descriptive investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(x) implement descriptive investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xi) implement descriptive investigative procedures, including identifying variables

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xii) implement descriptive investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiii) implement descriptive investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiv) implement descriptive investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(i) plan comparative investigative procedures, including making observations

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ii) plan comparative investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iii) plan comparative investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iv) plan comparative investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(v) plan comparative investigative procedures, including selecting appropriate equipment

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vi) plan comparative investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vii) plan comparative investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(viii) implement comparative investigative procedures, including making observations,
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ix) implement comparative investigative procedures, including asking well-defined questions

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(x) implement comparative investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xi) implement comparative investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xii) implement comparative investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiii) implement comparative investigative procedures, including selecting appropriate technology

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiv) implement comparative investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(i) plan experimental investigative procedures, including making observations
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ii) plan experimental investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iii) plan experimental investigative procedures, including formulating testable hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(iv) plan experimental investigative procedures, including identifying variables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(v) plan experimental investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vi) plan experimental investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(vii) plan experimental investigative procedures, including evaluating numerical answers for reasonableness

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(viii) implement experimental investigative procedures, including making observations,
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(ix) implement experimental investigative procedures, including asking well-defined questions
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(x) implement experimental investigative procedures, including formulating testable hypotheses
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xi) implement experimental investigative procedures, including identifying variables

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xii) implement experimental investigative procedures, including selecting appropriate equipment
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiii) implement experimental investigative procedures, including selecting appropriate technology
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(E) plan and implement descriptive, comparative, and experimental investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness	(xiv) implement experimental investigative procedures, including evaluating numerical answers for reasonableness
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(i) collect qualitative data and make measurements with accuracy using tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(ii) collect quantitative data and make measurements with precision using tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(iii) organize qualitative data and make measurements with accuracy using tools
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, and meter sticks	(iv) organize quantitative data and make measurements with precision using tools

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(i) analyze
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(ii) evaluate
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(iii) make inferences
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(G) analyze, evaluate, make inferences, and predict trends from data	(vi) predict trends from data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(i) identify causes of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(ii) identify effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(iii) quantify causes of uncertainties in measured data

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(H) identify and quantify causes and effects of uncertainties in measured data	(iv) quantify effects of uncertainties in measured data
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(i) organize data including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(ii) organize data including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(iii) organize data including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(iv) evaluate data including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(v) evaluate data including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(vi) evaluate data including the use of graphs

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(vii) make inferences from data including the use of tables
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(viii) make inferences from data including the use of charts
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(I) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs	(ix) make inferences from data including the use of graphs
(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:	(J) communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports	(i) communicate valid conclusions supported by the data through various methods
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(i) in all fields of science, analyze scientific explanations by using empirical evidence

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ii) in all fields of science, analyze scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iii) in all fields of science, analyze scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(iv) in all fields of science, analyze scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(v) in all fields of science, analyze scientific explanations, including examining all sides of scientific evidence of those scientific explanations

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vi) in all fields of science, evaluate scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(vii) in all fields of science, evaluate scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(viii) in all fields of science, evaluate scientific explanations by using experimental testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(ix) in all fields of science, evaluate scientific explanations by using observational testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(x) in all fields of science, evaluate scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xi) in all fields of science, critique scientific explanations by using empirical evidence
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xii) in all fields of science, critique scientific explanations by using logical reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiii) in all fields of science, critique scientific explanations by using experimental testing

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xiv) in all fields of science, critique scientific explanations by using observational testing
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking	(xv) in all fields of science, critique scientific explanations, including examining all sides of scientific evidence of those scientific explanations
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(i) communicate scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials	(ii) apply scientific information extracted from various sources
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(i) draw inferences based on data related to promotional materials for products

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(C) draw inferences based on data related to promotional materials for products and services	(ii) draw inferences based on data related to promotional materials for services
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(i) explain the impacts of the scientific contributions of a variety of historical scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(ii) explain the impacts of the scientific contributions of a variety of historical scientists on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iii) explain the impacts of the scientific contributions of a variety of contemporary scientists on scientific thought
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society	(iv) explain the impacts of the scientific contributions of a variety of contemporary scientists on society
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(E) evaluate models according to their limitations in representing biological objects or events	(i) evaluate models according to their limitations in representing biological objects or events

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the connections between science and future careers	(i) research the connections between science and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(F) research and describe the connections between science and future careers	(ii) describe the connections between science and future careers
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(i) express relationships symbolically to make predictions including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(ii) express relationships symbolically to make predictions including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iii) express relationships symbolically to solve problems mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(iv) express relationships symbolically to solve problems mathematically, including problems requiring graphical vector addition

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(v) interpret relationships to make predictions, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vi) interpret relationships to make predictions, including problems requiring graphical vector addition
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(vii) interpret relationships to solve problems mathematically, including problems requiring proportional reasoning
(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:	(G) express and interpret relationships symbolically to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition	(viii) interpret relationships to solve problems mathematically, including problems requiring graphical vector addition
(5) The student formulates hypotheses to guide experimentation and data collection. The student is expected to:	(A) perform background research with respect to an investigative problem	(i) perform background research with respect to an investigative problem
(5) The student formulates hypotheses to guide experimentation and data collection. The student is expected to:	(B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses	(i) examine hypotheses generated to guide a research process by evaluating the merits of the hypotheses

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student formulates hypotheses to guide experimentation and data collection. The student is expected to:	(B) examine hypotheses generated to guide a research process by evaluating the merits and feasibility of the hypotheses	(ii) examine hypotheses generated to guide a research process by evaluating the feasibility of the hypotheses
(6) The student analyzes published research. The student is expected to:	(A) identify the scientific methodology used by a researcher	(i) identify the scientific methodology used by a researcher
(6) The student analyzes published research. The student is expected to:	(B) examine a prescribed research design and identify dependent and independent variables	(i) examine a prescribed research design and identify dependent variables
(6) The student analyzes published research. The student is expected to:	(B) examine a prescribed research design and identify dependent and independent variables	(ii) examine a prescribed research design and identify independent variables
(6) The student analyzes published research. The student is expected to:	(C) evaluate a prescribed research design to determine the purpose for each of the procedures performed	(i) evaluate a prescribed research design to determine the purpose for each of the procedures performed
(6) The student analyzes published research. The student is expected to:	(D) compare the relationship of the hypothesis to the conclusion	(i) compare the relationship of the hypothesis to the conclusion
(7) The student develops and implements investigative designs. The student is expected to:	(A) interact and collaborate with scientific researchers or other members of the scientific community to complete a research project	(i) interact with scientific researchers or other members of the scientific community to complete a research project
(7) The student develops and implements investigative designs. The student is expected to:	(A) interact and collaborate with scientific researchers or other members of the scientific community to complete a research project	(ii) collaborate with scientific researchers or other members of the scientific community to complete a research project

Knowledge and Skill Statement	Student Expectation	Breakout
(7) The student develops and implements investigative designs. The student is expected to:	(B) identify and manipulate relevant variables within research situations	(i) identify relevant variables within research situations
(7) The student develops and implements investigative designs. The student is expected to:	(B) identify and manipulate relevant variables within research situations	(ii) manipulate relevant variables within research situations
(7) The student develops and implements investigative designs. The student is expected to:	(C) use a control in an experimental process	(i) use a control in an experimental process
(7) The student develops and implements investigative designs. The student is expected to:	(D) design procedures to test hypotheses	(i) design procedures to test hypotheses
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(A) differentiate between qualitative and quantitative data	(i) differentiate between qualitative and quantitative data
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(B) record observations as they occur within an investigation	(i) record observations as they occur within an investigation
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(i) acquire data using appropriate equipment following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(ii) manipulate data using appropriate equipment following the rules of significant digits

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(iii) analyze data using appropriate equipment following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(iv) acquire data using appropriate technology following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(v) manipulate data using appropriate technology following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(C) acquire, manipulate, and analyze data using appropriate equipment and technology following the rules of significant digits	(vi) analyze data using appropriate technology following the rules of significant digits
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(D) identify sources of random error and systematic error and differentiate between both types of error	(i) identify sources of random error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(D) identify sources of random error and systematic error and differentiate between both types of error	(ii) identify sources of systematic error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(D) identify sources of random error and systematic error and differentiate between both types of error	(iii) differentiate between both types of error

Knowledge and Skill Statement	Student Expectation	Breakout
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(E) report error of a set of measured data in various formats, including standard deviation and percent error	(i) report error of a set of measured data in various formats, including standard deviation
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(E) report error of a set of measured data in various formats, including standard deviation and percent error	(ii) report error of a set of measured data in various formats, including percent error
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(F) construct data tables to organize information collected in an experiment	(i) construct data tables to organize information collected in an experiment
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(i) evaluate data using statistical methods to recognize patterns
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(ii) evaluate data using statistical methods to recognize trends
(8) The student collects, organizes, and evaluates qualitative and quantitative data obtained through experimentation. The student is expected to:	(G) evaluate data using statistical methods to recognize patterns, trends, and proportional relationships	(iii) evaluate data using statistical methods to recognize proportional relationships
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(A) synthesize and justify conclusions supported by research data	(i) synthesize conclusions supported by research data

Knowledge and Skill Statement	Student Expectation	Breakout
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(A) synthesize and justify conclusions supported by research data	(ii) justify conclusions supported by research data
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(i) consider alternative explanations for observations
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(ii) consider alternative explanations for results
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(iii) communicate alternative explanations for observations
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(B) consider and communicate alternative explanations for observations and results	(iv) communicate alternative explanations for results
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(C) identify limitations within the research process and provide recommendations for additional research	(i) identify limitations within the research process
(9) The student knows how to synthesize valid conclusions from qualitative and quantitative data. The student is expected to:	(C) identify limitations within the research process and provide recommendations for additional research	(ii) provide recommendations for additional research

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(i) construct charts using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of peers
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(ii) construct tables using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of peers
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(iii) construct graphs using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of peers
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(iv) construct charts using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(v) construct tables using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(vi) construct graphs using technology in order to facilitate data analysis clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(vii) construct charts using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of peers
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(viii) construct tables using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of peers

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(ix) construct graphs using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of peers
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(x) construct charts using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(xi) construct tables using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(A) construct charts, tables, and graphs using technology in order to facilitate data analysis and to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project, to an audience of peers and professionals	(xii) construct graphs using technology in order to communicate experimental results clearly and effectively, including oral presentation of original findings of a research project to an audience of professionals

Knowledge and Skill Statement	Student Expectation	Breakout
(10) The student communicates conclusions clearly and concisely to an audience of professionals. The student is expected to:	(B) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel	(i) suggest alternative explanations from observations or trends evident within the data or from prompts provided by a review panel

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.418. Practicum in Science, Technology, Engineering, and Mathematics (Two Credits), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grade 12. Prerequisites: Algebra I, and Geometry. Recommended prerequisites: two Science, Technology, Engineering, and Mathematics (STEM) Career Cluster credits. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the STEM Career Cluster. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services such as physical science, social science, engineering, including laboratory and testing services, and research and development services.
(3) Practicum in STEM is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(i) demonstrate knowledge of how to dress appropriately
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(ii) demonstrate knowledge of how to speak politely
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession	(iii) demonstrate knowledge of how to conduct oneself in a manner appropriate for the profession
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, collaborate, and accept constructive criticism as a member of a group in an effort to achieve a positive collective outcome	(i) show the ability to cooperate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, collaborate, and accept constructive criticism as a member of a group in an effort to achieve a positive collective outcome	(ii) show the ability to contribute as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, collaborate, and accept constructive criticism as a member of a group in an effort to achieve a positive collective outcome	(iii) show the ability to collaborate as a member of a group in an effort to achieve a positive collective outcome
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) show the ability to cooperate, contribute, collaborate, and accept constructive criticism as a member of a group in an effort to achieve a positive collective outcome	(iv) show the ability to accept constructive criticism as a member of a group in an effort to achieve a positive collective outcome

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(i) present written communication in a clear, concise, and effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) present written and oral communication in a clear, concise, and effective manner	(ii) present oral communication in a clear, concise, and effective manner
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(i) demonstrate time-management skills in prioritizing tasks in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(ii) demonstrate time-management skills in following schedules in a way that produces efficient results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results	(iii) demonstrate time-management skills in performing goal-relevant activities in a way that produces efficience results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(i) demonstrate punctuality in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(ii) demonstrate dependability in performing assigned tasks as directed

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(iii) demonstrate reliability in performing tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(iv) demonstrate responsibility in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(v) adhere to policies in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) demonstrate punctuality, dependability, reliability, and responsibility and adhere to policies and procedures in performing assigned tasks as directed	(vi) adhere to procedures in performing assigned tasks as directed
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(F) apply ethical reasoning to a variety of situations in order to make ethical decisions	(i) apply ethical reasoning to a variety of situations in order to make ethical decisions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) complete tasks with the highest standards to ensure quality products and services	(i) complete tasks with the highest standards to ensure quality products
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(G) complete tasks with the highest standards to ensure quality products and services	(ii) complete tasks with the highest standards to ensure quality services

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) comply with practicum setting safety rules and regulations to maintain safe and healthy working conditions and environments	(i) comply with practicum setting safety rules and regulations to maintain safe working conditions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) comply with practicum setting safety rules and regulations to maintain safe and healthy working conditions and environments	(ii) comply with practicum setting safety rules and regulations to maintain safe environments
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) comply with practicum setting safety rules and regulations to maintain safe and healthy working conditions and environments	(iii) comply with practicum setting safety rules and regulations to maintain healthy working conditions
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(H) comply with practicum setting safety rules and regulations to maintain safe and healthy working conditions and environments	(iv) comply with practicum setting safety rules and regulations to maintain healthy environments
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(A) analyze elements of a problem to develop creative and innovative solutions	(i) analyze elements of a problem to develop creative solutions
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(A) analyze elements of a problem to develop creative and innovative solutions	(ii) analyze elements of a problem to develop innovative solutions
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(B) analyze information to determine value to the problem-solving task	(i) analyze information to determine value to the problem-solving task
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(C) compare and contrast alternatives using a variety of problem-solving and critical-thinking skills	(i) compare and contrast alternatives using a variety of problem-solving skills

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(C) compare and contrast alternatives using a variety of problem-solving and critical-thinking skills	(ii) compare and contrast alternatives using a variety of critical-thinking skills
(2) The student applies concepts of critical thinking and problem solving. The student is expected to:	(D) conduct technical research to gather information necessary for decision making	(i) conduct technical research to gather information necessary for decision making
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(A) analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation	(i) analyze leadership in relation to trust in a work situation
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(A) analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation	(ii) analyze leadership in relation to positive attitude in a work situation
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(A) analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation	(iii) analyze leadership in relation to integrity in a work situation
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(A) analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation	(iiii) analyze leadership in relation to willingness to accept key responsibilities in a work situation
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(i) demonstrate teamwork processes that promote team building

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(ii) demonstrate teamwork processes that promote consensus
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(iii) demonstrate teamwork processes that promote continuous improvement
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(iv) demonstrate teamwork processes that promote respect for the opinions of others
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(v) demonstrate teamwork processes that promote cooperation
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(vi) demonstrate teamwork processes that promote adaptability
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(B) demonstrate teamwork processes that promote team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution	(vii) demonstrate teamwork processes that promote conflict resolution

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(C) demonstrate responsibility for shared group and individual work tasks	(i) demonstrate responsibility for shared group work tasks
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(C) demonstrate responsibility for shared group and individual work tasks	(ii) demonstrate responsibility for individual work tasks
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(D) use positive interpersonal skills to establish and maintain effective working relationships in order to accomplish objectives and tasks	(i) use positive interpersonal skills to establish effective working relationships in order to accomplish objectives
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(D) use positive interpersonal skills to establish and maintain effective working relationships in order to accomplish objectives and tasks	(ii) use positive interpersonal skills to establish effective working relationships in order to accomplish tasks
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(D) use positive interpersonal skills to establish and maintain effective working relationships in order to accomplish objectives and tasks	(iii) use positive interpersonal skills to maintain effective working relationships in order to accomplish objectives
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(D) use positive interpersonal skills to establish and maintain effective working relationships in order to accomplish objectives and tasks	(iv) use positive interpersonal skills to maintain effective working relationships in order to accomplish tasks
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(E) negotiate effectively to arrive at decisions	(i) negotiate effectively to arrive at decisions

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(F) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds and diversity	(i) demonstrate respect for individuals, including those from different cultures
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(F) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds and diversity	(ii) demonstrate respect for individuals, including those from different genders
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(F) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds and diversity	(iii) demonstrate respect for individuals, including those from different backgrounds
(3) The student demonstrates leadership and teamwork skills in collaborating with others to accomplish goals and objectives. The student is expected to:	(F) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds and diversity	(i) demonstrate respect for diversity
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(i) demonstrate the use of content when analyzing information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(ii) demonstrate the use of technical concepts when analyzing information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(iii) demonstrate the use of vocabulary when analyzing information

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(iv) demonstrate the use of content when following directions
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(v) demonstrate the use of technical concepts when following directions
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(A) demonstrate the use of content, technical concepts, and vocabulary when analyzing information and following directions	(vi) demonstrate the use of vocabulary when following directions
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(B) employ verbal skills when obtaining and conveying information	(i) employ verbal skills when obtaining information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(B) employ verbal skills when obtaining and conveying information	(ii) employ verbal skills when conveying information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(i) use informational texts to review information sources for occupational tasks

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(ii) use scientific websites to review information sources for occupational tasks
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(iii) use technical materials to review information sources for occupational tasks
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(iv) use informational texts to apply information sources for occupational tasks
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(v) use scientific websites to apply information sources for occupational tasks
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(C) use informational texts, scientific websites, and technical materials to review and apply information sources for occupational tasks	(vi) use technical materials to apply information sources for occupational tasks
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(D) evaluate the reliability of information from informational texts, scientific websites, and technical materials and resources	(i) evaluate the reliability of information from informational texts

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(D) evaluate the reliability of information from informational texts, scientific websites, and technical materials and resources	(ii) evaluate the reliability of information from scientific websites
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(D) evaluate the reliability of information from informational texts, scientific websites, and technical materials and resources	(iii) evaluate the reliability of information from technical materials
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(D) evaluate the reliability of information from informational texts, scientific websites, and technical materials and resources	(iv) evaluate the reliability of information from technical resources
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(E) interpret verbal and nonverbal cues and behaviors to enhance communication	(i) interpret verbal cues to enhance communication
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(E) interpret verbal and nonverbal cues and behaviors to enhance communication	(ii) interpret nonverbal cues to enhance communication
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(E) interpret verbal and nonverbal cues and behaviors to enhance communication	(iii) interpret behaviors to enhance communication

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(F) apply active listening skills to obtain and clarify information	(i) apply active listening skills to obtain information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(F) apply active listening skills to obtain and clarify information	(ii) apply active listening skills to clarify information
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(G) use academic skills to facilitate effective written and oral communication	(i) use academic skills to facilitate effective written communication
(4) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:	(G) use academic skills to facilitate effective written and oral communication	(ii) use academic skills to facilitate effective oral communication
(5) The student demonstrates technical knowledge and skills required to pursue a career in the science, technology, engineering, and mathematics career field. The student is expected to:	(A) develop advanced technical knowledge and skills related to the student's occupational objective	(i) develop advanced technical knowledge related to the student's occupational objective
(5) The student demonstrates technical knowledge and skills required to pursue a career in the science, technology, engineering, and mathematics career field. The student is expected to:	(A) develop advanced technical knowledge and skills related to the student's occupational objective	(ii) develop technical skills related to the student's occupational objective

Knowledge and Skill Statement	Student Expectation	Breakout
(5) The student demonstrates technical knowledge and skills required to pursue a career in the science, technology, engineering, and mathematics career field. The student is expected to:	(B) evaluate strengths and weaknesses in technical skill proficiency	(i) evaluate strengths in technical skill proficiency
(5) The student demonstrates technical knowledge and skills required to pursue a career in the science, technology, engineering, and mathematics career field. The student is expected to:	(B) evaluate strengths and weaknesses in technical skill proficiency	(ii) evaluate weaknesses in technical skill proficiency
(6) The student documents technical knowledge and skills. The student is expected to:	(A) update a professional portfolio to include information such as: (i) attainment of technical skill competencies; (ii) licensures or certifications; (iii) recognitions, awards, and scholarships; (iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations; (v) abstract of key points of the practicum; (vi) resume; (vii) samples of work; and (viii) evaluation from the practicum supervisor	(i) update a professional portfolio to include: (i) attainment of technical skill competencies; (ii) licensures or certifications; (iii) recognitions, awards, and scholarships; (iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations; (v) abstract of key points of the practicum; (vi) resume; (vii) samples of work; and (viii) evaluation from the practicum supervisor
(6) The student documents technical knowledge and skills. The student is expected to:	(B) present the portfolio to interested stakeholders	(i) present the portfolio to interested stakeholders

Subject	**Chapter 130. Career and Technical Education, Subchapter O. Science, Technology, Engineering, and Mathematics**
Course Title	**§130.419. Extended Practicum in Science, Technology, Engineering, and Mathematics (One Credit), Adopted 2015.**

(a) General Requirements. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Science, Technology, Engineering, and Mathematics (STEM) Career Cluster. Prerequisites: Algebra I and Geometry. Recommended prerequisites: two credits from the courses in the STEM Career Cluster. Corequisite: Practicum in Science, Technology, Engineering, and Mathematics. This course must be taken concurrently with Practicum in Science, Technology, Engineering, and Mathematics and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
(2) The STEM Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.
(3) Extended Practicum in STEM is designed to give students supervised practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to STEM	(i) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge related to STEM
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(A) participate in a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to STEM	(ii) participate in a paid or unpaid, laboratory- or work-based application of previously studied skills related to STEM
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(B) participate in training, education, or preparation for licensure, certification, or other relevant credentials to prepare for employment	(i) participate in training, education, or preparation for licensure, certification, or other relevant credentials to prepare for employment
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) demonstrate professional standards and personal qualities needed to be employable such as self-discipline, positive attitude, integrity, leadership, appreciation for diversity, customer service, work ethic, and adaptability with increased fluency	(i) demonstrate professional standards needed to be employable
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(C) demonstrate professional standards and personal qualities needed to be employable such as self-discipline, positive attitude, integrity, leadership, appreciation for diversity, customer service, work ethic, and adaptability with increased fluency	(ii) demonstrate personal qualities needed to be employable
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) employ teamwork and conflict-management skills with increased fluency to achieve collective goals	(i) employ teamwork with increased fluency to achieve collective goals

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(D) employ teamwork and conflict-management skills with increased fluency to achieve collective goals	(ii) employ conflict-management skills with increased fluency to achieve collective goals
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(i) employ planning skills with increased fluency to enhance results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(ii) employ planning skills with increased fluency to complete work tasks
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(iii) employ planning tools with increased fluency to enhance results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(iv) employ planning tools with increased fluency to complete work tasks
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(v) employ time-management skills with increased fluency to enhance results

Knowledge and Skill Statement	Student Expectation	Breakout
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(vi) employ time-managment skills with increased fluency to complete work tasks
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(vii) employ time-management tools with increased fluency to enhance results
(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:	(E) employ planning and time-management skills and tools such as prioritizing tasks, following schedules, and performing goal-relevant activities with increased fluency to enhance results and complete work tasks	(viii) employ time-management tools with increased fluency to complete work tasks
(2) The student applies professional communications strategies. The student is expected to:	(A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner	(i) demonstrate verbal communication consistently in a clear, concise, and effective manner
(2) The student applies professional communications strategies. The student is expected to:	(A) demonstrate verbal and non-verbal communication consistently in a clear, concise, and effective manner	(ii) demonstrate non-verbal communication consistently in a clear, concise, and effective manner
(2) The student applies professional communications strategies. The student is expected to:	(B) apply active listening skills to obtain and clarify information	(i) apply active listening skills to obtain information
(2) The student applies professional communications strategies. The student is expected to:	(B) apply active listening skills to obtain and clarify information	(ii) apply active listening skills to clarify information
(2) The student applies professional communications strategies. The student is expected to:	(C) create and deliver formal and informal presentations effectively	(i) create formal presentations effectively

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student applies professional communications strategies. The student is expected to:	(C) create and deliver formal and informal presentations effectively	(ii) create informal presentations effectively
(2) The student applies professional communications strategies. The student is expected to:	(C) create and deliver formal and informal presentations effectively	(iii) deliver formal presentations effectively
(2) The student applies professional communications strategies. The student is expected to:	(C) create and deliver formal and informal presentations effectively	(iv) deliver informal presentations effectively
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(i) analyze information
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(ii) analyze data
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(iii) analyze observations
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(iv) interpret information
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(v) interpret data
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(vi) interpret observations

Knowledge and Skill Statement	Student Expectation	Breakout
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(vii) effectively communicate information
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(viii) effectively communicate data
(2) The student applies professional communications strategies. The student is expected to:	(D) analyze, interpret, and effectively communicate information, data, and observations	(ix) effectively communicate observations
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(i) observe verbal cues to enhance communication
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(ii) observe nonverbal cues to enhance communication
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(iii) observe behaviors to enhance communication
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(iv) interpret verbal cues to enhance communication
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(v) interpret nonverbal cues to enhance communication
(2) The student applies professional communications strategies. The student is expected to:	(E) observe and interpret verbal and nonverbal cues and behaviors to enhance communication	(vi) interpret behaviors to enhance communication

Knowledge and Skill Statement	Student Expectation	Breakout
(3) The student implements advanced problem-solving methods. The student is expected to:	(A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions	(i) employ critical-thinking skills with increased fluency independently to solve problems
(3) The student implements advanced problem-solving methods. The student is expected to:	(A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions	(ii) employ critical-thinking skills with increased fluency in groups to solve problems
(3) The student implements advanced problem-solving methods. The student is expected to:	(A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions	(iii) employ critical-thinking skills with increased fluency independently to make decisions
(3) The student implements advanced problem-solving methods. The student is expected to:	(A) employ critical-thinking skills with increased fluency both independently and in groups to solve problems and make decisions	(iv) employ critical-thinking skills with increased fluency in groups to make decisions
(3) The student implements advanced problem-solving methods. The student is expected to:	(B) analyze elements of problems to develop creative and innovative solutions	(i) analyze elements of problems to develop creative solutions
(3) The student implements advanced problem-solving methods. The student is expected to:	(B) analyze elements of problems to develop creative and innovative solutions	(ii) analyze elements of problems to develop innovative solutions
(3) The student implements advanced problem-solving methods. The student is expected to:	(C) apply decision-making techniques with increased fluency to the selection of technological solutions	(i) apply decision-making techniques with increased fluency to the selection of technological solutions
(3) The student implements advanced problem-solving methods. The student is expected to:	(D) conduct technical research to gather information necessary for decision making	(i) conduct technical research to gather information necessary for decision making

Knowledge and Skill Statement	Student Expectation	Breakout
(4) The student understands and applies proper safety and security techniques in the workplace. The student is expected to understand and consistently follow workplace safety rules and regulations.	[A] understand and consistently follow workplace safety rules and regulations	(i) understand workplace safety rules and regulations
(4) The student understands and applies proper safety and security techniques in the workplace. The student is expected to understand and consistently follow workplace safety rules and regulations.	[A] understand and consistently follow workplace safety rules and regulations	(ii) consistently follow workplace safety rules and regulations
(5) The student understands the professional, ethical, and legal responsibilities in STEM-related fields. The student is expected to:	(A) demonstrate a positive, productive work ethic by performing assigned tasks as directed	(i) demonstrate a positive, productive work ethic by performing assigned tasks as directed
(5) The student understands the professional, ethical, and legal responsibilities in STEM-related fields. The student is expected to:	(B) apply ethical reasoning to a variety of situations in order to make ethical decisions	(i) apply ethical reasoning to a variety of situations in order to make ethical decisions
(5) The student understands the professional, ethical, and legal responsibilities in STEM-related fields. The student is expected to:	(C) comply with all applicable rules, laws, and regulations in a consistent manner	(i) comply with all applicable rules in a consistent manner
(5) The student understands the professional, ethical, and legal responsibilities in STEM-related fields. The student is expected to:	(C) comply with all applicable rules, laws, and regulations in a consistent manner	(ii) comply with all applicable laws in a consistent manner
(5) The student understands the professional, ethical, and legal responsibilities in STEM-related fields. The student is expected to:	(C) comply with all applicable rules, laws, and regulations in a consistent manner	(iii) comply with all applicable regulations in a consistent manner

Knowledge and Skill Statement	Student Expectation	Breakout
(6) The student participates in a supervised STEM experience. The student is expected to:	(A) conduct, document, and evaluate learning activities in a supervised STEM experience	(i) conduct learning activities in a supervised STEM experience
(6) The student participates in a supervised STEM experience. The student is expected to:	(A) conduct, document, and evaluate learning activities in a supervised STEM experience	(ii) document learning activities in a supervised STEM experience
(6) The student participates in a supervised STEM experience. The student is expected to:	(A) conduct, document, and evaluate learning activities in a supervised STEM experience	(iii) evaluate learning activities in a supervised STEM experience
(6) The student participates in a supervised STEM experience. The student is expected to:	(B) develop advanced technical knowledge and skills related to the student's occupational objective	(i) develop advanced technical knowledge related to the student's occupational objective
(6) The student participates in a supervised STEM experience. The student is expected to:	(B) develop advanced technical knowledge and skills related to the student's occupational objective	(ii) develop advanced technical skills related to the student's occupational objective
(6) The student participates in a supervised STEM experience. The student is expected to:	(C) evaluate strengths and weaknesses in technical skill proficiency	(i) evaluate strengths in technical skill proficiency
(6) The student participates in a supervised STEM experience. The student is expected to:	(C) evaluate strengths and weaknesses in technical skill proficiency	(ii) evaluate weaknesses in technical skill proficiency
(6) The student participates in a supervised STEM experience. The student is expected to:	(D) collect representative work samples	(i) collect representative work samples