Science, Grade 4

Subject: Science
Grade: 04
Num Expectations: 43
Num Breakouts: 171

(A) Introduction.

(1) In Kindergarten through Grade 5 Science, content is organized into recurring strands. The concepts within each grade level build on prior knowledge, prepare students for the next grade level, and establish a foundation for high school courses. In Grade 4, the following concepts will be addressed in each strand.

(A) Scientific and engineering practices. Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, correlative, comparative, or experimental. The method chosen should be appropriate to the grade level and question being asked. Student learning for different types of investigations includes descriptive investigations, which have no hypothesis that tentatively answers the research question and involve collecting data and recording observations without making comparisons; correlative and comparative investigations, which have a hypothesis that predicts a relationship and involve collecting data, measuring variables relevant to the hypothesis that are manipulated, and comparing results; and experimental investigations, which involve processes similar to comparative investigations but in which a hypothesis can be tested by comparing a treatment with a control.

(i) Scientific practices. Students ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(ii) Engineering practices. Students identify problems and design solutions using appropriate tools and models.

(iii) To support instruction in the science content standards, it is recommended that districts integrate scientific and engineering practices through classroom and outdoor investigations for at least 50% of instructional time.

(B) Matter and energy. Students investigate matter's measurable properties, including mass, volume, states, temperature, magnetism, and relative density, to determine how it is classified, changed, and used. Students compare and contrast a variety of mixtures, including solutions, and demonstrate that matter is conserved.

(C) Force, motion, and energy. Students investigate forces, including friction, gravity, and magnetism, to observe their effects on objects. They differentiate between mechanical, sound, light, thermal, and electrical energy. Students observe the cycle of energy and the parts of a system while exploring circuits that produce light and thermal energy. They will build on their understanding of circuits in Grade 5. As students explore thermal and electrical energy, they observe the behavior of different materials to identify patterns and label the materials as conductors or insulators.

(D) Earth and space. Students learn about processes on Earth that create patterns of change. These processes include the water cycle, weathering, erosion, deposition, the appearance of the Moon, and seasons. Students will build on this understanding in Grade 5 when they learn about day and night, shadows, and the rotation of Earth on its axis. Finally, students identify Earth's resources and classify them as renewable or nonrenewable.

(E) Organisms and environments. In this strand, students begin to understand how organisms within an ecosystem interact. Students investigate producers to learn how they make food. Students build on their understanding of food chains, from Grade 3, as they explore food webs where they describe the flow of energy and the role of producers, consumers, and decomposers. They also use fossil evidence to describe environments of the past. Additionally, students explore plant structures and their functions. Students also differentiate between inherited and acquired traits of organisms.

(2) Nature of science. 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 currently scientifically testable.

(3) Scientific observations, inferences, hypotheses, and theories. Students are expected to know that:

(A) observations are active acquisition of either qualitative or quantitative information from a primary source through the senses;

(B) inferences are conclusions reached on the basis of observations or reasoning supported by relevant evidence;

(C) 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; and

(D) 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.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students distinguish between scientific decision-making practices and ethical and social decisions that involve science.

(5) Recurring themes and concepts. Science consists of recurring themes and making connections between overarching concepts. Recurring themes include structure and function, systems, models, and patterns. 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. Models have limitations but provide a tool for understanding the ideas presented. Students analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(6) Statements containing the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(B) Knowledge and Skills Statements

(1) Scientific and engineering practices. The student asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

Breakouts

(i) ask questions based on observations or information from text, phenomena, models, or investigations

(ii) define problems based on observations or information from text, phenomena, models, or investigations

(B) use scientific practices to plan and conduct descriptive investigations and use engineering practices to design solutions to problems;

Breakouts

(i) use scientific practices to plan descriptive investigations

(ii) use scientific practices to conduct descriptive investigations

(iii) use engineering practices to design solutions to problems

(C) demonstrate safe practices and the use of safety equipment during classroom and field investigations as outlined in Texas Education Agency-approved safety standards;

Breakouts

(i) demonstrate safe practices during classroom investigations as outlined in Texas Education Agency-approved safety standards

(ii) demonstrate the use safety equipment during classroom investigations as outlined in Texas Education Agency-approved safety standards

(iii) demonstrate safe practices during field investigations as outlined in Texas Education Agency-approved safety standards

(iv) demonstrate the use safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards

(D) use tools, including hand lenses; metric rulers; Celsius thermometers; calculators; laser pointers; mirrors; digital scales; balances; graduated cylinders; beakers; hot plates; meter sticks; magnets; notebooks; timing devices; sieves; materials for building circuits; materials to support observation of habitats of organisms such as terrariums, aquariums, and collecting nets; and materials to support digital data collection such as computers, tablets, and cameras, to observe, measure, test, and analyze information;

Breakouts

(i) use tools to observe

(ii) use tools to measure

(iii) use tools to test

(iv) use tools to analyze information

(E) collect observations and measurements as evidence;

Breakouts

(i) collect observations as evidence

(ii) collect measurements as evidence

(F) construct appropriate graphic organizers to collect data, including tables, bar graphs, line graphs, tree maps, concept maps, Venn diagrams, flow charts or sequence maps, and input- output tables that show cause and effect; and

Breakouts

(i) construct appropriate graphic organizers to collect data, including tables

(ii) construct appropriate graphic organizers to collect data, including bar graphs

(iii) construct appropriate graphic organizers to collect data, including line graphs

(iv) construct appropriate graphic organizers to collect data, including tree maps

(v) construct appropriate graphic organizers to collect data, including concept maps

(vi) construct appropriate graphic organizers to collect data, including Venn diagrams

(vii) construct appropriate graphic organizers to collect data, including flow charts or sequence maps

(viii) construct appropriate graphic organizers to collect data, including input-output tables that show cause and effect

(G) develop and use models to represent phenomena, objects, and processes or design a prototype for a solution to a problem.

Breakouts

(i) develop models to represent phenomena or design a prototype for a solution to a problem

(ii) develop models to represent objects or design a prototype for a solution to a problem

(iii) develop models to represent processes or design a prototype for a solution to a problem

(iv) use models to represent phenomena or design a prototype for a solution to a problem

(v) use models to represent objects or design a prototype for a solution to a problem

(vi) use models to represent processes or design a prototype for a solution to a problem

(2) Scientific and engineering practices. The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

Breakouts

(i) identify advantages of models

(ii) identify limitations of models

(B) analyze data by identifying any significant features, patterns, or sources of error;

Breakouts

(i) analyze data by identifying any significant features, patterns, or sources of error

(C) use mathematical calculations to compare patterns and relationships; and Breakouts

(i) use mathematical calculations to compare patterns

(ii) use mathematical calculations to compare relationships

(D) evaluate a design or object using criteria.

Breakouts

(i) evaluate a design or object using criteria

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models;

Breakouts

(i) develop explanations supported by data

(ii) develop explanations supported by models

(iii) propose solutions supported by data

(iv) propose solutions supported by models

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

Breakouts

(i) communicate explanations individually in a variety of settings

(ii) communicate explanations collaboratively in a variety of settings

(iii) communicate explanations individually in a variety of formats

(iv) communicate explanations collaboratively in a variety of formats

(v) communicate solutions individually in a variety of settings

(vi) communicate solutions collaboratively in a variety of settings

(vii) communicate solutions individually in a variety of formats

(viii) communicate solutions collaboratively in a variety of formats

(C) listen actively to others' explanations to identify relevant evidence and engage respectfully in scientific discussion.

Breakouts

(i) listen actively to others' explanations to identify relevant evidence

(ii) engage respectfully in scientific discussion

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation for society. The student is expected to:

(A) explain how scientific discoveries and innovative solutions to problems impact science and society; and

Breakouts

(i) explain how scientific discoveries impact science

(ii) explain how scientific discoveries impact society

(iii) explain how innovative solutions to problems impact science

(iv) explain how innovative solutions to problems impact society

(B) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field to investigate STEM careers.

Breakouts

(i) research STEM careers

(ii) explore resources to investigate STEM careers

(5) Recurring themes and concepts. The student understands that recurring themes and concepts provide a framework for making connections across disciplines. The student is expected to:

(A) identify and use patterns to explain scientific phenomena or to design solutions;

Breakouts

(i) identify patterns to explain scientific phenomena or to design solutions

(ii) use patterns to explain scientific phenomena or to design solutions

(B) identify and investigate cause-and-effect relationships to explain scientific phenomena or analyze problems;

Breakouts

(i) identify cause-and-effect relationships to explain scientific phenomena or analyze problems

(ii) investigate cause-and-effect relationships to explain scientific phenomena or analyze problems

(C) use scale, proportion, and quantity to describe, compare, or model different systems;

Breakouts

(i) use scale to describe, compare, or model different systems

(ii) use proportion to describe, compare, or model different systems

(iii) use quantity to describe, compare, or model different systems

(D) examine and model the parts of a system and their interdependence in the function of the system;

Breakouts

(i) examine the parts of a system

(ii) model the parts of a system

(iii) examine [the parts of a system's] interdependence in the function of the system

(iv) model [the parts of a system's] interdependence in the function of the system

(E) investigate how energy flows and matter cycles through systems and how matter is conserved;

Breakouts

(i) investigate how energy flows through systems

(ii) investigate how matter cycles through systems

(iii) investigate how matter is conserved [through systems]

(F) explain the relationship between the structure and function of objects, organisms, and systems; and

Breakouts

(i) explain the relationship between the structure and function of objects

(ii) explain the relationship between the structure and function of organisms

(iii) explain the relationship between the structure and function of systems

(G) explain how factors or conditions impact stability and change in objects, organisms, and systems.

Breakouts

(i) explain how factors or conditions impact stability in objects

(ii) explain how factors or conditions impact stability in organisms

(iii) explain how factors or conditions impact stability systems

(iv) explain how factors or conditions impact change in objects

(v) explain how factors or conditions impact change in organisms

(vi) explain how factors or conditions impact change in systems

(6) Matter and energy. The student knows that matter has measurable physical properties that determine how matter is identified, classified, changed, and used. The student is expected to:

(A) classify and describe matter using observable physical properties, including temperature, mass, magnetism, relative density (the ability to sink or float in water), and physical state (solid, liquid, gas);

Breakouts

(i) classify matter using observable physical properties, including temperature

(ii) classify matter using observable physical properties, including mass

(iii) classify matter using observable physical properties, including magnetism

(iv) classify matter using observable physical properties, including relative density (the ability to sink or float in water)

(v) classify matter using observable physical properties, including physical state (solid, liquid, gas)

(vi) describe matter using observable physical properties, including temperature

(vii) describe matter using observable physical properties, including mass

(viii) describe matter using observable physical properties, including magnetism

(ix) describe matter using observable physical properties, including relative density (the ability to sink or float in water)

(x) describe matter using observable physical properties, including physical state (solid, liquid, gas)

(B) investigate and compare a variety of mixtures, including solutions that are composed of liquids in liquids and solids in liquids; and

Breakouts

(i) investigate a variety of mixtures, including solutions that are composed of liquids in liquids

(ii) investigate a variety of mixtures, including solutions that are solids in liquids

(iii) compare a variety of mixtures, including solutions that are composed of liquids in liquids

(iv) compare a variety of mixtures, including solutions that are composed of solids in liquids

(C) demonstrate that matter is conserved when mixtures such as soil and water or oil and water are formed.

Breakouts

(i) demonstrate that matter is conserved when mixtures are formed

(7) Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction, or magnetism in contact or at a distance on an object.

(A) plan and conduct descriptive investigations to explore the patterns of forces such as gravity, friction, or magnetism in contact or at a distance on an object.

Breakouts

(i) plan descriptive investigations to explore the patterns of forces

(ii) conduct descriptive investigations to explore the patterns of forces

(8) Force, motion, and energy. The student knows that energy is everywhere and can be observed in cycles, patterns, and systems. The student is expected to:

(A) investigate and identify the transfer of energy by objects in motion, waves in water, and sound;

Breakouts

(i) investigate the transfer of energy by objects in motion

(ii) investigate the transfer of energy by waves in water

(iii) investigate the transfer of energy by sound

(iv) identify the transfer of energy by objects in motion

(v) identify the transfer of energy by waves in water

(vi) identify the transfer of energy by sound

(B) identify conductors and insulators of thermal and electrical energy; and

Breakouts

(i) identify conductors of thermal energy

(ii) identify conductors of electrical energy

(iii) identify insulators of thermal energy

(iv) identify insulators of electrical energy

(C) demonstrate and describe how electrical energy travels in a closed path that can produce light and thermal energy.

Breakouts

(i) demonstrate how electrical energy travels in a closed path that can produce light energy

(ii) demonstrate how electrical energy travels in a closed path that can produce thermal energy

(iii) describe how electrical energy travels in a closed path that can produce light energy

(iv) describe how electrical energy travels in a closed path that can produce thermal energy

(9) Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to:

(A) collect and analyze data to identify sequences and predict patterns of change in seasons such as change in temperature and length of daylight; and

Breakouts

(i) collect data to identify sequences in seasons

(ii) analyze data to identify sequences in seasons

(iii) collect data to predict patterns of change in seasons

(iv) analyze data to predict patterns of change in seasons

(B) collect and analyze data to identify sequences and predict patterns of change in the observable appearance of the Moon from Earth.

Breakouts

(i) collect data to identify sequences in the observable appearance of the Moon from Earth

(ii) analyze data to identify sequences in the observable appearance of the Moon from Earth

(iii) collect data to predict patterns of change in the observable appearance of the Moon from Earth

(iv) analyze data to predict patterns of change in the observable appearance of the Moon from Earth

(10) Earth and space. The student knows that there are processes on Earth that create patterns of change. The student is expected to:

(A) describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process;

Breakouts

(i) describe the continuous movement of water above the surface of Earth through the water cycle

(ii) describe the continuous movement of water on the surface of Earth through the water cycle

(iii) illustrate the continuous movement of water above the surface of Earth through the water cycle

(iv) illustrate the continuous movement of water on the surface of Earth through the water cycle

(v) explain the role of the Sun as a major source of energy in this process

(B) model and describe slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice; and

Breakouts

(i) model slow changes to Earth's surface caused by weathering from water

(ii) model slow changes to Earth's surface caused by weathering from wind

(iii) model slow changes to Earth's surface caused by weathering from ice

(iv) model slow changes to Earth's surface caused by erosion from water

(v) model slow changes to Earth's surface caused by erosion from wind

(vi) model slow changes to Earth's surface caused by erosion from ice

(vii) model slow changes to Earth's surface caused by deposition from water

(viii) model slow changes to Earth's surface caused by deposition from wind

(ix) model slow changes to Earth's surface caused by deposition from ice

(x) describe slow changes to Earth's surface caused by weathering from water

(xi) describe slow changes to Earth's surface caused by weathering from wind

(xii) describe slow changes to Earth's surface caused by weathering from ice

(xiii) describe slow changes to Earth's surface caused by erosion from water

(xiv) describe slow changes to Earth's surface caused by erosion from wind

(xv) describe slow changes to Earth's surface caused by erosion from ice

(xvi) describe slow changes to Earth's surface caused by deposition from water

(xvii) describe slow changes to Earth's surface caused by deposition from wind

(xviii) describe slow changes to Earth's surface caused by deposition from ice

(C) differentiate between weather and climate.

Breakouts

(i) differentiate between weather and climate

(11) Earth and space. The student understands how natural resources are important and can be managed. The student is expected to:

(A) identify and explain advantages and disadvantages of using Earth's renewable and nonrenewable natural resources such as wind, water, sunlight, plants, animals, coal, oil, and natural gas;

Breakouts

(i) identify advantages of using Earth's renewable natural resources

(ii) identify disadvantages of using Earth's renewable natural resources

(iii) identify advantages of using Earth's nonrenewable natural resources

(iv) identify disadvantages of using Earth's nonrenewable natural resources

(v) explain advantages of using Earth's renewable natural resources

(vi) explain disadvantages of using Earth's renewable natural resources

(vii) explain advantages of using Earth's nonrenewable natural resources

(viii) explain disadvantages of using Earth's nonrenewable natural resources

(B) explain the critical role of energy resources to modern life and how conservation, disposal, and recycling of natural resources impact the environment; and

Breakouts

(i) explain the critical role of energy resources to modern life

(ii) explain how conservation of natural resources impact the environment

(iii) explain how disposal of natural resources impact the environment

(iv) explain how recycling of natural resources impact the environment

(C) determine the physical properties of rocks that allow Earth's natural resources to be stored there.

Breakouts

(i) determine the physical properties of rocks that allow Earth's natural resources to be stored there

(12) Organisms and environments. The student describes patterns, cycles, systems, and relationships within environments. The student is expected to:

(A) investigate and explain how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter;

Breakouts

(i) investigate how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter

(ii) explain how most producers can make their own food using sunlight, water, and carbon dioxide through the cycling of matter

(B) describe the cycling of matter and flow of energy through food webs, including the roles of the Sun, producers, consumers, and decomposers; and

Breakouts

(i) describe the cycling of matter through food webs, including the role of the Sun

(ii) describe the cycling of matter through food webs, including the role of the producers

(iii) describe the cycling of matter through food webs, including the role of the consumers

(iv) describe the cycling of matter through food webs, including the role of the decomposers

(v) describe the flow of energy through food webs, including the role of the Sun

(vi) describe the flow of energy through food webs, including the role of the producers

(vii) describe the flow of energy through food webs, including the role of the consumers

(viii) describe the flow of energy through food webs, including the role of the decomposers

(C) identify and describe past environments based on fossil evidence, including common Texas fossils.

Breakouts

(i) identify past environments based on fossil evidence, including common Texas fossils

(ii) describe past environments based on fossil evidence, including common Texas fossils

(13) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that function to help them survive within their environments. The student is expected to:

(A) explore and explain how structures and functions of plants such as waxy leaves and deep roots enable them to survive in their environment; and

Breakouts

(i) explore how structures of plants enable them to survive in their environment

(ii) explore how functions of plants enable them to survive in their environment

(iii) explain how structures of plants enable them to survive in their environment

(iv) explain how functions of plants enable them to survive in their environment

(B) differentiate between inherited and acquired physical traits of organisms.

Breakouts

(i) differentiate between inherited and acquired physical traits of organisms