Science, Grade 5

Subject: Science
Grade: 05
Num Expectations: 42
Num Breakouts: 140

(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 5, 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 expanding their understanding of properties learned in Grade 4 (mass, volume, states, temperature, magnetism, and relative density) to include solubility and the ability to conduct or insulate both thermal and electrical energy. Students observe the combination of substances to make mixtures and develop an understanding of conservation of matter. These concepts lead to the understanding of elements and compounds. Students will build on this understanding in middle school when they learn to determine density and to identify evidence of chemical changes.

(C) Force, motion, and energy. Students investigate equal and unequal forces and the effects these forces have on objects (motion and direction). Additionally, students investigate energy, including mechanical, light, thermal, electrical, and sound. They uncover cycles (e.g., movement of thermal energy), patterns (e.g., behavior of light, including reflection and refraction), and systems through their exploration. Students will build on this understanding in middle school when they begin to use calculations and measurements to study force, motion, and energy through the study of Newton's Laws of Motion.

(D) Earth and space. This strand is focused on identifying recognizable patterns and processes as students learn about Earth's rotation and demonstrate the effects this movement has on Earth's surface, including day and night, shadows, and the rotation of Earth on its axis. Students continue their learning of patterns and processes on Earth while exploring weather, climate, the water cycle, the formation of sedimentary rock and fossil fuels, and the formation of landforms. Finally, students learn ways to manage natural resources to support a healthy environment.

(E) Organisms and environments. This strand focuses on identifying relationships, systems, and cycles within organisms and environments. Students describe the interactions of biotic and abiotic factors in an ecosystem. Students build on their understanding of food webs from Grade 4 by predicting how ecosystem changes affect the flow of energy. Additionally, they describe how humans impact the ecosystem. Students also learn how organisms' structures help them to survive, and they distinguish between instinctual and learned behaviors in animals. This will set the foundation for Grade 6 where students compare and contrast variations within organisms and how they impact survival.

(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 and simple experimental 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 scientific practices to plan simple experimental investigations

(iv) use scientific practices to conduct simple experimental investigations

(v) 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 of 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 of safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards

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

Breakouts

(i) use tools 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 used 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 used to collect data, including tables

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

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

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

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

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

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

(viii) construct appropriate graphic organizers used 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 experimental and engineering designs.

Breakouts

(i) evaluate experimental designs

(ii) evaluate engineering designs

(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) compare and contrast matter based on measurable, testable, or observable physical properties, including mass, magnetism, relative density (sinking and floating using water as a reference point), physical state (solid, liquid, gas), volume, solubility in water, and the ability to conduct or insulate thermal energy and electric energy;

Breakouts

(i) compare and contrast matter based on measurable, testable, or observable physical properties, including mass

(ii) compare and contrast matter based on measurable, testable, or observable physical properties, including magnetism

(iii) compare and contrast matter based on measurable, testable, or observable physical properties, including relative density (sinking and floating using water as a reference point)

(iv) compare and contrast matter based on measurable, testable, or observable physical properties, including physical state (solid, liquid, gas)

(v) compare and contrast matter based on measurable, testable, or observable physical properties, including volume

(vi) compare and contrast matter based on measurable, testable, or observable physical properties, including solubility in water

(vii) compare and contrast matter based on measurable, testable, or observable physical properties, including the ability to conduct or insulate thermal energy

(B) demonstrate and explain that some mixtures maintain physical properties of their substances such as iron filings and sand or sand and water;

Breakouts

(i) demonstrate that some mixtures maintain physical properties of their substances

(ii) explain that some mixtures maintain physical properties of their substances

(C) compare the properties of substances before and after they are combined into a solution and demonstrate that matter is conserved in solutions; and

Breakouts

(i) compare the properties of substances before and after they are combined into a solution

(ii) demonstrate that matter is conserved in solutions

(D) illustrate how matter is made up of particles that are too small to be seen such as air in a balloon.

Breakouts

(i) illustrate how matter is made up of particles that are too small to be seen

(7) Force, motion, and energy. The student knows the nature of forces and the patterns of their interactions. The student is expected to:

(A) investigate and explain how equal and unequal forces acting on an object cause patterns of motion and transfer of energy; and

Breakouts

(i) investigate how equal forces acting on an object cause patterns of motion

(ii) investigate how unequal forces acting on an object cause patterns of motion

(iii) investigate how equal forces acting on an object cause transfer of energy

(iv) investigate how unequal forces acting on an object cause transfer of energy

(v) explain how equal forces acting on an object cause patterns of motion

(vi) explain how unequal forces acting on an object cause patterns of motion

(vii) explain how equal forces acting on an object cause transfer of energy

(viii) explain how unequal forces acting on an object cause transfer of energy

(B) design a simple experimental investigation that tests the effect of force on an object in a system such as a car on a ramp or a balloon rocket on a string.

Breakouts

(i) design a simple experimental investigation that tests the effect of force on an object in a system

(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 describe the transformation of energy in systems such as energy in a flashlight battery that changes from chemical energy to electrical energy to light energy;

Breakouts

(i) investigate the transformation of energy in systems

(ii) describe the transformation of energy in systems

(B) demonstrate that electrical energy in complete circuits can be transformed into motion, light, sound, or thermal energy and identify the requirements for a functioning electrical circuit; and Breakouts

(i) demonstrate that electrical energy in complete circuits can be transformed into motion, light, sound, or thermal energy

(ii) identify the requirements for a functioning electrical circuit

(C) demonstrate and explain how light travels in a straight line and can be reflected, refracted, or absorbed.

Breakouts

(i) demonstrate how light travels in a straight line

(ii) demonstrate how light can be reflected, refracted, or absorbed

(iii) explain how light travels in a straight line

(iv) explain how light can be reflected, refracted, or absorbed

(9) Earth and space. The student recognizes patterns among the Sun, Earth, and Moon system and their effects. The student is expected to demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.

(A) demonstrate that Earth rotates on its axis once approximately every 24 hours and explain how that causes the day/night cycle and the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.

Breakouts

(i) demonstrate that Earth rotates on its axis once approximately every 24 hours

(ii) explain how [rotation] causes the day/night cycle

(iii) explain how [rotation] causes the appearance of the Sun moving across the sky, resulting in changes in shadow positions and shapes.

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

(A) explain how the Sun and the ocean interact in the water cycle and affect weather;

Breakouts

(i) explain how the Sun and the ocean interact in the water cycle

(ii) explain how the Sun affects weather

(iii) explain how the ocean affects weather

(B) model and describe the processes that led to the formation of sedimentary rocks and fossil fuels; and

Breakouts

(i) model the processes that led to the formation of sedimentary rocks

(ii) model the processes that led to the formation of fossil fuels

(iii) describe the processes that led to the formation of sedimentary rocks

(iv) describe the processes that led to the formation of fossil fuels

(C) model and identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas, canyons, and sand dunes.

Breakouts

(i) model how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas

(ii) model how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including canyons

(iii) model how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including sand dunes

(iv) identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including deltas

(v) identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including canyons

(vi) identify how changes to Earth's surface by wind, water, or ice result in the formation of landforms, including sand dunes

(11) Earth and space. The student understands how natural resources are important and can be managed. The student is expected to design and explain solutions such as conservation, recycling, or proper disposal to minimize environmental impact of the use of natural resources.

(A) design and explain solutions such as conservation, recycling, or proper disposal to minimize environmental impact of the use of natural resources.

Breakouts

(i) design solutions to minimize environmental impact of the use of natural resources

(ii) explain solutions to minimize environmental impact of the use of natural resources

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

(A) observe and describe how a variety of organisms survive by interacting with biotic and abiotic factors in a healthy ecosystem;

Breakouts

(i) observe how a variety of organisms survive by interacting with biotic factors in a healthy ecosystem

(ii) observe how a variety of organisms survive by interacting with abiotic factors in a healthy ecosystem

(iii) describe how a variety of organisms survive by interacting with biotic factors in a healthy ecosystem

(iv) describe how a variety of organisms survive by interacting with abiotic factors in a healthy ecosystem

(B) predict how changes in the ecosystem affect the cycling of matter and flow of energy in a food web; and

Breakouts

(i) predict how changes in the ecosystem affect the cycling of matter in a food web

(ii) predict how changes in the ecosystem affect the flow of energy in a food web

(C) describe a healthy ecosystem and how human activities can be beneficial or harmful to an ecosystem.

Breakouts

(i) describe a healthy ecosystem

(ii) describe how human activities can be beneficial or harmful to an ecosystem

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

(A) analyze the structures and functions of different species to identify how organisms survive in the same environment; and

Breakouts

(i) analyze the structures of different species to identify how organisms survive in the same environment

(ii) analyze the functions of different species to identify how organisms survive in the same environment

(B) explain how instinctual behavioral traits such as turtle hatchlings returning to the sea and learned behavioral traits such as orcas hunting in packs increase chances of survival.

Breakouts

(i) explain how instinctual behavioral traits increase chances of survival

(ii) explain how learned behavioral traits increase chances of survival