Approved for second reading and final adoption by the State Board of Education on November 19, 2021.

Not yet filed as adopted with the Texas Register; subject to technical edits by Texas Register editors.

Text of Adopted New 19 TAC

Chapter 112. Texas Essential Knowledge and Skills for Science

Subchapter A. Elementary

§112.1. Implementation of Texas Essential Knowledge and Skills for Science, Elementary, Adopted 2021.

(a) The provisions of §§112.2-112.7 of this subchapter shall be implemented by school districts.

(b) No later than July 31, 2023, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for science as adopted in §§112.2-112.7 of this subchapter.

(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§112.2-112.7 of this subchapter shall be implemented beginning with the 2024-2025 school year and apply to the 2024-2025 and subsequent school years.

(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than July 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§112.2-112.7 of this subchapter shall be implemented for the following school year.

(e) Sections 112.11-112.16 of this subchapter shall be superseded by the implementation of §§112.2-112.7 of this subchapter.

§112.2. Science, Kindergarten, Adopted 2021.

(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 in science. In Kindergarten, 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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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 80% of instructional time.

(B) Matter and its properties. Students build their knowledge of the natural world using their senses. The students focus on observable properties and patterns of objects, including shape, color, texture, and material.

(C) Force, motion, and energy. Students explore the location, motion, and position of objects and investigate the importance of light energy as it relates to the students' everyday lives. Students focus on demonstrating light energy sources and their effect on objects.

(D) Earth and space. Patterns are recognizable in the natural world and among objects in the sky. Students understand that weather, seasons of the year, and day and night are repeated patterns. Materials found on Earth can be used and classified.

(E) Organisms and environments. All living organisms satisfy basic needs through interactions with nonliving things and living organisms, and they have structures and functions that help them survive within their environments. Students investigate the life cycle of plants and identify likenesses between parents and young.

(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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

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

(C) identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use tools, including hand lenses, goggles, trays, cups, bowls, sieves or sifters, notebooks, terrariums, aquariums, samples (rocks, sand, soil, loam, gravel, clay, seeds, and plants), windsock, demonstration thermometer, rain gauge, straws, ribbons, non-standard measuring items, blocks or cubes, tuning fork, various flashlights, small paper cups, items that roll, noise makers, hot plate, opaque objects, transparent objects, foil pie pans, foil muffin cups, wax paper, [~~technology,~~] Sun-Moon-Earth model, and plant life cycle model to observe, measure, test, and compare;

(E) collect observations and measurements as evidence;

(F) record and organize data using pictures, numbers, words, symbols, and simple graphs; and

(G) develop and use models to represent phenomena, objects, and 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 basic advantages and limitations of models such as their size, properties, and materials;

(B) analyze data by identifying significant features and patterns;

(C) use mathematical concepts to compare two objects with common attributes; and

(D) evaluate a design or object using criteria to determine if it works as intended.

(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;

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

(C) listen actively to others' explanations to identify important evidence and 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 on society. The student is expected to:

(A) explain how science or an innovation can help others; and

(B) identify [~~what~~] scientists and engineers such as Issac Newton, Mae Jemison, and Ynes Mexia [~~are~~] and explore what different scientists and engineers do.

(5) Recurring themes and concepts. The student uses recurring themes and concepts to make connections across disciplines. The student is expected to:

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

(B) investigate and predict cause-and-effect relationships in science;

(C) describe the properties of objects in terms of relative size (scale) and relative quantity;

(D) examine the parts of a whole to define or model a system;

(E) identify forms of energy and properties of matter;

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

(G) describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

(6) Matter and its properties. The student knows that objects have physical properties that determine how they are described and classified. The student is expected to identify and record observable physical properties of objects, including shape, color, texture, and material, and generate ways to classify objects.

(7) Force, motion, and energy. The student knows that forces cause changes in motion and position in everyday life. The student is expected to describe and predict how a magnet interacts with various materials and how magnets can be used to push or pull.

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

(A) communicate the idea that objects can only be seen when a light source is present and compare the effects of different amounts of light on the appearance of objects; and

(B) demonstrate and explain that light travels through some objects and is blocked by other objects, creating shadows.

(9) Earth and space. The student knows that there are recognizable patterns in the natural world and among objects in the sky. The student is expected to:

(A) identify, describe, and predict the patterns of day and night and their observable characteristics; and

(B) observe, describe, and illustrate the Sun, Moon, stars, and objects in the sky such as clouds.

(10) Earth and space. The student knows that the natural world includes earth materials and systems that can be observed. The student is expected to:

(A) describe and classify rocks by the observable properties of size, shape, color, and texture;

(B) observe and describe weather changes from day to day and over seasons; and

(C) identify evidence that supports the idea that air is all around us and demonstrate that wind is moving air using items such as a windsock, pinwheel, or ribbon.

(11) Earth and space. The student knows that earth materials are important to everyday life. The student is expected to observe and generate examples of practical uses for rocks, soil, and water.

(12) Organisms and environments. The student knows that plants and animals depend on the environment to meet their basic needs for survival. The student is expected to:

(A) observe and identify the dependence of plants on air, sunlight, water, nutrients in the soil, and space to grow; and

(B) observe and identify the dependence of animals on air, water, food, space, and shelter.

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

(A) identify the structures of plants, including roots, stems, leaves, flowers, and fruits;

(B) identify the different structures that animals have that allow them to interact with their environment such as seeing, hearing, moving, and grasping objects;

(C) identify and record the changes from seed, seedling, plant, flower, and fruit in a simple plant life cycle; and

(D) identify ways that young plants resemble the parent plant.

§112.3. Science, Grade 1, Adopted 2021.

(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 in science. In Grade 1, 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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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 80% of instructional time.

(B) Matter and its properties. Students build their knowledge of the natural world using their senses. Students focus on observable properties and patterns of objects, including larger and smaller, heavier and lighter, shape, color, and texture. The students understand changes in materials caused by heating and cooling.

(C) Force, motion, and energy. Students know that force and motion are related and that energy exists in many forms as a part of everyday life. Magnetism interacts with various materials and can be used as a push and pull. The students investigate the importance of heat and focus on changes caused by heating and cooling.

(D) Earth and space. Patterns, cycles, and systems are recognizable in the natural world and among objects in the sky. Students make informed choices by understanding weather and seasonal patterns. Students understand that natural resources on Earth, including rocks, soil, and water, are used by humans and can be conserved.

(E) Organisms and environments. All living organisms interact with living and nonliving things within their environments and use structures to meet their basic needs. Students know that organisms are interdependent and part of a food chain. The students investigate the life cycle of animals and identify likenesses between parents and young.

(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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

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

(C) identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use tools, including hand lenses, goggles, heat-resistant gloves, trays, cups, bowls, beakers, sieves/sifters, tweezers, primary balance, notebooks, terrariums, aquariums, stream tables, soil samples (loam, sand, gravel, rocks, and clay), seeds, plants, windsock, pinwheel, student thermometer, demonstration thermometer, rain gauge, straws, ribbons, non-standard measuring items, flashlights, sandpaper, wax paper, items that are magnetic, non-magnetic items, a variety of magnets, hot plate, aluminum foil, [~~technology.~~] Sun-Moon-Earth model, and plant and animal life cycle models to observe, measure, test, and compare;

(E) collect observations and measurements as evidence;

(F) record and organize data using pictures, numbers, words, symbols, and simple graphs; and

(G) develop and use models to represent phenomena, objects, and 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 basic advantages and limitations of models such as their size, properties, and materials;

(B) analyze data by identifying significant features and patterns;

(C) use mathematical concepts to compare two objects with common attributes; and

(D) evaluate a design or object using criteria to determine if it works as intended.

(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;

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

(C) listen actively to others' explanations to identify important evidence and 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 science or an innovation can help others; and

(B) identify [~~what~~] scientists and engineers such as Katherine Johnson, Sally Ride, and Ernest Just [~~are~~] and explore what different scientists and engineers do.

(5) Recurring themes and concepts. The student uses recurring themes and concepts to make connections across disciplines. The student is expected to:

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

(B) investigate and predict cause-and-effect relationships in science;

(C) describe the properties of objects in terms of relative size (scale) and relative quantity;

(D) examine the parts of a whole to define or model a system;

(E) identify forms of energy and properties of matter;

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

(G) describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

(6) Matter and its properties. The student knows that objects have physical properties that determine how they are described and classified. The student is expected to:

(A) classify objects by observable physical properties, including, shape, color, and texture, and attributes such as larger and smaller and heavier and lighter;

(B) explain and predict changes in materials caused by heating and cooling; and

(C) demonstrate and explain that a whole object is a system made of organized parts such as a toy that can be taken apart and put back together.

(7) Force, motion, and energy. The student knows that forces cause changes in motion and position in everyday life. The student is expected to:

(A) explain how pushes and pulls can start, stop, or change the speed or direction of an object's motion; and

(B) plan and conduct a descriptive investigation that predicts how pushes and pulls can start, stop, or change the speed or direction of an object's motion.

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

(A) investigate and describe applications of heat in everyday life such as cooking food or using a clothes [~~hair~~] dryer; and

(B) describe how some changes caused by heat may be reversed such as melting butter and other changes cannot be reversed such as cooking an egg or baking a cake.

(9) Earth and space. The student knows that the natural world has recognizable patterns. The student is expected to describe and predict the patterns of seasons of the year such as order of occurrence and changes in nature.

(10) Earth and space. The student knows that the natural world includes earth materials that can be observed in systems and processes. The student is expected to:

(A) investigate and document the properties of particle size, shape, texture, and color and the components of different types of soils such as topsoil, clay, and sand;

(B) investigate and describe how water can move rock and soil particles from one place to another;

(C) compare the properties of puddles, ponds, streams, rivers, lakes, and oceans, including color, clarity, size, shape, and whether it is freshwater or saltwater; and

(D) describe and record observable characteristics of weather, including hot or cold, clear or cloudy, calm or windy, and rainy or icy, and explain the impact of weather on daily choices.

(11) Earth and space. The student knows that earth materials and products made from these materials are important to everyday life. The student is expected to:

(A) identify and describe how plants, animals, and humans use rocks, soil, and water; [~~and~~]

(B) explain why water conservation is important; and

(C) [~~(B)~~] describe ways to conserve water such as turning off the faucet when brushing teeth and protect natural sources of water such as [~~turning off the faucet when brushing teeth and~~] keeping trash out of bodies of water.

(12) Organisms and environments. The student knows that the environment is composed of relationships between living organisms and nonliving components. The student is expected to:

(A) classify living and nonliving things based upon whether they have basic needs and produce young;

(B) describe and record examples of interactions and dependence between living and nonliving components in terrariums or aquariums; and

(C) identify and illustrate how living organisms depend on each other through food chains.

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

(A) identify the external structures of different animals and compare how those structures help different animals live, move, and meet basic needs for survival;

(B) record observations of and describe basic life cycles of animals, including a bird, a mammal, and a fish; and

(C) compare ways that young animals resemble their parents.

§112.4. Science, Grade 2, Adopted 2021.

(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 in science. In Grade 2, 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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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 60% of instructional time.

(B) Matter and its properties. Students build upon their knowledge of the natural world using their senses. The students focus on physical properties of matter and determine how observable properties can be changed through various processes. Students use these processes to form new objects.

(C) Force, motion, and energy. Students know that force and motion are related and that energy exists in many forms as a part of everyday life. Magnetism interacts with various materials and can be used as a push and pull. The students investigate sound energy and focus on how sound affects objects.

(D) Earth and space. Students observe objects in the sky, including the Sun and the Moon, and collect and analyze weather data. In addition, students identify natural and manmade resources and how they can be conserved.

(E) Organisms and environments. All living organisms interact with living and nonliving things within their environments and use structures to meet their basic needs. Students understand that organisms are interdependent and part of a food chain. The students investigate the life cycle of animals and identify likenesses between parents and young.

(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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

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

(C) identify, describe, and demonstrate safe practices during classroom and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use tools, including hand lenses, goggles, heat-resistant gloves, trays, cups, bowls, beakers, notebooks, stream tables, soil, sand, gravel, flowering plants, student thermometer, demonstration thermometer, rain gauge, flashlights, ramps, balls, spinning tops, drums, tuning forks, sandpaper, wax paper, items that are flexible, non-flexible items, magnets, hot plate, aluminum foil, [~~technology.~~] Sun-Moon-Earth model, and frog and butterfly life cycle models to observe, measure, test, and compare;

(E) collect observations and measurements as evidence;

(F) record and organize data using pictures, numbers, words, symbols, and simple graphs; and

(G) develop and use models to represent phenomena, objects, and 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 basic advantages and limitations of models such as their size, properties, and materials;

(B) analyze data by identifying significant features and patterns;

(C) use mathematical concepts to compare two objects with common attributes; and

(D) evaluate a design or object using criteria to determine if it works as intended.

(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;

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

(C) listen actively to others' explanations to identify important evidence and 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 science or an innovation can help others; and

(B) identify [~~what~~] scientists and [~~or~~] engineers such as Alexander Graham Bell, Marie Daly, Mario Molina, and Jane Goodall [~~are~~] and explore what different scientists and engineers do.

(5) Recurring themes and concepts. The student uses recurring themes and concepts to make connections across disciplines. The student is expected to:

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

(B) investigate and predict cause-and-effect relationships in science;

(C) measure and describe the properties of objects in terms of size and quantity;

(D) examine the parts of a whole to define or model a system;

(E) identify forms of energy and properties of matter;

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

(G) describe how factors or conditions can cause objects, organisms, and systems to either change or stay the same.

(6) Matter and its properties. The student knows that matter has physical properties that determine how it is described, classified, and used. The student is expected to:

(A) classify matter by observable physical properties, including texture, flexibility, and relative temperature, and identify whether a material is a solid or liquid;

(B) conduct a descriptive investigation to explain how physical properties can be changed through processes such as cutting, folding, sanding, melting, or freezing; and

(C) demonstrate that small units such as building blocks can be combined or reassembled to form new objects for different purposes and explain the materials chosen based on their physical properties.

(7) Force, motion, and energy. The student knows that forces cause changes in motion and position in everyday life. The student is expected to:

(A) explain how objects push on each other and may change shape when they touch or collide; and

(B) plan and conduct a descriptive investigation to demonstrate how the strength of a push and pull changes an object's motion.

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

(A) demonstrate and explain that sound is made by vibrating matter and that vibrations can be caused by a variety of means, including sound;

(B) explain how different levels of sound are used in everyday life such as a whisper in a classroom or a fire alarm; and

(C) design and build a device using tools and materials that uses sound to solve the problem of communicating over a distance.

(9) Earth and space. The student knows that there are recognizable patterns in the natural world and among objects in the sky. The student is expected to:

(A) describe the Sun as a star that provides light and heat and explain that the Moon reflects the Sun's light; and

(B) observe [~~and compare how~~] objects in the sky using tools such as [~~are more visible and can appear different with~~] a telescope and compare how objects in the sky are more visible and can appear different with a tool than with an unaided eye.

(10) Earth and space. The student knows that the natural world includes earth materials that can be observed in systems and processes. The student is expected to:

(A) investigate and describe how wind and water move soil and rock particles across the Earth's surface such as wind blowing sand into dunes on a beach or a river carrying rocks as it flows;

(B) measure, record, and graph weather information, including temperature and precipitation; and

(C) investigate different types of severe weather events such as a hurricane, tornado, or flood and explain that some events are more likely than others in a given region.

(11) Earth and space. The student knows that earth materials and products made from these materials are important to everyday life. The student is expected to:

(A) distinguish between natural and manmade resources; and

(B) describe how human impact can be limited by making choices to conserve and properly dispose of materials such as reducing use of, reusing , or recycling paper, plastic, and metal.

(12) Organisms and environments. The student knows that living organisms have basic needs that must be met through interactions within their environment. The student is expected to:

(A) describe how the physical characteristics of environments, including the amount of rainfall, support plants and animals within an ecosystem;

(B) create and describe food chains identifying producers and consumers to demonstrate how animals depend on other living things; and

(C) explain and demonstrate how some plants depend on other living things, wind, or water for pollination and to move their seeds around.

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

(A) identify the roots, stems, leaves, flowers, fruits, and seeds of plants and compare how those structures help different plants meet their basic needs for survival;

(B) record and compare how the structures and behaviors of animals help them find and take in food, water, and air;

(C) record and compare how being part of a group helps animals obtain food, defend themselves, and cope with changes; and

(D) investigate and describe some of the unique life cycles of animals where young animals do not resemble their parents, including butterflies and frogs.

§112.5. Science, Grade 3, Adopted 2021.

(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 3, 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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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 60% of instructional time.

(B) Matter and energy. Students build upon the knowledge learned in Kindergarten-Grade 2 by investigating the physical properties of matter. Students explore states of matter and observe that changes can occur to matter through heating and cooling. The students explore using substances by combining them to create or modify objects based on their physical properties.

(C) Force, motion, and energy. Students manipulate objects by pushing and pulling to demonstrate changes in motion and position. Students also identify forces such as magnetism and gravity. Students understand energy exists in many forms, including mechanical, thermal, light, and sound. The students identify forms of energy in everyday life.

(D) Earth and space. Students learn that there are recognizable processes that change the Earth over time. Students compare day-to-day changes in weather. They also investigate how soil is formed through the processes of weathering and decomposition. Students model rapid changes to Earth's surface as well as explore ways to conserve Earth's resources. Students recognize that there are identifiable objects and patterns in Earth's solar system. Students model the orbits of the Sun, Earth, and Moon as well as describe their relationship to each other. This will set the foundation for Grade 4 when they look at changes in the appearance of the Moon. Students also identify the sequence of the planets in Earth's solar system.

(E) Organisms and environments. Students explore patterns, systems, and cycles within environments by investigating characteristics of organisms, life cycles, and interactions among all components of the natural environment. Students examine how environment and the structures and functions of animals play a key role in survival. Students know that when changes in the environment occur, organisms may thrive, become ill, or perish. Students also examine fossils as evidence of past living 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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

(B) use scientific practices to plan and conduct descriptive investigations and 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;

(D) use tools, including hand lenses; metric rulers; Celsius thermometers; wind vanes; rain gauges; graduated cylinders; beakers; digital scales; hot plates; meter sticks; magnets; notebooks; Sun, Earth, Moon system models; timing devices; 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;

(E) collect observations and 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

(G) develop and use models to represent phenomena, objects, and 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;

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

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

(D) 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;

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

(C) listen actively to others' explanations to identify relevant evidence and 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

(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.

(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;

(B) identify and 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;

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

(E) investigate the flow of energy and cycling of matter through systems;

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

(G) explain how factors or conditions impact stability and change in objects, organisms, and 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) measure, test, and record physical properties of matter, including temperature, mass, magnetism, and the ability to sink or float in water;

(B) describe and classify samples of matter as solids, liquids, and gases and demonstrate that solids have a definite shape and that liquids and gases take the shape of their container;

(C) predict, observe, and record changes in the state of matter caused by heating or cooling in a variety of substances such as ice becoming liquid water, condensation forming on the outside of a glass, or liquid water being heated to the point of becoming water vapor (gas); and

(D) demonstrate that materials can be combined based on their physical properties to create or modify objects such as building a tower or adding clay to sand to make a stronger brick and justify the selection of materials based on their physical properties.

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

(A) demonstrate and describe forces acting on an object in contact or at a distance, including magnetism, gravity, and pushes and pulls; and

(B) plan and conduct a descriptive investigation to demonstrate and explain how position and motion can be changed by pushing and pulling objects such as swings, balls, and wagons.

(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) identify everyday examples of energy, including light, sound, thermal, and mechanical; and

(B) plan and conduct investigations that demonstrate how the speed of an object is related to its mechanical energy.

(9) Earth and space. The student knows there are recognizable objects and patterns in Earth's solar system. The student is expected to:

(A) construct models and explain the orbits of the Sun, Earth, and Moon in relation to each other; and

(B) identify the order [~~sequence~~] of the planets in Earth's solar system in relation to the Sun.

(10) Earth and space. The student knows that there are recognizable processes that change Earth over time. The student is expected to:

(A) compare and describe day-to-day weather in different locations at the same time, including air temperature, wind direction, and precipitation;

(B) investigate and explain how soils such as sand and clay are formed by weathering of rock and by decomposition of plant and animal remains; and

(C) model and describe rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides.

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

(A) explore and explain how humans use natural resources such as in construction, in agriculture, in transportation, and to make products; [~~and~~]

(B) explain why the conservation of natural resources is important; and

(C) [~~(B)~~]identify ways to conserve natural resources through reducing, reusing, or recycling.

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

(A) explain how temperature and precipitation affect animal growth and behavior through migration and hibernation and plant responses through dormancy;

(B) identify and describe the flow of energy in a food chain and predict how changes in a food chain such as removal of frogs from a pond or bees from a field affect the ecosystem;

(C) describe how natural changes to the environment such as floods and droughts cause some organisms to thrive and others to perish or move to new locations; and

(D) identify fossils as evidence of past living organisms and environments, 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 external structures and functions of animals such as the neck of a giraffe or webbed feet on a duck enable them to survive in their environment; and

(B) explore, illustrate, and compare life cycles in organisms such as beetles, crickets, radishes, or lima beans.

§112.6. Science, Grade 4, Adopted 2021.

(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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

(B) use scientific practices to plan and conduct descriptive investigations and 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;

(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;

(E) collect observations and 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

(G) develop and use models to represent phenomena, objects, and 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;

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

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

(D) 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;

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

(C) listen actively to others' explanations to identify relevant evidence and 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

(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.

(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;

(B) identify and 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;

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

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

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

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

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

(C) demonstrate that matter is conserved when mixtures such as soil and water or [~~and~~] oil and water 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.

(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;

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

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

(B) collect and analyze data to identify sequences and 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;

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

(C) 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; [~~and~~]

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

(C) 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;

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

(C) identify and 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

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

§112.7. Science, Grade 5, Adopted 2021.

(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 [~~include~~] 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 [~~with~~] variables relevant to the hypothesis that are manipulated , and comparing [~~to compare~~] 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 [~~is identified~~] .

(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) [~~(A)~~] 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) [~~(B)~~] 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.

(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;

(B) use scientific practices to plan and conduct descriptive and simple experimental investigations and 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;

(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;

(E) collect observations and 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

(G) develop and use models to represent phenomena, objects, and 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;

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

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

(D) evaluate experimental and 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;

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

(C) listen actively to others' explanations to identify relevant evidence and 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

(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.

(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;

(B) identify and 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;

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

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

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

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

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

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

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

(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

(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.

(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;

(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

(C) demonstrate and explain how light travels in a straight line and can be reflected , [~~and~~] 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.

(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;

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

(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.

(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.

(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;

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

(C) describe a healthy ecosystem and 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

(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.