

## Chapter 112. Texas Essential Knowledge and Skills for Science

### Subchapter B. Middle School

*Statutory Authority: The provisions of this Subchapter B issued under the Texas Education Code, §§7.102(c)(4), 28.002, and 28.008, unless otherwise noted.*

#### **§112.17. Implementation of Texas Essential Knowledge and Skills for Science, Middle School, Beginning with School Year 2010-2011.**

The provisions of §§112.18-112.20 of this subchapter shall be implemented by school districts beginning with the 2010-2011 school year and at that time shall supersede §§112.22-112.24 of this subchapter.

*Source: The provisions of this §112.17 adopted to be effective August 4, 2009, 34 TexReg 5063.*

#### **§112.18. Science, Grade 6, Beginning with School Year 2010-2011.**

(a) Introduction.

- (1) Science, as defined by the National Academy of Science, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
- (2) Scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions become theories. Scientific theories are based on natural and physical phenomena and are capable of being tested by multiple, independent researchers. Students should know that scientific theories, unlike hypotheses, are well-established and highly reliable, but they may still be subject to change as new information and technologies are developed. Students should be able to distinguish between scientific decision-making methods and ethical/social decisions that involve the application of scientific information.
- (3) Grade 6 science is interdisciplinary in nature; however, much of the content focus is on physical science. National standards in science are organized as multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale.
- (4) The strands for Grade 6 include:
  - (A) Scientific investigations and reasoning.
    - (i) To develop a rich knowledge of science and the natural world, students must become familiar with different modes of scientific inquiry, rules of evidence, ways of formulating questions, ways of proposing explanations, and the diverse ways scientists study the natural world and propose explanations based on evidence derived from their work.
    - (ii) Scientific investigations are conducted for different reasons. All investigations require a research question, careful observations, data gathering, and analysis of the data to identify the patterns that will explain the findings. Descriptive investigations are used to explore new phenomena such as conducting surveys of organisms or measuring the abiotic components in a given habitat. Descriptive statistics include frequency, range, mean, median, and mode. A hypothesis is not required in a descriptive investigation. On the other hand, when conditions can be controlled in order to focus on a single variable,

experimental research design is used to determine causation. Students should experience both types of investigations and understand that different scientific research questions require different research designs.

- (iii) Scientific investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and the methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. Models have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.

(B) Matter and energy.

- (i) Matter can be classified as elements, compounds, or mixtures. Students have already had experience with mixtures in Grade 5, so Grade 6 will concentrate on developing an understanding of elements and compounds. It is important that students learn the differences between elements and compounds based on observations, description of physical properties, and chemical reactions. Elements are represented by chemical symbols, while compounds are represented by chemical formulas. Subsequent grades will learn about the differences at the molecular and atomic level.
- (ii) Elements are classified as metals, nonmetals, and metalloids based on their physical properties. The elements are divided into three groups on the Periodic Table. Each different substance usually has a different density, so density can be used as an identifying property. Therefore, calculating density aids classification of substances.
- (iii) Energy resources are available on a renewable, nonrenewable, or indefinite basis. Understanding the origins and uses of these resources enables informed decision making. Students should consider the ethical/social issues surrounding Earth's natural energy resources, while looking at the advantages and disadvantages of their long-term uses.

- (C) Force, motion, and energy. Energy occurs in two types, potential and kinetic, and can take several forms. Thermal energy can be transferred by conduction, convection, or radiation. It can also be changed from one form to another. Students will investigate the relationship between force and motion using a variety of means, including calculations and measurements.

- (D) Earth and space. The focus of this strand is on introducing Earth's processes. Students should develop an understanding of Earth as part of our solar system. The topics include organization of our solar system, the role of gravity, and space exploration.

- (E) Organisms and environments. Students will gain an understanding of the broadest taxonomic classifications of organisms and how characteristics determine their classification. The other major topics developed in this strand include the interdependence between organisms and their environments and the levels of organization within an ecosystem.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student, for at least 40% of instructional time, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:
  - (A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and

- (B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.
- (2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:
- (A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;
  - (B) design and implement experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
  - (C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers;
  - (D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and
  - (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.
- (3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:
- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
  - (B) use models to represent aspects of the natural world such as a model of Earth's layers;
  - (C) identify advantages and limitations of models such as size, scale, properties, and materials; and
  - (D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.
- (4) Scientific investigation and reasoning. The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to:
- (A) use appropriate tools to collect, record, and analyze information, including journals/notebooks, beakers, Petri dishes, meter sticks, graduated cylinders, hot plates, test tubes, triple beam balances, microscopes, thermometers, calculators, computers, timing devices, and other equipment as needed to teach the curriculum; and
  - (B) use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.
- (5) Matter and energy. The student knows the differences between elements and compounds. The student is expected to:
- (A) know that an element is a pure substance represented by chemical symbols;
  - (B) recognize that a limited number of the many known elements comprise the largest portion of solid Earth, living matter, oceans, and the atmosphere;
  - (C) differentiate between elements and compounds on the most basic level; and
  - (D) identify the formation of a new substance by using the evidence of a possible chemical change such as production of a gas, change in temperature, production of a precipitate, or color change.

- (6) Matter and energy. The student knows matter has physical properties that can be used for classification. The student is expected to:
- (A) compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability;
  - (B) calculate density to identify an unknown substance; and
  - (C) test the physical properties of minerals, including hardness, color, luster, and streak.
- (7) Matter and energy. The student knows that some of Earth's energy resources are available on a nearly perpetual basis, while others can be renewed over a relatively short period of time. Some energy resources, once depleted, are essentially nonrenewable. The student is expected to:
- (A) research and debate the advantages and disadvantages of using coal, oil, natural gas, nuclear power, biomass, wind, hydropower, geothermal, and solar resources; and
  - (B) design a logical plan to manage energy resources in the home, school, or community.
- (8) Force, motion, and energy. The student knows force and motion are related to potential and kinetic energy. The student is expected to:
- (A) compare and contrast potential and kinetic energy;
  - (B) identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces;
  - (C) calculate average speed using distance and time measurements;
  - (D) measure and graph changes in motion; and
  - (E) investigate how inclined planes and pulleys can be used to change the amount of force to move an object.
- (9) Force, motion, and energy. The student knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form. The student is expected to:
- (A) investigate methods of thermal energy transfer, including conduction, convection, and radiation;
  - (B) verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler until all the substances attain the same temperature such as an ice cube melting; and
  - (C) demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.
- (10) Earth and space. The student understands the structure of Earth, the rock cycle, and plate tectonics. The student is expected to:
- (A) build a model to illustrate the structural layers of Earth, including the inner core, outer core, mantle, crust, asthenosphere, and lithosphere;
  - (B) classify rocks as metamorphic, igneous, or sedimentary by the processes of their formation;
  - (C) identify the major tectonic plates, including Eurasian, African, Indo-Australian, Pacific, North American, and South American; and
  - (D) describe how plate tectonics causes major geological events such as ocean basins, earthquakes, volcanic eruptions, and mountain building.
- (11) Earth and space. The student understands the organization of our solar system and the relationships among the various bodies that comprise it. The student is expected to:

- (A) describe the physical properties, locations, and movements of the Sun, planets, Galilean moons, meteors, asteroids, and comets;
  - (B) understand that gravity is the force that governs the motion of our solar system; and
  - (C) describe the history and future of space exploration, including the types of equipment and transportation needed for space travel.
- (12) Organisms and environments. The student knows all organisms are classified into Domains and Kingdoms. Organisms within these taxonomic groups share similar characteristics which allow them to interact with the living and nonliving parts of their ecosystem. The student is expected to:
- (A) understand that all organisms are composed of one or more cells;
  - (B) recognize that the presence of a nucleus determines whether a cell is prokaryotic or eukaryotic;
  - (C) recognize that the broadest taxonomic classification of living organisms is divided into currently recognized Domains;
  - (D) identify the basic characteristics of organisms, including prokaryotic or eukaryotic, unicellular or multicellular, autotrophic or heterotrophic, and mode of reproduction, that further classify them in the currently recognized Kingdoms;
  - (E) describe biotic and abiotic parts of an ecosystem in which organisms interact; and
  - (F) diagram the levels of organization within an ecosystem, including organism, population, community, and ecosystem.

*Source: The provisions of this §112.18 adopted to be effective August 4, 2009, 34 TexReg 5063.*

**§112.19. Science, Grade 7, Beginning with School Year 2010-2011.**

- (a) Introduction.
- (1) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
  - (2) Scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions become theories. Scientific theories are based on natural and physical phenomena and are capable of being tested by multiple, independent researchers. Students should know that scientific theories, unlike hypotheses, are well-established and highly reliable, but they may still be subject to change as new information and technologies are developed. Students should be able to distinguish between scientific decision-making methods and ethical/social decisions that involve the application of scientific information.
  - (3) Grade 7 science is interdisciplinary in nature; however, much of the content focus is on organisms and the environment. National standards in science are organized as a multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale.
  - (4) The strands for Grade 7 include:
    - (A) Scientific investigation and reasoning.
      - (i) To develop a rich knowledge of science and the natural world, students must become familiar with different modes of scientific inquiry, rules of evidence,

ways of formulating questions, ways of proposing explanations, and the diverse ways scientists study the natural world and propose explanations based on evidence derived from their work.

- (ii) Scientific investigations are conducted for different reasons. All investigations require a research question, careful observations, data gathering, and analysis of the data to identify the patterns that will explain the findings. Descriptive investigations are used to explore new phenomena such as conducting surveys of organisms or measuring the abiotic components in a given habitat. Descriptive statistics include frequency, range, mean, median, and mode. A hypothesis is not required in a descriptive investigation. On the other hand, when conditions can be controlled in order to focus on a single variable, experimental research design is used to determine causation. Students should experience both types of investigations and understand that different scientific research questions require different research designs.
  - (iii) Scientific investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and the methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. Models have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.
- (B) Matter and energy. Matter and energy are conserved throughout living systems. Radiant energy from the Sun drives much of the flow of energy throughout living systems due to the process of photosynthesis in organisms described as producers. Most consumers then depend on producers to meet their energy needs. Decomposers play an important role in recycling matter. Organic compounds are composed of carbon and other elements that are recycled due to chemical changes that rearrange the elements for the particular needs of that living system. Large molecules such as carbohydrates are composed of chains of smaller units such as sugars, similar to a train being composed of multiple box cars. Subsequent grade levels will learn about the differences at the molecular and atomic level.
- (C) Force, motion, and energy. Force, motion, and energy are observed in living systems and the environment in several ways. Interactions between muscular and skeletal systems allow the body to apply forces and transform energy both internally and externally. Force and motion can also describe the direction and growth of seedlings, turgor pressure, and geotropism. Catastrophic events of weather systems such as hurricanes, floods, and tornadoes can shape and restructure the environment through the force and motion evident in them. Weathering, erosion, and deposition occur in environments due to the forces of gravity, wind, ice, and water.
- (D) Earth and space. Earth and space phenomena can be observed in a variety of settings. Both natural events and human activities can impact Earth systems. There are characteristics of Earth and relationships to objects in our solar system that allow life to exist.
- (E) Organisms and environments.
- (i) Students will understand the relationship between living organisms and their environment. Different environments support different living organisms that are adapted to that region of Earth. Organisms are living systems that maintain a steady state with that environment and whose balance may be disrupted by internal and external stimuli. External stimuli include human activity or the environment. Successful organisms can reestablish a balance through different

processes such as a feedback mechanism. Ecological succession can be seen on a broad or small scale.

- (ii) Students learn that all organisms obtain energy, get rid of wastes, grow, and reproduce. During both sexual and asexual reproduction, traits are passed onto the next generation. These traits are contained in genetic material that is found on genes within a chromosome from the parent. Changes in traits sometimes occur in a population over many generations. One of the ways a change can occur is through the process of natural selection. Students extend their understanding of structures in living systems from a previous focus on external structures to an understanding of internal structures and functions within living things.
- (iii) All living organisms are made up of smaller units called cells. All cells use energy, get rid of wastes, and contain genetic material. Students will compare plant and animal cells and understand the internal structures within them that allow them to obtain energy, get rid of wastes, grow, and reproduce in different ways. Cells can organize into tissues, tissues into organs, and organs into organ systems. Students will learn the major functions of human body systems such as the ability of the integumentary system to protect against infection, injury, and ultraviolet (UV) radiation; regulate body temperature; and remove waste.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student, for at least 40% of the instructional time, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:
  - (A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and
  - (B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.
- (2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:
  - (A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;
  - (B) design and implement experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
  - (C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers;
  - (D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and
  - (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.
- (3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:
  - (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

- (B) use models to represent aspects of the natural world such as human body systems and plant and animal cells;
  - (C) identify advantages and limitations of models such as size, scale, properties, and materials; and
  - (D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.
- (4) Science investigation and reasoning. The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to:
- (A) use appropriate tools to collect, record, and analyze information, including life science models, hand lens, stereoscopes, microscopes, beakers, Petri dishes, microscope slides, graduated cylinders, test tubes, meter sticks, metric rulers, metric tape measures, timing devices, hot plates, balances, thermometers, calculators, water test kits, computers, temperature and pH probes, collecting nets, insect traps, globes, digital cameras, journals/notebooks, and other equipment as needed to teach the curriculum; and
  - (B) use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.
- (5) Matter and energy. The student knows that interactions occur between matter and energy. The student is expected to:
- (A) recognize that radiant energy from the Sun is transformed into chemical energy through the process of photosynthesis;
  - (B) demonstrate and explain the cycling of matter within living systems such as in the decay of biomass in a compost bin; and
  - (C) diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids.
- (6) Matter and energy. The student knows that matter has physical and chemical properties and can undergo physical and chemical changes. The student is expected to:
- (A) identify that organic compounds contain carbon and other elements such as hydrogen, oxygen, phosphorus, nitrogen, or sulfur;
  - (B) distinguish between physical and chemical changes in matter in the digestive system; and
  - (C) recognize how large molecules are broken down into smaller molecules such as carbohydrates can be broken down into sugars.
- (7) Force, motion, and energy. The student knows that there is a relationship among force, motion, and energy. The student is expected to:
- (A) contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still;
  - (B) illustrate the transformation of energy within an organism such as the transfer from chemical energy to heat and thermal energy in digestion; and
  - (C) demonstrate and illustrate forces that affect motion in everyday life such as emergence of seedlings, turgor pressure, and geotropism.
- (8) Earth and space. The student knows that natural events and human activity can impact Earth systems. The student is expected to:
- (A) predict and describe how different types of catastrophic events impact ecosystems such as floods, hurricanes, or tornadoes;



- (B) analyze the effects of weathering, erosion, and deposition on the environment in ecoregions of Texas; and
  - (C) model the effects of human activity on groundwater and surface water in a watershed.
- (9) Earth and space. The student knows components of our solar system. The student is expected to:
- (A) analyze the characteristics of objects in our solar system that allow life to exist such as the proximity of the Sun, presence of water, and composition of the atmosphere; and
  - (B) identify the accommodations, considering the characteristics of our solar system, that enabled manned space exploration.
- (10) Organisms and environments. The student knows that there is a relationship between organisms and the environment. The student is expected to:
- (A) observe and describe how different environments, including microhabitats in schoolyards and biomes, support different varieties of organisms;
  - (B) describe how biodiversity contributes to the sustainability of an ecosystem; and
  - (C) observe, record, and describe the role of ecological succession such as in a microhabitat of a garden with weeds.
- (11) Organisms and environments. The student knows that populations and species demonstrate variation and inherit many of their unique traits through gradual processes over many generations. The student is expected to:
- (A) examine organisms or their structures such as insects or leaves and use dichotomous keys for identification;
  - (B) explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb; and
  - (C) identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch (*Geospiza fortis*) or domestic animals.
- (12) Organisms and environments. The student knows that living systems at all levels of organization demonstrate the complementary nature of structure and function. The student is expected to:
- (A) investigate and explain how internal structures of organisms have adaptations that allow specific functions such as gills in fish, hollow bones in birds, or xylem in plants;
  - (B) identify the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, excretory, reproductive, integumentary, nervous, and endocrine systems;
  - (C) recognize levels of organization in plants and animals, including cells, tissues, organs, organ systems, and organisms;
  - (D) differentiate between structure and function in plant and animal cell organelles, including cell membrane, cell wall, nucleus, cytoplasm, mitochondrion, chloroplast, and vacuole;
  - (E) compare the functions of a cell to the functions of organisms such as waste removal; and
  - (F) recognize that according to cell theory all organisms are composed of cells and cells carry on similar functions such as extracting energy from food to sustain life.
- (13) Organisms and environments. The student knows that a living organism must be able to maintain balance in stable internal conditions in response to external and internal stimuli. The student is expected to:

- (A) investigate how organisms respond to external stimuli found in the environment such as phototropism and fight or flight; and
  - (B) describe and relate responses in organisms that may result from internal stimuli such as wilting in plants and fever or vomiting in animals that allow them to maintain balance.
- (14) Organisms and environments. The student knows that reproduction is a characteristic of living organisms and that the instructions for traits are governed in the genetic material. The student is expected to:
- (A) define heredity as the passage of genetic instructions from one generation to the next generation;
  - (B) compare the results of uniform or diverse offspring from sexual reproduction or asexual reproduction; and
  - (C) recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus.

*Source: The provisions of this §112.19 adopted to be effective August 4, 2009, 34 TexReg 5063.*

**§112.20. Science, Grade 8, Beginning with School Year 2010-2011.**

- (a) Introduction.
- (1) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.
  - (2) Scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions become theories. Scientific theories are based on natural and physical phenomena and are capable of being tested by multiple, independent researchers. Students should know that scientific theories, unlike hypotheses, are well-established and highly reliable, but they may still be subject to change as new information and technologies are developed. Students should be able to distinguish between scientific decision-making methods and ethical/social decisions that involve the application of scientific information.
  - (3) Grade 8 science is interdisciplinary in nature; however, much of the content focus is on earth and space science. National standards in science are organized as multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale.
  - (4) The strands for Grade 8 include:
    - (A) Scientific investigation and reasoning.
      - (i) To develop a rich knowledge of science and the natural world, students must become familiar with different modes of scientific inquiry, rules of evidence, ways of formulating questions, ways of proposing explanations, and the diverse ways scientists study the natural world and propose explanations based on evidence derived from their work.
      - (ii) Scientific investigations are conducted for different reasons. All investigations require a research question, careful observations, data gathering, and analysis of the data to identify the patterns that will explain the findings. Descriptive investigations are used to explore new phenomena such as conducting surveys of organisms or measuring the abiotic components in a given habitat.

Descriptive statistics include frequency, range, mean, median, and mode. A hypothesis is not required in a descriptive investigation. On the other hand, when conditions can be controlled in order to focus on a single variable, experimental research design is used to determine causation. Students should experience both types of investigations and understand that different scientific research questions require different research designs.

- (iii) Scientific investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and the methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. Models have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.
  - (B) Matter and energy. Students recognize that matter is composed of atoms. Students examine information on the Periodic Table to recognize that elements are grouped into families. In addition, students understand the basic concept of conservation of mass. Lab activities will allow students to demonstrate evidence of chemical reactions. They will use chemical formulas and balanced equations to show chemical reactions and the formation of new substances.
  - (C) Force, motion, and energy. Students experiment with the relationship between forces and motion through the study of Newton's three laws. Students learn how these forces relate to geologic processes and astronomical phenomena. In addition, students recognize that these laws are evident in everyday objects and activities. Mathematics is used to calculate speed using distance and time measurements.
  - (D) Earth and space. Students identify the role of natural events in altering Earth systems. Cycles within Sun, Earth, and Moon systems are studied as students learn about seasons, tides, and lunar phases. Students learn that stars and galaxies are part of the universe and that distances in space are measured by using light waves. In addition, students use data to research scientific theories of the origin of the universe. Students will illustrate how Earth features change over time by plate tectonics. They will interpret land and erosional features on topographic maps. Students learn how interactions in solar, weather, and ocean systems create changes in weather patterns and climate.
  - (E) Organisms and environments. In studies of living systems, students explore the interdependence between these systems. Interactions between organisms in ecosystems, including producer/consumer, predator/prey, and parasite/host relationships, are investigated in aquatic and terrestrial systems. Students describe how biotic and abiotic factors affect the number of organisms and populations present in an ecosystem. In addition, students explore how organisms and their populations respond to short- and long-term environmental changes, including those caused by human activities.
- (b) Knowledge and skills.
- (1) Scientific investigation and reasoning. The student, for at least 40% of instructional time, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:
    - (A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and
    - (B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.
  - (2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:

- (A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;
  - (B) design and implement comparative and experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;
  - (C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers;
  - (D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and
  - (E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.
- (3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists. The student is expected to:
- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
  - (B) use models to represent aspects of the natural world such as an atom, a molecule, space, or a geologic feature;
  - (C) identify advantages and limitations of models such as size, scale, properties, and materials; and
  - (D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.
- (4) Scientific investigation and reasoning. The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to:
- (A) use appropriate tools to collect, record, and analyze information, including lab journals/notebooks, beakers, meter sticks, graduated cylinders, anemometers, psychrometers, hot plates, test tubes, spring scales, balances, microscopes, thermometers, calculators, computers, spectrosopes, timing devices, and other equipment as needed to teach the curriculum; and
  - (B) use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.
- (5) Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:
- (A) describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud;
  - (B) identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;
  - (C) interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements;
  - (D) recognize that chemical formulas are used to identify substances and determine the number of atoms of each element in chemical formulas containing subscripts;
  - (E) investigate how evidence of chemical reactions indicate that new substances with different properties are formed; and

- (F) recognize whether a chemical equation containing coefficients is balanced or not and how that relates to the law of conservation of mass.
- (6) Force, motion, and energy. The student knows that there is a relationship between force, motion, and energy. The student is expected to:
- (A) demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion;
  - (B) differentiate between speed, velocity, and acceleration; and
  - (C) investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.
- (7) Earth and space. The student knows the effects resulting from cyclical movements of the Sun, Earth, and Moon. The student is expected to:
- (A) model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons;
  - (B) demonstrate and predict the sequence of events in the lunar cycle; and
  - (C) relate the position of the Moon and Sun to their effect on ocean tides.
- (8) Earth and space. The student knows characteristics of the universe. The student is expected to:
- (A) describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification;
  - (B) recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star;
  - (C) explore how different wavelengths of the electromagnetic spectrum such as light and radio waves are used to gain information about distances and properties of components in the universe;
  - (D) model and describe how light years are used to measure distances and sizes in the universe; and
  - (E) research how scientific data are used as evidence to develop scientific theories to describe the origin of the universe.
- (9) Earth and space. The student knows that natural events can impact Earth systems. The student is expected to:
- (A) describe the historical development of evidence that supports plate tectonic theory;
  - (B) relate plate tectonics to the formation of crustal features; and
  - (C) interpret topographic maps and satellite views to identify land and erosional features and predict how these features may be reshaped by weathering.
- (10) Earth and space. The student knows that climatic interactions exist among Earth, ocean, and weather systems. The student is expected to:
- (A) recognize that the Sun provides the energy that drives convection within the atmosphere and oceans, producing winds and ocean currents;
  - (B) identify how global patterns of atmospheric movement influence local weather using weather maps that show high and low pressures and fronts; and
  - (C) identify the role of the oceans in the formation of weather systems such as hurricanes.

- (11) Organisms and environments. The student knows that interdependence occurs among living systems and the environment and that human activities can affect these systems. The student is expected to:
- (A) describe producer/consumer, predator/prey, and parasite/host relationships as they occur in food webs within marine, freshwater, and terrestrial ecosystems;
  - (B) investigate how organisms and populations in an ecosystem depend on and may compete for biotic and abiotic factors such as quantity of light, water, range of temperatures, or soil composition;
  - (C) explore how short- and long-term environmental changes affect organisms and traits in subsequent populations; and
  - (D) recognize human dependence on ocean systems and explain how human activities such as runoff, artificial reefs, or use of resources have modified these systems.

*Source: The provisions of this §112.20 adopted to be effective August 4, 2009, 34 TexReg 5063.*

#### **§112.21. Implementation of Texas Essential Knowledge and Skills for Science, Middle School.**

The provisions of §§112.22-112.24 of this subchapter shall be superseded by §§112.18-112.20 of this subchapter beginning with the 2010-2011 school year.

*Source: The provisions of this §112.21 adopted to be effective September 1, 1998, 22 TexReg 7647; amended to be effective August 4, 2009, 34 TexReg 5063.*

#### **§112.22. Science, Grade 6.**

- (a) Introduction.
- (1) In Grade 6, the study of science includes conducting field and laboratory investigations using scientific methods, analyzing data, making informed decisions, and using tools such as beakers, test tubes, and spring scales to collect, analyze, and record information. Students also use computers and information technology tools to support scientific investigations.
  - (2) As students learn science skills, they identify components of the solar system including the Sun, planets, moon, and asteroids and learn how seasons and the length of the day are caused by the tilt and rotation of the Earth as it orbits the Sun. Students investigate the rock cycle and identify sources of water in a watershed. In addition, students identify changes in objects including position, direction, and speed when acted upon by a force.
  - (3) Students classify substances by their chemical properties and identify the water cycle and decay of biomass as examples of the interactions between matter and energy. They identify life processes and the relationships between structure and function of organisms.
  - (4) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.
  - (5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.
  - (6) Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.

- (b) Knowledge and skills.
- (1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
    - (A) demonstrate safe practices during field and laboratory investigations; and
    - (B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
  - (2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
    - (A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
    - (B) collect data by observing and measuring;
    - (C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
    - (D) communicate valid conclusions; and
    - (E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.
  - (3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
    - (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
    - (B) draw inferences based on data related to promotional materials for products and services;
    - (C) represent the natural world using models and identify their limitations;
    - (D) evaluate the impact of research on scientific thought, society, and the environment; and
    - (E) connect Grade 6 science concepts with the history of science and contributions of scientists.
  - (4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
    - (A) collect, analyze, and record information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, timing devices, hot plates, test tubes, safety goggles, spring scales, magnets, balances, microscopes, telescopes, thermometers, calculators, field equipment, compasses, computers, and computer probes; and
    - (B) identify patterns in collected information using percent, average, range, and frequency.
  - (5) Scientific concepts. The student knows that systems may combine with other systems to form a larger system. The student is expected to:
    - (A) identify and describe a system that results from the combination of two or more systems such as in the solar system; and
    - (B) describe how the properties of a system are different from the properties of its parts.
  - (6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
    - (A) identify and describe the changes in position, direction of motion, and speed of an object when acted upon by force;
    - (B) demonstrate that changes in motion can be measured and graphically represented; and

- (C) identify forces that shape features of the Earth including uplifting, movement of water, and volcanic activity.
- (7) Science concepts. The student knows that substances have physical and chemical properties. The student is expected to:
- (A) demonstrate that new substances can be made when two or more substances are chemically combined and compare the properties of the new substances to the original substances; and
  - (B) classify substances by their physical and chemical properties.
- (8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
- (A) define matter and energy;
  - (B) explain and illustrate the interactions between matter and energy in the water cycle and in the decay of biomass such as in a compost bin; and
  - (C) describe energy flow in living systems including food chains and food webs.
- (9) Science concepts. The student knows that obtaining, transforming, and distributing energy affects the environment. The student is expected to:
- (A) identify energy transformations occurring during the production of energy for human use such as electrical energy to heat energy or heat energy to electrical energy;
  - (B) compare methods used for transforming energy in devices such as water heaters, cooling systems, or hydroelectric and wind power plants; and
  - (C) research and describe energy types from their source to their use and determine if the type is renewable, non-renewable, or inexhaustible.
- (10) Science concepts. The student knows the relationship between structure and function in living systems. The student is expected to:
- (A) differentiate between structure and function;
  - (B) determine that all organisms are composed of cells that carry on functions to sustain life; and
  - (C) identify how structure complements function at different levels of organization including organs, organ systems, organisms, and populations.
- (11) Science concepts. The student knows that traits of species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
- (A) identify some changes in traits that can occur over several generations through natural occurrence and selective breeding;
  - (B) identify cells as structures containing genetic material; and
  - (C) interpret the role of genes in inheritance.
- (12) Science concepts. The student knows that the responses of organisms are caused by internal or external stimuli. The student is expected to:
- (A) identify responses in organisms to internal stimuli such as hunger or thirst;
  - (B) identify responses in organisms to external stimuli such as the presence or absence of heat or light; and
  - (C) identify components of an ecosystem to which organisms may respond.
- (13) Science concepts. The student knows components of our solar system. The student is expected to:



- (A) identify characteristics of objects in our solar system including the Sun, planets, meteorites, comets, asteroids, and moons; and
- (B) describe types of equipment and transportation needed for space travel.
- (14) Science concepts. The student knows the structures and functions of Earth systems. The student is expected to:
  - (A) summarize the rock cycle;
  - (B) identify relationships between groundwater and surface water in a watershed; and
  - (C) describe components of the atmosphere, including oxygen, nitrogen, and water vapor, and identify the role of atmospheric movement in weather change.

*Source: The provisions of this §112.22 adopted to be effective September 1, 1998, 22 TexReg 7647.*

### §112.23. Science, Grade 7.

- (a) Introduction.
  - (1) In Grade 7, the study of science includes conducting field and laboratory investigations using scientific methods, critical-thinking, problem-solving, and using tools such as weather instruments and calculators to collect and analyze information to explain a phenomenon. Students also use computers and information technology tools to support scientific investigations.
  - (2) As students learn science skills, they identify gravity and phases of the moon as components of the solar system and explore the effects of events such as hurricanes on the Earth. Students use pulleys and levers to understand the relationship between force and motion. Students then relate the concept to processes in the human organism such as the movement of blood. In addition, students study chemical and physical properties of substances by examining the tarnishing of metal or burning of wood as examples of chemical processes, and by identifying physical properties used to place elements on the periodic table.
  - (3) Students learn about kinetic and potential energy and identify photosynthesis as an example of the transformation of radiant energy from the Sun into chemical energy for use by plants. Students investigate systems in humans to identify their structures and functions. Student compare asexual and sexual reproduction to illustrate that genetic materials are responsible for both dominant and recessive traits in organisms.
  - (4) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.
  - (5) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.
  - (6) Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.
- (b) Knowledge and skills.
  - (1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
    - (A) demonstrate safe practices during field and laboratory investigations; and

- (B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
- (2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
- (A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
  - (B) collect data by observing and measuring;
  - (C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;
  - (D) communicate valid conclusions; and
  - (E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.
- (3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
  - (B) draw inferences based on data related to promotional materials for products and services;
  - (C) represent the natural world using models and identify their limitations;
  - (D) evaluate the impact of research on scientific thought, society, and the environment; and
  - (F) connect Grade 7 science concepts with the history of science and contributions of scientists.
- (4) Scientific processes. The student knows how to use tools and methods to conduct science inquiry. The student is expected to:
- (A) collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses; and
  - (B) collect and analyze information to recognize patterns such as rates of change.
- (5) Science concepts. The student knows that an equilibrium of a system may change. The student is expected to:
- (A) describe how systems may reach an equilibrium such as when a volcano erupts; and
  - (B) observe and describe the role of ecological succession in maintaining an equilibrium in an ecosystem.
- (6) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
- (A) demonstrate basic relationships between force and motion using simple machines including pulleys and levers;
  - (B) demonstrate that an object will remain at rest or move at a constant speed and in a straight line if it is not being subjected to an unbalanced force; and
  - (C) relate forces to basic processes in living organisms including the flow of blood and the emergence of seedlings.
- (7) Science concepts. The student knows that substances have physical and chemical properties. The student is expected to:

- (A) identify and demonstrate everyday examples of chemical phenomena such as rusting and tarnishing of metals and burning of wood;
  - (B) describe physical properties of elements and identify how they are used to position an element on the periodic table; and
  - (C) recognize that compounds are composed of elements.
- (8) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
- (A) illustrate examples of potential and kinetic energy in everyday life such as objects at rest, movement of geologic faults, and falling water; and
  - (B) identify that radiant energy from the Sun is transferred into chemical energy through the process of photosynthesis.
- (9) Science concepts. The student knows the relationship between structure and function in living systems. The student is expected to:
- (A) identify the systems of the human organism and describe their functions; and
  - (B) describe how organisms maintain stable internal conditions while living in changing external environments.
- (10) Science concepts. The student knows that species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
- (A) identify that sexual reproduction results in more diverse offspring and asexual reproduction results in more uniform offspring;
  - (B) compare traits of organisms of different species that enhance their survival and reproduction; and
  - (C) distinguish between dominant and recessive traits and recognize that inherited traits of an individual are contained in genetic material.
- (11) Science concepts. The student knows that the responses of organisms are caused by internal or external stimuli. The student is expected to:
- (A) analyze changes in organisms such as a fever or vomiting that may result from internal stimuli; and
  - (B) identify responses in organisms to external stimuli found in the environment such as the presence or absence of light.
- (12) Science concepts. The student knows that there is a relationship between organisms and the environment. The student is expected to:
- (A) identify components of an ecosystem;
  - (B) observe and describe how organisms including producers, consumers, and decomposers live together in an environment and use existing resources;
  - (C) describe how different environments support different varieties of organisms; and
  - (D) observe and describe the role of ecological succession in ecosystems.
- (13) Science concepts. The student knows components of our solar system. The student is expected to:
- (A) identify and illustrate how the tilt of the Earth on its axis as it rotates and revolves around the Sun causes changes in seasons and the length of a day; and
  - (B) relate the Earth's movement and the moon's orbit to the observed cyclical phases of the moon.

- (14) Science concepts. The student knows that natural events and human activity can alter Earth systems. The student is expected to:
- (A) describe and predict the impact of different catastrophic events on the Earth;
  - (B) analyze effects of regional erosional deposition and weathering; and
  - (C) make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources.

*Source: The provisions of this §112.23 adopted to be effective September 1, 1998, 22 TexReg 7647.*

**§112.24. Science, Grade 8.**

- (a) Introduction.
- (1) In Grade 8, the study of science includes planning and conducting field and laboratory investigations using scientific methods, analyzing data, critical-thinking, scientific problem-solving, and using tools such as telescopes to collect and analyze information. Students also use computers and information technology tools to support scientific investigations.
  - (2) As students learn science skills, they identify the roles of both human activities and natural events in altering Earth systems. Students learn that stars and galaxies are part of the universe, identify light years as a way to describe distance, and learn about scientific theories of the origin of the universe. Cycles within Earth systems are studied as students learn about lunar cycles and the rock cycle.
  - (3) Students examine information on the periodic table to recognize that elements are grouped into families. In addition, students demonstrate that exothermic and endothermic chemical reactions indicate that energy is lost or gained during a chemical reaction. Interactions in matter and energy are explored in solar, weather, and ocean systems. Students identify the origin of waves and investigate their ability to travel through different media.
  - (4) Students predict possible outcomes that result from different genetic combinations and explore the extinction of some species.
  - (5) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.
  - (6) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed and measured as patterns. These patterns help to predict what will happen next and can change over time.
  - (7) Investigations are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that methods, models, and conclusions built from these investigations change as new observations are made. Models of objects and events are tools for understanding the natural world and can show how systems work. They have limitations and based on new discoveries are constantly being modified to more closely reflect the natural world.
- (b) Knowledge and skills.
- (1) Scientific processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
    - (A) demonstrate safe practices during field and laboratory investigations; and
    - (B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.

- (2) Scientific processes. The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
- (A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
  - (B) collect data by observing and measuring;
  - (C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence;
  - (D) communicate valid conclusions; and
  - (E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.
- (3) Scientific processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
  - (B) draw inferences based on data related to promotional materials for products and services;
  - (C) represent the natural world using models and identify their limitations;
  - (D) evaluate the impact of research on scientific thought, society, and the environment; and
  - (E) connect Grade 8 science concepts with the history of science and contributions of scientists.
- (4) Scientific processes. The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
- (A) collect, record, and analyze information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, water test kits, and timing devices; and
  - (B) extrapolate from collected information to make predictions.
- (5) Scientific processes. The student knows that relationships exist between science and technology. The student is expected to:
- (A) identify a design problem and propose a solution;
  - (B) design and test a model to solve the problem; and
  - (C) evaluate the model and make recommendations for improving the model.
- (6) Science concepts. The student knows that interdependence occurs among living systems. The student is expected to:
- (A) describe interactions among systems in the human organism;
  - (B) identify feedback mechanisms that maintain equilibrium of systems such as body temperature, turgor pressure, and chemical reactions; and
  - (C) describe interactions within ecosystems.
- (7) Science concepts. The student knows that there is a relationship between force and motion. The student is expected to:
- (A) demonstrate how unbalanced forces cause changes in the speed or direction of an object's motion; and

- (B) recognize that waves are generated and can travel through different media.
- (8) Science concepts. The student knows that matter is composed of atoms. The student is expected to:
- (A) describe the structure and parts of an atom; and
  - (B) identify the properties of an atom including mass and electrical charge.
- (9) Science concepts. The student knows that substances have chemical and physical properties. The student is expected to:
- (A) demonstrate that substances may react chemically to form new substances;
  - (B) interpret information on the periodic table to understand that physical properties are used to group elements;
  - (C) recognize the importance of formulas and equations to express what happens in a chemical reaction; and
  - (D) identify that physical and chemical properties influence the development and application of everyday materials such as cooking surfaces, insulation, adhesives, and plastics.
- (10) Science concepts. The student knows that complex interactions occur between matter and energy. The student is expected to:
- (A) illustrate interactions between matter and energy including specific heat;
  - (B) describe interactions among solar, weather, and ocean systems; and
  - (C) identify and demonstrate that loss or gain of heat energy occurs during exothermic and endothermic chemical reactions.
- (11) Science concepts. The student knows that traits of species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to:
- (A) identify that change in environmental conditions can affect the survival of individuals and of species;
  - (B) distinguish between inherited traits and other characteristics that result from interactions with the environment; and
  - (C) make predictions about possible outcomes of various genetic combinations of inherited characteristics.
- (12) Science concepts. The student knows that cycles exist in Earth systems. The student is expected to:
- (A) analyze and predict the sequence of events in the lunar and rock cycles;
  - (B) relate the role of oceans to climatic changes; and
  - (C) predict the results of modifying the Earth's nitrogen, water, and carbon cycles.
- (13) Science concepts. The student knows characteristics of the universe. The student is expected to:
- (A) describe characteristics of the universe such as stars and galaxies;
  - (B) explain the use of light years to describe distances in the universe; and
  - (C) research and describe historical scientific theories of the origin of the universe.
- (14) Science concepts. The student knows that natural events and human activities can alter Earth systems. The student is expected to:
- (A) predict land features resulting from gradual changes such as mountain building, beach erosion, land subsidence, and continental drift;

- (B) analyze how natural or human events may have contributed to the extinction of some species; and
- (C) describe how human activities have modified soil, water, and air quality.

*Source: The provisions of this §112.24 adopted to be effective September 1, 1998, 22 TexReg 7647.*