

6th Grade

Texas Essential Knowledge and Skills

§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.