

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

CHRISTINA CASTILLO COMER
Plaintiff,

v.

ROBERT SCOTT, Commissioner, Texas
Education Agency, et al.,
Defendants.

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CA No. 1:08CV00511-LY

**DEFENDANT’S UNOPPOSED REQUEST FOR THE COURT TO TAKE JUDICIAL
NOTICE OF PROPOSED RULES**

TO THE HONORABLE LEE YEAKEL:

In support of his unopposed request for the Court to take judicial notice of proposed revisions to the Texas Essential Knowledge and Skills for Science, the defendant respectfully submits the following.

I.

On February 12, 2009, the undersigned counsel for defendant contacted plaintiff’s counsel by e-mail to inquire whether the plaintiff opposes this request. Counsel replied on February 17 that “Plaintiff does not oppose this request, subject to her right to respond to Defendant’s filing.”

II.

At its most recent meeting, the State Board of Education voted to propose revisions to 19 T.A.C. chapter 112, Texas Essential Knowledge and Skills for Science. The proposed revisions were filed with the Texas Register on February 2, 2009, for public review and comment, to be followed by a vote at the March SBOE meeting on whether to finally adopt them. The proposed TEKS can be viewed at <http://www.tea.state.tx.us/rules/home/>, then to “Proposed SBOE Rules,” then to: “Text of Proposed Revisions to 19 TAC Chapter 112, Subchapter A

Text of Proposed Revisions to 19 TAC Chapter 112, Subchapter B

Text of Proposed Revisions to 19 TAC Chapter 112, Subchapter C.”

For convenience, a copy of the proposed revisions is attached to this Request.

III.

Under proposed new chapter 112, subchapter C, the science TEKS for high school, beginning in the 2010-11 school year, §112.34(c) provides:

- (7) Science concepts. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to:
- (A) analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental;
 - (B) analyze and evaluate the sufficiency or insufficiency of common ancestry to explain the sudden appearance, stasis, and sequential nature of groups in the fossil record;
 - (C) analyze and evaluate how natural selection produces change in populations, not individuals;
 - (D) analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;
 - (E) analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species; and
 - (F) analyze and evaluate the effects of other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination.

At its March 2009 meeting, the State Board of Education will decide, inter alia, whether to adopt the foregoing and/or to restore the “strengths and weaknesses” language contained in the current TEKS on biology with respect to evolution.

IV.

The defendant respectfully requests the Court take judicial notice of the proposed revisions to 19 T.A.C. chapter 112, Texas Essential Knowledge and Skills for Science.

Respectfully submitted,

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CERTIFICATE OF CONFERENCE

As recited in part I above, on February 12, 2009, I contacted plaintiff's counsel by e-mail to inquire whether the plaintiff opposes this request. Counsel replied on February 17 that "Plaintiff does not oppose this request, subject to her right to respond to Defendant's filing."

/s/ James C. Todd
JAMES C. TODD

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

CHRISTINA CASTILLO COMER	§	
Plaintiff,	§	
	§	
v.	§	CA No. 1:08CV00511-LY
	§	
ROBERT SCOTT, Commissioner, Texas	§	
Education Agency, in his official	§	
capacity and TEXAS EDUCATION	§	
AGENCY,	§	
Defendants.	§	

ORDER

On this day the Court considered Defendant's Unopposed Request for the Court to Take Judicial Notice of Proposed Rules. After due consideration, the Court is of the opinion that the Motion is meritorious and that it should be granted. Accordingly,

The Court takes judicial notice of proposed revisions to 19 Texas Administrative Code chapter 112, Texas Essential Knowledge and Skills for Science.

SIGNED this _____ day of March, 2009.

HON. LEE YEAKEL
UNITED STATES DISTRICT JUDGE

SUBCHAPTER “A”

Text of Proposed Revisions to 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.

The provisions of §§112.2-112.7 of this subchapter shall be superseded by §§112.11-112.16 of this subchapter beginning with the 2010-2011 school year ~~[implemented by school districts beginning September 1, 1998, and at that time shall supersede §75.28(a) (6) of this title (relating to Science)]~~.

§112.10. Implementation of Texas Essential Knowledge and Skills for Science, Elementary, Beginning with School Year 2010-2011.

The provisions of §§112.11-112.16 of this subchapter shall be implemented by school districts beginning with the 2010-2011 school year and at that time shall supersede §§112.2-112.7 of this subchapter.

§112.11. Science, Kindergarten, 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."
- (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
- (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific processes, including inquiry methods, analyzing information, making informed decisions, and using tools to collect and record information, while addressing the major concepts and vocabulary, in the context of physical, earth, and life sciences. Districts are encouraged to facilitate classroom and outdoor investigations for at least 80% of instructional time.
- (4) In Kindergarten, students observe and describe the natural world using their five senses. Students do science as inquiry in order to develop and enrich their abilities to understand scientific concepts and processes. Students develop vocabulary through their experiences investigating properties of common objects, earth materials, and organisms.
 - (A) A central theme throughout the study of scientific investigation and reasoning: matter and energy; force, motion, and energy; Earth and space; and organisms and environment is active engagement in asking questions, communicating ideas, and exploring with scientific tools. Scientific investigation and reasoning involves practicing safe procedures, asking questions about the natural world, and seeking answers to those questions through simple observations and descriptive investigations.
 - (B) Matter is described in terms of its physical properties, including relative size and mass, shape, color, and texture. The importance of light, heat, and sound energy is identified as it relates to the students' everyday life. The location and motion of objects are explored.
 - (C) Weather is recorded and discussed on a daily basis so students may begin to recognize patterns in the weather. Other patterns are observed in the appearance of objects in the sky.
 - (D) In life science, students recognize the interdependence of organisms in the natural world. They understand that all organisms have basic needs that can be satisfied through interactions with living and nonliving things. Students will investigate the life cycle of plants and identify likenesses between parents and offspring.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and uses environmentally appropriate and responsible practices. The student is expected to:
 - (A) identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately;
 - (B) discuss the importance of safe practices to keep self and others safe and healthy; and
 - (C) demonstrate how to use, conserve, and dispose of natural resources and materials such as conserving water and reusing or recycling paper, plastic, and metal.
- (2) Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to:
 - (A) ask questions about organisms, objects, and events observed in the natural world;
 - (B) plan and conduct simple descriptive investigations such as ways objects move;
 - (C) collect data and make observations using simple equipment such as hand lenses, primary balances, and non-standard measurement tools;
 - (D) record and organize data and observations using pictures, numbers, and words; and
 - (E) communicate observations with others about simple descriptive investigations.
- (3) Scientific investigation and reasoning. The student knows that information and critical thinking are used in scientific problem solving. The student is expected to:
 - (A) identify and explain a problem such as the impact of littering on the playground and propose a solution in his/her own words;
 - (B) make predictions based on observable patterns in nature such as the shapes of leaves; and
 - (C) explore that scientists investigate different things in the natural world and use tools to help in their investigations.
- (4) Scientific investigation and reasoning. The student uses age-appropriate tools and models to investigate the natural world. The student is expected to:
 - (A) collect information using tools, including cameras; computers; hand lenses; non-standard measuring items such as paper clips and clothespins; weather instruments such as demonstration thermometers and wind socks; primary balances; cups; bowls; timing devices, including clocks and timers; magnets; collecting nets; notebooks; and materials to support observations of habitats of organisms such as terrariums and aquariums; and
 - (B) use senses as a tool of observation to identify properties and patterns of organisms, objects, and events in the environment.
- (5) Matter and energy. The student knows that objects have properties and patterns. The student is expected to:
 - (A) observe and record properties of objects, including relative size and mass, such as bigger or smaller and heavier or lighter, shape, color, and texture; and
 - (B) observe, record, and discuss how materials can be changed by heating or cooling.
- (6) Force, motion, and energy. The student knows that energy, force, and motion are related and are a part of their everyday life. The student is expected to:
 - (A) use the five senses to explore different forms of energy such as light, heat, and sound;
 - (B) explore interactions between magnets and various materials;

- (C) observe and describe the location of an object in relation to another such as above, below, behind, in front of, and beside; and
- (D) observe and describe the ways that objects can move such as in a straight line, zigzag, up and down, back and forth, round and round, and fast and slow.
- (7) Earth and space. The student knows that the natural world includes earth materials. The student is expected to:
 - (A) observe, describe, compare, and sort rocks by size, shape, color, and texture;
 - (B) observe and describe physical properties of natural sources of water, including color and clarity; and
 - (C) give examples of ways rocks, soil, and water are useful.
- (8) 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) observe and describe weather changes from day to day and over seasons;
 - (B) identify events that have repeating patterns, including seasons of the year and day and night; and
 - (C) observe, describe, and illustrate objects in the sky such as the clouds, Moon, and stars, including the Sun.
- (9) Organisms and environments. The student knows that plants and animals have basic needs and depend on the living and nonliving things around them for survival. The student is expected to:
 - (A) differentiate between living and nonliving things based upon whether they have basic needs and produce offspring; and
 - (B) examine evidence that living organisms have basic needs such as food, water, and shelter for animals and air, water, nutrients, sunlight, and space for plants.
- (10) Organisms and environments. The student knows that organisms resemble their parents and have structures and processes that help them survive within their environments. The student is expected to:
 - (A) sort plants and animals into groups based on physical characteristics such as color, size, body covering, or leaf shape;
 - (B) identify parts of plants such as roots, stem, and leaves and parts of animals such as head, eyes, and limbs;
 - (C) identify ways that young plants resemble the parent plant; and
 - (D) observe changes that are part of a simple life cycle of a plant: seed, seedling, plant, flower, and fruit.

§112.12. Science, Grade 1, 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."
- (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
- (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific processes, including inquiry methods, analyzing information, making informed decisions, and using tools to collect and record information, while addressing the major concepts and vocabulary, in the context of physical, earth, and life sciences.

Districts are encouraged to facilitate classroom and outdoor investigations for at least 80% of instructional time.

- (4) In Grade 1, students observe and describe the natural world using their five senses. Students do science as inquiry in order to develop and enrich their abilities to understand the world around them in the context of scientific concepts and processes. Students develop vocabulary through their experiences investigating properties of common objects, earth materials, and organisms.
- (A) A central theme in first grade science is active engagement in asking questions, communicating ideas, and exploring with scientific tools in order to explain scientific concepts and processes like scientific investigation and reasoning; matter and energy; force, motion, and energy; Earth and space; and organisms and environment. Scientific investigation and reasoning involves practicing safe procedures, asking questions about the natural world, and seeking answers to those questions through simple observations and descriptive investigations.
- (B) Matter is described in terms of its physical properties, including relative size and mass, shape, color, and texture. The importance of light, heat, and sound energy is identified as it relates to the students' everyday life. The location and motion of objects are explored.
- (C) Weather is recorded and discussed on a daily basis so students may begin to recognize patterns in the weather. In addition, patterns are observed in the appearance of objects in the sky.
- (D) In life science, students recognize the interdependence of organisms in the natural world. They understand that all organisms have basic needs that can be satisfied through interactions with living and nonliving things. Students will investigate life cycles of animals and identify likenesses between parents and offspring.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and uses environmentally appropriate and responsible practices. The student is expected to:
- (A) recognize and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately;
- (B) recognize the importance of safe practices to keep self and others safe and healthy; and
- (C) identify and learn how to use natural resources and materials, including conservation and reuse or recycling of paper, plastic, and metals.
- (2) Scientific investigation and reasoning. The student develops abilities to ask questions and seek answers in classroom and outdoor investigations. The student is expected to:
- (A) ask questions about organisms, objects, and events observed in the natural world;
- (B) plan and conduct simple descriptive investigations such as ways objects move;
- (C) collect data and make observations using simple equipment such as hand lenses, primary balances, and non-standard measurement tools;
- (D) record and organize data using pictures, numbers, and words; and
- (E) communicate observations and provide reasons for explanations using student-generated data from simple descriptive investigations.
- (3) Scientific investigation and reasoning. The student knows that information and critical thinking are used in scientific problem solving. The student is expected to:
- (A) identify and explain a problem such as finding a home for a classroom pet and propose a solution in his/her own words;

- (B) make predictions based on observable patterns; and
- (C) describe what scientists do.
- (4) Scientific investigation and reasoning. The student uses age-appropriate tools and models to investigate the natural world. The student is expected to:
 - (A) collect, record, and compare information using tools, including cameras; computers; hand lenses; non-standard measuring items such as paper clips and clothespins; weather tools such as classroom demonstration thermometers and weather vanes; primary balances; cups; bowls; timing devices, including clocks and timers; magnets; collecting nets; notebooks; materials to support observations of habitats of organisms such as aquariums and terrariums; and safety goggles; and
 - (B) measure and compare organisms and objects using non-standard units.
- (5) Matter and energy. The student knows that objects have properties and patterns. The student is expected to:
 - (A) classify objects by observable properties of the materials from which they are made such as larger and smaller, heavier and lighter, shape, color, and texture; and
 - (B) predict and identify changes in materials caused by heating and cooling such as ice melting, water freezing, and water evaporating.
- (6) Force, motion, and energy. The student knows that force, motion, and energy are related and are a part of everyday life. The student is expected to:
 - (A) identify and discuss how different forms of energy such as light, heat, and sound are important to everyday life;
 - (B) predict and describe how a magnet can be used to push or pull an object;
 - (C) describe the change in the location of an object such as closer to, nearer to, and farther from; and
 - (D) demonstrate and record the ways that objects can move such as in a straight line, zig zag, up and down, back and forth, round and round, and fast and slow.
- (7) Earth and space. The student knows that the natural world includes rocks, soil, and water that can be observed in cycles, patterns, and systems. The student is expected to:
 - (A) observe, compare, describe, and sort components of soil by size, texture, and color;
 - (B) identify and describe a variety of natural sources of water, including streams, lakes, and oceans; and
 - (C) gather evidence of how rocks, soil, and water help to make useful products.
- (8) Earth and space. The student knows that the natural world includes the air around us and objects in the sky. The student is expected to:
 - (A) record weather information, including relative temperature, such as hot or cold, clear or cloudy, calm or windy, and rainy or icy;
 - (B) observe and record changes in the appearance of objects in the sky such as clouds, the Moon, and stars, including the Sun;
 - (C) identify characteristics of the seasons of the year; and
 - (D) demonstrate that air is all around us and observe that wind is moving air.
- (9) Organisms and environments. The student knows that the living environment is composed of relationships between organisms and the life cycles that occur. The student is expected to:
 - (A) sort and classify living and nonliving things based upon whether or not they have basic needs and produce offspring;

- (B) analyze and record examples of interdependence found in various situations such as terrariums and aquariums or pet and caregiver; and
- (C) gather evidence of interdependence among living organisms such as energy transfer through food chains and animals using plants for shelter.
- (10) Organisms and environments. The student knows that organisms resemble their parents and have structures and processes that help them survive within their environments. The student is expected to:
 - (A) investigate how the external characteristics of an animal are related to where it lives, how it moves, and what it eats;
 - (B) identify and compare the parts of plants;
 - (C) compare ways that young animals resemble their parents; and
 - (D) observe and record life cycles of animals such as a chicken, frog, or fish.

§112.13. Science, Grade 2, 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."
- (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
- (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific processes, including inquiry methods, analyzing information, making informed decisions, and using tools to collect and record information, while addressing the major concepts and vocabulary, in the context of physical, earth, and life sciences. Districts are encouraged to facilitate classroom and outdoor investigations for at least 60% of instructional time.
- (4) In Grade 2, careful observation and investigation are used to learn about the natural world and reveal patterns, changes, and cycles. Students should understand that certain types of questions can be answered by using observation and investigations and that the information gathered in these may change as new observations are made. As students participate in investigation, they develop the skills necessary to do science as well as develop new science concepts.
 - (A) Within the physical environment, students expand their understanding of the properties of objects such as shape, mass, temperature, and flexibility then use those properties to compare, classify, and then combine the objects to do something that they could not do before. Students manipulate objects to demonstrate a change in motion and position.
 - (B) Within the natural environment, students will observe the properties of earth materials as well as predictable patterns that occur on Earth and in the sky. The students understand that those patterns are used to make choices in clothing, activities, and transportation.
 - (C) Within the living environment, students explore patterns, systems, and cycles by investigating characteristics of organisms, life cycles, and interactions among all the components within their habitat. Students examine how living organisms depend on each other and on their environment.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures. The student is expected to:

- (A) identify and demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including wearing safety goggles, washing hands, and using materials appropriately;
- (B) describe the importance of safe practices; and
- (C) identify and demonstrate how to use, conserve, and dispose of natural resources and materials such as conserving water and reuse or recycling of paper, plastic, and metal.
- (2) Scientific investigation and reasoning. The student develops abilities necessary to do scientific inquiry in classroom and outdoor investigations. The student is expected to:
 - (A) ask questions about organisms, objects, and events during observations and investigations;
 - (B) plan and conduct descriptive investigations such as how organisms grow;
 - (C) collect data from observations using simple equipment such as hand lenses, primary balances, thermometers, and non-standard measurement tools;
 - (D) record and organize data using pictures, numbers, and words;
 - (E) communicate observations and justify explanations using student-generated data from simple descriptive investigations; and
 - (F) compare results of investigations with what students and scientists know about the world.
- (3) Scientific investigation and reasoning. The student knows that information and critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to:
 - (A) identify and explain a problem in his/her own words and propose a task and solution for the problem such as lack of water in a habitat;
 - (B) make predictions based on observable patterns; and
 - (C) identify what a scientist is and explore what different scientists do.
- (4) Scientific investigation and reasoning. The student uses age-appropriate tools and models to investigate the natural world. The student is expected to:
 - (A) collect, record, and compare information using tools, including cameras; computers; hand lenses; rulers; weather instruments such as thermometers and rain gauges; primary balances; plastic beakers; timing devices, including clocks and stopwatches; magnets; collecting nets; notebooks; materials to support observations of habitats of organisms such as terrariums and aquariums; and safety goggles; and
 - (B) measure and compare organisms and objects using non-standard units that approximate metric units.
- (5) Matter and energy. The student knows that matter has physical properties and those properties determine how it is described, classified, changed, and used. The student is expected to:
 - (A) classify matter by physical properties, including shape, relative mass, relative temperature, texture, flexibility, and whether material is a solid or liquid;
 - (B) compare changes in materials caused by heating and cooling;
 - (C) demonstrate that things can be done to materials to change their physical properties such as cutting, folding, sanding, and melting; and
 - (D) combine materials that when put together can do things that they cannot do by themselves such as building a tower or a bridge and justify the selection of those materials based on their physical properties.

- (6) Force, motion, and energy. The student knows that forces cause change and energy exists in many forms. The student is expected to:
- (A) investigate the effects on an object by increasing or decreasing amounts of light, heat, and sound energy such as how the color of an object appears different in dimmer light or how heat melts butter;
 - (B) observe and identify how magnets are used in everyday life;
 - (C) trace the changes in the position of an object over time such as a cup rolling on the floor and a car rolling down a ramp; and
 - (D) compare patterns of movement of objects such as sliding, rolling, and spinning.
- (7) Earth and space. The student knows that the natural world includes earth materials. The student is expected to:
- (A) observe and describe the various sizes of rock such as boulders and gravel;
 - (B) identify and compare the properties of natural sources of freshwater and saltwater; and
 - (C) distinguish between natural and manmade resources.
- (8) 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) measure, record, and graph weather information, including temperature, wind conditions, precipitation, and cloud coverage, in order to identify patterns in the data;
 - (B) identify the importance of weather and seasonal information to make choices in clothing, activities, and transportation;
 - (C) explore the processes in the water cycle, including evaporation, condensation, and precipitation, as connected to weather conditions; and
 - (D) observe, describe, and record patterns caused by objects in the sky, including shadows and the appearance of the Moon.
- (9) Organisms and environments. The student knows that living organisms have basic needs that must be met for them to survive within their environment. The student is expected to:
- (A) identify the basic needs of plants and animals;
 - (B) identify factors in the environment, including temperature and precipitation, that affect growth and behavior such as migration, hibernation, and dormancy of living things; and
 - (C) compare and give examples of the ways living organisms depend on each other and on their environments such as food chains within a garden, park, beach, lake, and wooded area.
- (10) Organisms and environments. The student knows that organisms resemble their parents and have structures and processes that help them survive within their environments. The student is expected to:
- (A) observe, record, and compare how the physical characteristics and behaviors of animals help them meet their basic needs such as fins help fish move and balance in the water;
 - (B) observe, record, and compare how the physical characteristics of plants help them meet their basic needs such as stems carry water throughout the plant; and
 - (C) investigate and record some of the unique stages that insects undergo during their life cycle.

§112.14. Science, Grade 3, 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."
 - (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
 - (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific methods, analyzing information, making informed decisions, and using tools to collect and record information while addressing the content and vocabulary in physical, earth, and life sciences. Districts are encouraged to facilitate classroom and outdoor investigations for at least 60% of instructional time.
 - (4) In Grade 3, students learn that the study of science uses appropriate tools and safe practices in planning and implementing investigations, asking and answering questions, collecting data by observing and measuring, and by using models to support scientific inquiry about the natural world.
 - (A) Students recognize that patterns, relationships, and cycles exist in matter. Students will investigate the physical properties of matter and will learn that changes occur. They explore mixtures and investigate light, sound, and heat/thermal energy in everyday life. Students manipulate objects by pushing and pulling to demonstrate changes in motion and position.
 - (B) Students investigate how the surface of Earth changes and provides resources that humans use. As students explore objects in the sky, they describe how relationships affect patterns and cycles on Earth. Students will construct models to demonstrate Sun, Earth, and Moon system relationships and will describe the Sun's role in the water cycle.
 - (C) 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 the environment plays a key role in survival. Students know that when changes in the environment occur organisms may thrive, become ill, or perish.
- (b) Knowledge and skills.
- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following school and home safety procedures and environmentally appropriate practices. The student is expected to:
 - (A) demonstrate safe practices as described in the Texas Safety Standards during classroom and outdoor investigations, including observing a schoolyard habitat; and
 - (B) make informed choices in the use and conservation of natural resources by recycling or reusing materials such as paper, aluminum cans, and plastics.
 - (2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:
 - (A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
 - (B) collect data by observing and measuring using the metric system and recognize differences between observed and measured data;
 - (C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
 - (D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;
 - (E) demonstrate that repeated investigations may increase the reliability of results; and

- (F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.
- (3) Scientific investigation and reasoning. The student knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to:
- (A) justify an explanation, argument, or conclusion using student-generated data;
 - (B) draw inferences and evaluate accuracy of product claims found in advertisements and labels such as for toys and food;
 - (C) represent the natural world using models such as volcanoes or Sun, Earth, and Moon system and identify their limitations, including size, properties, and materials; and
 - (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.
- (4) Scientific investigation and reasoning. 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 microscopes; cameras; computers; hand lenses; metric rulers; Celsius thermometers; pan balances; graduated cylinders; beakers; hot plates; meter sticks; compasses; timing devices, including clocks and stopwatches; magnets; collecting nets; notebooks; sound recorders; Sun, Earth, and Moon system models; and materials to support observation of habitats of organisms such as terrariums and aquariums; and
 - (B) use safety equipment as appropriate, including safety goggles and gloves.
- (5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is 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;
 - (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; and
 - (D) explore and recognize that a mixture is created when two materials are combined such as gravel and sand and metal and plastic paper clips.
- (6) Force, motion, and energy. The student knows that forces cause change and that energy exists in many forms. The student is expected to:
- (A) explore different forms of energy, including light, sound, and heat/thermal in everyday life;
 - (B) demonstrate and observe that position and motion can be changed by pushing and pulling objects such as swings, cars, and balls; and
 - (C) observe forces such as magnetism and gravity acting on objects.
- (7) Earth and space. The student knows that Earth consists of natural resources and its surface is constantly changing. The student is expected to:
- (A) explore and record how soils are formed by weathering of rock and the decomposition of plant and animal remains;
 - (B) investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides;

- (C) identify and compare different landforms, including mountains, hills, valleys, and plains; and
- (D) explore the characteristics of natural resources that make them useful in products and materials such as clothing and furniture and how resources may be conserved.
- (8) Earth and space. The student knows there are recognizable patterns in the natural world and in the Sun, Earth, and Moon system. The student is expected to:
 - (A) observe, measure, record, and compare day-to-day weather changes in different locations at the same time that include air temperature, wind direction, and precipitation;
 - (B) describe and illustrate the Sun as a star composed of gases that provides light and heat energy for the water cycle; and
 - (C) construct models that demonstrate the relationship of the Sun, Earth, and Moon, including orbits and positions.
- (9) Organisms and environments. The student knows that organisms have characteristics that help them survive and can describe patterns, cycles, systems, and relationships within the environments. The student is expected to:
 - (A) observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem;
 - (B) identify and describe the flow of energy in a food chain and predict how changes in a food chain affect the ecosystem such as removal of frogs from a pond or bees from a field; and
 - (C) describe environmental changes such as floods and droughts where some organisms thrive and others perish or move to new locations.
- (10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to:
 - (A) explore how structures and functions of plants and animals allow them to survive in a particular environment;
 - (B) explore that some characteristics of organisms are inherited such as the number of limbs on an animal or flower color and recognize that some behaviors are learned from the environment such as animals using tools to get food; and
 - (C) investigate and compare how animals and plants undergo a series of orderly changes in their diverse life cycles such as tomato plants, mealworms, and lady bugs.

§112.15. Science, Grade 4, 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."
- (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
- (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific processes, including inquiry methods, analyzing information, making informed decisions, and using tools to collect and record information, while addressing the major concepts and vocabulary, in the context of physical, earth, and life sciences. Districts are encouraged to facilitate classroom and outdoor investigations for at least 50% of instructional time.

- (4) In Grade 4, 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.
- (A) Within the natural environment, students know that earth materials have properties that are constantly changing due to Earth's forces. The students learn that the natural world consists of resources, including renewable and nonrenewable, and their responsibility to conserve our natural resources for future generations. They will also explore Sun, Earth, and Moon relationships. The students will recognize that our major source of energy is the Sun.
- (B) Within the living environment, students know and understand that living organisms within an ecosystem interact with one another and with their environment. The students will recognize that plants and animals have basic needs, and they are met through a flow of energy known as food webs. Students will explore how all living organisms go through a life cycle and that adaptations enable organisms to survive in their ecosystem.
- (b) Knowledge and skills.
- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations, following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
- (A) demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations; and
- (B) make informed choices in the use and conservation of natural resources and reusing and recycling of materials such as paper, aluminum, glass, cans, and plastic.
- (2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:
- (A) plan and implement descriptive investigations, including asking well-defined questions, making inferences, and selecting and using appropriate equipment or technology to answer his/her questions;
- (B) collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals such as labeled drawings, writing, and concept maps;
- (C) construct simple tables, charts, bar graphs, and maps using tools and current technology to organize, examine, and evaluate data;
- (D) analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured;
- (E) perform repeated investigations to increase the reliability of results; and
- (F) communicate valid, oral, and written results supported by data.
- (3) Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) justify explanations, arguments, or conclusions using student-generated data;
- (B) draw inferences and evaluate accuracy of services and product claims found in advertisements and labels such as for toys, food, and sunscreen;
- (C) represent the natural world using models such as rivers, stream tables, or fossils and identify their limitations, including accuracy and size; and

- (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.
- (4) Scientific investigation and reasoning. The student knows how to use a variety of tools, materials, equipment, and models to conduct science inquiry. The student is expected to:
 - (A) collect, record, and analyze information using tools, including calculators; microscopes; cameras; computers; hand lenses; metric rulers; Celsius thermometers; mirrors; pan balances; triple beam balances; graduated cylinders; beakers; hot plates; meter sticks; compasses; timing devices, including clocks and stopwatches; magnets; collecting nets; notebooks; and materials to support observation of habitats of organisms such as terrariums and aquariums; and
 - (B) use safety equipment as appropriate, including safety goggles and gloves.
- (5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:
 - (A) measure, compare, and contrast physical properties of matter, including size, mass, volume, states (solid, liquid, gas), temperature, magnetism, and the ability to sink or float;
 - (B) predict the changes caused by heating and cooling such as ice becoming liquid water and condensation forming on the outside of a glass of ice water; and
 - (C) compare and contrast a variety of mixtures and solutions such as rocks in sand, sand in water, or sugar in water.
- (6) Force, motion, and energy. The student knows that energy occurs in many forms and can be observed in cycles, patterns, and systems. The student is expected to:
 - (A) differentiate among forms of energy, including sound, electricity, light, and heat/thermal;
 - (B) differentiate between conductors and insulators;
 - (C) demonstrate that electricity travels in a closed path, creating an electrical circuit, and explore an electromagnetic field; and
 - (D) design an experiment to test the effect of force of an object.
- (7) Earth and space. The students know that Earth consists of useful resources and its surface is constantly changing. The student is expected to:
 - (A) examine properties of soils, including color and texture, capacity to retain water, and ability to support the growth of plants;
 - (B) observe and identify slow changes to Earth's surface caused by weathering, erosion, and deposition from water, wind, and ice; and
 - (C) identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation.
- (8) Earth and space. The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to:
 - (A) identify changes in living organisms that occur over the seasons;
 - (B) 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; and
 - (C) collect and analyze data to identify sequences and predict patterns of change in shadows, in the reflection of sunlight, and in the observable appearance of the Moon over time.

- (9) Organisms and environments. The student knows and understands that living organisms within an ecosystem interact with one another and with their environment. The student is expected to:
- (A) investigate that most plants need sunlight, water, and carbon dioxide to make their own food, while animals are dependent on other organisms for food, producers, and consumers; and
 - (B) describe the flow of energy through food webs, beginning with the Sun, and predict how changes in the ecosystem affect the food web such as a fire in a forest.
- (10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environment. The student is expected to:
- (A) explore how adaptations enable organisms to survive in their environment such as comparing birds' beaks and leaves on plants;
 - (B) demonstrate that some likenesses between parents and offspring are inherited, passed from generation to generation such as eye color in humans or shapes of leaves in plants. Other likenesses are learned such as table manners or reading a book and seals balancing balls on their noses; and
 - (C) explore, illustrate, and compare life cycles in living organisms such as butterflies, beetles, radishes, or lima beans.

§112.16. Science, Grade 5, 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."
- (2) Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include patterns, cycles, systems, models, and change and constancy.
- (3) The study of elementary science includes planning and safely implementing classroom and outdoor investigations using scientific processes, including inquiry methods, analyzing information, making informed decisions, and using tools to collect and record information, while addressing the major concepts and vocabulary, in the context of physical, earth, and life sciences. Districts are encouraged to facilitate classroom and outdoor investigations for at least 50% of instructional time.
- (4) In Grade 5, 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.
 - (A) Within the physical environment, students learn about the physical properties of matter, including magnetism, physical states of matter, relative density, solubility in water, and the ability to conduct or insulate electrical and heat energy. Students explore the uses of light, thermal, electrical, and sound energies.
 - (B) Within the natural environment, students learn how changes occur on Earth's surface and that predictable patterns occur in the sky. Students learn that the natural world consists of resources, including nonrenewable, renewable, and alternative energy sources.
 - (C) Within the living environment, students learn that structure and function of organisms can improve the survival of members of a species. Students learn to differentiate between inherited traits and learned behaviors. Students learn that life cycles occur in animals and plants and that the carbon dioxide-oxygen cycle occurs naturally to support the living environment.

(b) Knowledge and skills.

- (1) Scientific investigation and reasoning. The student conducts classroom and outdoor investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
 - (A) demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations; and
 - (B) make informed choices in the conservation, disposal, and recycling of materials.
- (2) Scientific investigation and reasoning. The student uses scientific methods during laboratory and outdoor investigations. The student is expected to:
 - (A) describe, plan, and implement simple experimental investigations testing one variable;
 - (B) ask well-defined questions, formulate testable hypotheses, and select and use appropriate equipment and technology;
 - (C) collect information by detailed observations and accurate measuring;
 - (D) analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence;
 - (E) demonstrate that repeated investigations may increase the reliability of results;
 - (F) communicate valid conclusions in both written and verbal forms; and
 - (G) construct appropriate simple graphs, tables, maps, and charts using technology, including computers, to organize, examine, and evaluate information.
- (3) Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
 - (A) use scientific evidence to develop and evaluate scientific explanations;
 - (B) evaluate the accuracy of the information related to promotional materials for products and services such as nutritional labels;
 - (C) draw or develop a model that represents how something works or looks that cannot be seen such as how a soda dispensing machine works; and
 - (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.
- (4) Scientific investigation and reasoning. 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 calculators; microscopes; cameras; computers; hand lenses; metric rulers; Celsius thermometers; prisms; mirrors; pan balances; triple beam balances; graduated cylinders; beakers; hot plates; meter sticks; timing devices, including clocks and stopwatches; magnets; collecting nets; notebooks; and materials to support observations of habitats or organisms such as terrariums and aquariums; and
 - (B) use safety equipment, including safety goggles and gloves.
- (5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:
 - (A) classify matter based on physical properties, including mass, magnetism, physical state (solid, liquid, and gas), relative density (sinking and floating), solubility in water, and the ability to conduct or insulate thermal energy or electric energy;
 - (B) identify the boiling and freezing/melting points of water on the Celsius scale;

- (C) demonstrate that some mixtures maintain physical properties of their ingredients such as iron filings and sand; and
- (D) identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water.
- (6) Force, motion, and energy. The student knows that energy occurs in many forms and can be observed in cycles, patterns, and systems. The student is expected to:
 - (A) explore the uses of energy, including light, thermal, electrical, and sound energy;
 - (B) demonstrate that the flow of electricity in circuits requires a complete path through which an electric current can pass and can produce light, heat, and sound; and
 - (C) demonstrate that light travels in a straight line until it strikes an object or travels through one medium to another and demonstrate that light can be reflected such as the use of mirrors or other shiny surfaces and refracted such as the appearance of an object when observed through water.
- (7) Earth and space. The student knows Earth's surface is constantly changing and consists of useful resources. The student is expected to:
 - (A) explore the processes that led to the formation of sedimentary rocks and fossil fuels;
 - (B) recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice;
 - (C) identify alternative energy resources such as wind, solar, hydroelectric, geothermal, and biofuels; and
 - (D) identify fossils as evidence of past living organisms and the nature of the environments at the time using models.
- (8) Earth and space. The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to:
 - (A) differentiate between weather and climate;
 - (B) explain how the Sun and the ocean interact in the water cycle; and
 - (C) demonstrate that Earth rotates on its axis once approximately every 24 hours causing the day/night cycle and the apparent movement of the Sun across the sky.
- (9) Organisms and environments. The student knows that there are relationships, systems, and cycles within environments. The student is expected to:
 - (A) observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements;
 - (B) describe how the flow of energy derived from the Sun, used by producers to create their own food, is transferred through a food chain and food web to consumers and decomposers;
 - (C) predict the effects of changes in ecosystems caused by living organisms, including humans, such as the overpopulation of grazers or the building of highways; and
 - (D) identify the significance of the carbon dioxide-oxygen cycle to the survival of plants and animals.
- (10) Organisms and environments. The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to:
 - (A) compare the structures and functions of different species that help them live and survive such as hooves on prairie animals or webbed feet in aquatic animals;

- (B) differentiate between inherited traits of plants and animals such as spines on a cactus or shape of a beak and learned behaviors such as an animal learning tricks or a child riding a bicycle; and
- (C) describe the differences between complete and incomplete metamorphosis of insects.

SUBCHAPTER “B”

Text of Proposed Revisions to 19 TAC

Chapter 112. Texas Essential Knowledge and Skills for Science

Subchapter B. Middle School

§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.

§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 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) differentiate among scientific fact, scientific hypothesis, scientific theory, and scientific law;
 - (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 compounds 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 direction, motion, and speed of an object when acted upon by unbalanced forces;
 - (C) calculate average speed using distance and time measurements; and
 - (D) measure and graph changes in motion.
- (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.

§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 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) differentiate among scientific fact, scientific hypothesis, scientific theory, and scientific law;
 - (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) relate the amount of work done during an everyday activity to energy transformations; 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 are adapted to perform 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.

§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 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) differentiate among scientific fact, scientific hypothesis, scientific theory, and scientific law;
 - (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 lunar cycle to its 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.

§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 [implemented by school districts beginning September 1, 1998, and at that time shall supersede §75.28(g) and §75.44 of this title (relating to Science)].

SUBCHAPTER “C”

