



STATE BOARD OF EDUCATION

Request for Supplemental Science Materials

Grades 5, 6, 7, and 8

May 21, 2010

Revised: November 19, 2010

Copyright © Notice:

The materials are copyrighted © and trademarked ™ as the property of the Texas Education Agency (TEA) and may not be reproduced without the express written permission of TEA, except under the following conditions:

1. Texas public school districts, charter schools, and Education Service Centers may reproduce and use copies of the Materials and Related Materials for the districts' and schools' educational use without obtaining permission from TEA.
2. Residents of the state of Texas may reproduce and use copies of the Materials and Related Materials for individual personal use only without obtaining written permission of TEA.
3. Any portion reproduced must be reproduced in its entirety and remain unedited, unaltered and unchanged in any way.
4. No monetary charge can be made for the reproduced materials or any document containing them; however, a reasonable charge to cover only the cost of reproduction and distribution may be charged.

Private entities or persons located in Texas that are **not** Texas public school districts, Texas Education Service Centers, or Texas charter schools or any entity, whether public or private, educational or non-educational, located **outside the state of Texas** *MUST* obtain written approval from TEA and will be required to enter into a license agreement that may involve the payment of a licensing fee or a royalty.

For information contact:
Office of Copyrights, Trademarks, License Agreements, and Royalties,
Texas Education Agency,
1701 N. Congress Ave., Austin, TX 78701-1494;
phone 512-463-9270 or 512-463-9437;
email: copyrights@tea.state.tx.us.

Table of Contents

Schedule of Events	1
Purpose	5
Requirements	5
Review	7
Cost	7
Statutory Citation	8
Texas Essential Knowledge and Skills	9
Subchapter A. Elementary	9
§112.16 Science, Grade 5, Beginning with School Year 2010-2011.....	9
Subchapter B. Middle School	14
§112.18 Science, Grade 6, Beginning with School Year 2010-2011.....	14
§112.19 Science, Grade 7, Beginning with School Year 2010-2011.....	20
§112.20 Science, Grade 8, Beginning with School Year 2010-2011.....	27

Schedule of Events

Date	Event
September 2010	<ul style="list-style-type: none"> ▶ Texas Education Agency (TEA) conducts <i>Bidder Orientation Meeting</i> for parties interested in filing a <i>Notice of Intent</i>.
December 10, 2010	<ul style="list-style-type: none"> ▶ Deadline for bidders to file <i>Notice of Intent</i>. Bidders shall provide detailed specifications regarding price, hardware, software, and/or special equipment needed to review any item included in a submission. Bidders shall file all documents with IMET by 5:00 P.M. CST. <p><i>Note: Only bidders who file a Notice of Intent by 5:00 P.M. CST on December 10, 2010 will be considered for adoption under this request.</i></p>
April 1, 2011	<ul style="list-style-type: none"> ▶ Deadline for bidders to file <i>Official Bid Form</i>. Bidders shall file all documents with IMET by 5:00 P.M. CDT
April 29, 2011	<ul style="list-style-type: none"> ▶ Deadline for bidders to file one (1) complete official sample copy of instructional materials along with one (1) completed <i>Correlations to the Texas Essential Knowledge and Skills (TEKS)</i> form with IMET. Bidders shall file all materials by 5:00 P.M. CDT. <p>Bidders shall ensure that all samples are complete as to content and representative of the finished format. Materials must be completely functional.</p> <p><i>Note: The TEA may require additional samples for use by contracted reviewers, members of the SBOE, and others.</i></p> <ul style="list-style-type: none"> ▶ Deadline for bidders to file <i>Form M</i> and <i>Warranty</i>, certifying that the materials adhere to applicable web delivery standards. Bidders shall file all documents with IMET by 5:00 P.M. CDT.
	<ul style="list-style-type: none"> ▶ TEA provides instructions to bidders for delivery of materials for review. Samples must be complete as to content and representative of the finished product. Bidders shall provide appropriate hardware or equipment for the review.
May 13, 2011	<ul style="list-style-type: none"> ▶ Deadline for bidders to withdraw a submission prior to state panel review. Bidders shall file all documents with IMET by 5:00 P.M. CDT. ▶ TEA makes samples of instructional materials submitted for adoption available for public examination via the Division of Instructional Materials and Educational Technology (IMET) website: http://www.tea.state.tx.us/imet
June 2011	<ul style="list-style-type: none"> ▶ IMET conducts orientation and training sessions for State Review Panel. ▶ The State Review Panel evaluates instructional materials submitted in response to the <i>Request for Supplemental Science Materials</i>. ▶ Bidders must revise their submissions to address any TEKS that the State Review Panels determine are insufficiently covered.

Date	Event
July 1, 2011	<ul style="list-style-type: none"> ▶ Deadline for bidders to file <i>Disclosure of Errors and Editorial Changes</i> form listing the corrections to be made to the materials submitted for adoption. Bidders shall file all documents with IMET by 5:00 P.M. CDT.
	<ul style="list-style-type: none"> ▶ Deadline for Texas residents to file lists of alleged factual errors in instructional materials under consideration. Residents shall file all documents with IMET by 5:00 P.M. CDT.
	<ul style="list-style-type: none"> ▶ Deadline for Texas residents to file official written comments concerning instructional materials. Residents shall file all documents with IMET by 5:00 P.M. CDT. Prior to the July public hearing, the TEA will provide written comments and lists of alleged factual errors to the SBOE, participating bidders, ESCs, and persons who have filed written requests.
	<ul style="list-style-type: none"> ▶ Deadline for persons to file complaints alleging violations of statutes, rules, or procedural irregularities. Persons shall file all documents with IMET by 5:00 P.M. CDT.
July 8, 2011	<ul style="list-style-type: none"> ▶ Commissioner of Education releases <i>Recommendations for Adoption of Supplemental Science Materials</i>.
July 2011 <i>SBOE Meeting</i>	<ul style="list-style-type: none"> ▶ Prior to the SBOE meeting, the TEA releases copies of official written comments from Texas residents via the IMET website. ▶ SBOE considers final recommendations of the Commissioner of Education regarding the adoption of supplemental science materials.
July 29, 2011	<ul style="list-style-type: none"> ▶ Deadline for bidders to provide each school district and open-enrollment charter school with information that fully describes adopted supplemental materials. Bidders shall file all documents by 5:00 P.M. CDT.
	<ul style="list-style-type: none"> ▶ Deadline for bidders to file the <i>Register of Contact</i> form indicating all visits, meetings, or contact with SBOE members, including the date, time, location, and purpose of the communication. Bidders shall file all documents with IMET by 5:00 P.M. CDT.
	<ul style="list-style-type: none"> ▶ School districts and open-enrollment charter schools begin to submit orders for supplemental instructional materials to IMET.
	<ul style="list-style-type: none"> ▶ Deadline for bidders to file signed Affidavit of Quality Assurance verifying that all required corrections have been made and all insufficiently covered TEKS have been addressed. Bidders shall file all documents with IMET by 5:00 p.m. CDT.

Date	Event
<p>July 29, 2011 (continued)</p>	<ul style="list-style-type: none"> ▶ Deadline for bidders to file one (1) copy of instructional materials that incorporate all required corrections with IMET. Corrected samples shall be identical to materials that will be provided to school districts after purchase. Bidders shall file all materials by 5:00 P.M. CDT. <p>Bidders must also supply appropriate information, such as locator information and passwords, required to ensure access to a demonstration version of their programs to be accessible from the TEA website throughout the life of the license.</p>
<p>August 2011</p>	<ul style="list-style-type: none"> ▶ Successful bidders make available adopted supplemental materials to school districts and open-enrollment charter schools. <p>Each successful bidder shall guarantee access to the adopted materials at least ten business days before the opening day of school of the year for which the materials are ordered if the orders are placed by a date specified in the sales contract.</p>

Purpose

The purpose of this *Request for Supplemental Science Materials* is to solicit bids from qualified content providers for producing supplemental instructional materials that meet all of the new and expanded requirements of the Texas Essential Knowledge and Skills (TEKS) adopted by the State Board of Education (SBOE) in March 2009. The SBOE is issuing this *Request for Supplemental Science Materials* to ensure that Texas schools are equipped with instructional materials that sufficiently cover all of the Texas Essential Knowledge and Skills for Science, grades 5, 6, 7, and 8. It is the intent of the SBOE that the supplemental materials adopted will be used in conjunction with currently adopted materials.

Requirements

- This request is for materials that address the required student expectations in Science, grade 5, Science, grade 6, Science, grade 7, and Science, grade 8.
- Materials submitted in response to this request must sufficiently address each of the new or expanded student expectations identified by bold and italic text in this request.
- Materials that do not sufficiently address all of the required expectations—as determined by the state review panel—will not be considered for adoption.
- Submissions must sufficiently address all of the new and expanded student expectations in such a way as to allow the materials to be used successfully with any of the currently adopted materials.
- Although the bold and italicized type in sections other than the student expectations are not required to be directly included in the materials submitted in response to this request, it should be remembered that a student expectation can only be correctly understood within the context of its knowledge and skills statement.
- All submissions must consist of online materials. A print-on-demand feature is optional.
- Ancillaries of any kind are not permitted.
- Bidders must submit a *Notice of Intent* on or before December 10, 2010. Only bidders that submit a *Notice of Intent* by 5:00 P.M. CST on December 10, 2010 will be considered.
- *Notices of Intent* must include pricing information. Certain information contained in the *Notices of Intent*, including price, will be sealed.
- Changes to the *Notices of Intent* will not be permitted after December 10, 2010.

- Bidders must submit *Official Bid Forms* on April 1, 2011. Product information on the *Official Bid Form* may not differ from product information given on the *Notice of Intent*. Price information on the *Official Bid Form* may differ from that given on the *Notice of Intent*.
- The price of providing a print-on-demand option must be given on either a per-student or a per-teacher basis and must be listed separately from the price for the online product. A bidder that decides to offer the print-on-demand feature free of charge does not contravene the restriction on ancillaries.
- Bidders must submit correlations indentifying the precise location(s) in the materials where each of the required student expectations is sufficiently addressed.
- Correlations must link directly to the exact location(s) where a specific student expectation is sufficiently addressed. For expanded TEKS, the correlation must also contain a short explanation (one to two sentences) describing how the content sufficiently addresses the required student expectation.
- A bidder that does not meet all of the requirements of this request will not be considered.

Review

- The materials submitted in response to this *Request for Supplemental Science Materials* will be reviewed by a panel of academic experts in each course for which supplemental materials are being considered to determine if the materials contain sufficient information to teach and/or learn the new and expanded concepts required by the Texas Essential Knowledge and Skills.
- Because all materials must meet 100% of the required student expectations, there will be no Conforming or Nonconforming list. Materials will be recommended for either adoption or rejection.
- The review panels will also document any factual errors discovered in the materials. All factual errors must be corrected in adopted materials before the materials are made available to schools.

Cost

- Bidders may submit price in one or more of the following configurations: per-student, per-teacher, or statewide license.
- The state reserves the right to negotiate for a final price.
- The SBOE will make its decision regarding the adoption of materials based on the extent to which the materials sufficiently address the required student expectations as well as the price of the materials.
- The SBOE is not restricted in the number of materials it may adopt, but may adopt only one submission.

Statutory Citation

Texas Education Code, §31.002, Definitions:

In this chapter:

- (1) "Electronic textbook" means computer software, interactive videodisc, magnetic media, CD-ROM, computer courseware, on-line services, an electronic medium, or other means of conveying information to the student or otherwise contributing to the learning process through electronic means, including an open-source textbook.
 - (1-a) "Open-source textbook" means an electronic textbook that is available for downloading from the Internet at no charge to a student and without requiring the purchase of an unlock code, membership, or other access or use charge, except for a charge to order an optional printed copy of all or part of the textbook. The term includes a state-developed open-source textbook purchased under Subchapter B-1.
- (2) "Publisher" includes an on-line service or a developer or distributor of an electronic textbook.
- (3) "Textbook" means a book, a system of instructional materials, or a combination of a book and supplementary instructional materials that conveys information to the student or otherwise contributes to the learning process, or an electronic textbook.
- (4) "Technological equipment" means hardware, a device, or equipment necessary for:
 - (A) instructional use in the classroom, including to gain access to or enhance the use of an electronic textbook; or
 - (B) professional use by a classroom teacher.

Texas Essential Knowledge and Skills

The entire text of the new Texas Essential Knowledge and Skills for Science, grade 5 are provided on the following pages. The new and expanded TEKS are indicated by the bold and italic type. For comparison purposes, the 1998 Science TEKS—no longer in effect—will be made available on the Division of Instructional Materials and Educational Technology (IMET) website: <http://www.tea.state.tx.us/imet>.

§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) in all fields of science, analyze, evaluate, and critique scientific explanations ***by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;***

(B) 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, spring scales, graduated cylinders, beakers*, hot plates, meter sticks, magnets, collecting nets, *and notebooks*; timing devices, including clocks and stopwatches; *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 *mechanical*, 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;

(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; and

(D) design an experiment that tests the effect of force on an object.

(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;***

(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; and

(D) identify and compare the physical characteristics of the Sun, Earth, and Moon.

(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.

The entire text of the new Texas Essential Knowledge and Skills for Science, grade 6 are provided on the following pages. The new and expanded TEKS are indicated by the bold and italic type. For comparison purposes, the 1998 Science TEKS—no longer in effect—will be made available on the Division of Instructional Materials and Educational Technology (IMET) website: <http://www.tea.state.tx.us/imet>.

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

(a) Introduction.

(1) Science, as defined by the National Academy of Science, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(2) Scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions become theories. Scientific theories are based on natural and physical phenomena and are capable of being tested by multiple, independent researchers. Students should know that scientific theories, unlike hypotheses, are well-established and highly reliable, but they may still be subject to change as new information and technologies are developed. Students should be able to distinguish between scientific decision-making methods and ethical/social decisions that involve the application of scientific information.

(3) Grade 6 science is interdisciplinary in nature; however, much of the content focus is on physical science. National standards in science are organized as multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale.

(4) The strands for Grade 6 include:

(A) Scientific investigations and reasoning.

(i) To develop a rich knowledge of science and the natural world, students must become familiar with different modes of scientific inquiry, rules of evidence, ways of formulating questions, ways of proposing explanations, and the diverse ways scientists study the natural world and propose explanations based on evidence derived from their work.

(ii) Scientific investigations are conducted for different reasons. All investigations require a research question, careful observations, data gathering, and analysis of the data to identify the patterns that will explain the findings. Descriptive investigations are used to explore new phenomena such as conducting surveys of organisms or measuring the abiotic components in a given habitat. Descriptive statistics include frequency, range, mean, median, and mode. A hypothesis is not required in a descriptive investigation. On the other hand, when conditions can be controlled in order to focus on a single variable, experimental research design is used to determine causation. Students should experience both types of investigations and understand that different scientific research questions require different research designs.

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

(B) Matter and energy.

(i) Matter can be classified as elements, compounds, or mixtures. Students have already had experience with mixtures in Grade 5, so Grade 6 will concentrate on developing an understanding of elements and compounds. It is important that students learn the differences between elements and compounds based on observations, description of physical properties, and chemical reactions. Elements are represented by chemical symbols, while compounds are represented by chemical formulas. Subsequent grades will learn about the differences at the molecular and atomic level.

(ii) Elements are classified as metals, nonmetals, and metalloids based on their physical properties. The elements are divided into three groups on the Periodic Table. Each different substance usually has a different density, so density can be used as an identifying property. Therefore, calculating density aids classification of substances.

(iii) Energy resources are available on a renewable, nonrenewable, or indefinite basis. Understanding the origins and uses of these resources enables informed decision making. Students should consider the ethical/social issues surrounding Earth's natural energy resources, while looking at the advantages and disadvantages of their long-term uses.

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

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

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

(b) Knowledge and skills.

(1) Scientific investigation and reasoning. The student, ***for at least 40% of instructional time***, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and

(B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:

(A) plan and implement ***comparative and descriptive*** investigations by ***making observations***, asking ***well-defined*** questions, and using appropriate equipment and technology;

(B) design and implement ***experimental*** investigations by ***making observations***, asking ***well-defined*** questions, formulating testable hypotheses, and using appropriate equipment and technology;

(C) collect and record data ***using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers***;

(D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and

(E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and ***knows the contributions of relevant scientists***. The student is expected to:

(A) in all fields of science, analyze, ***evaluate***, and critique scientific explanations ***by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student***;

(B) use models to represent aspects of the natural world such as a model of Earth's layers;

(C) identify ***advantages and*** limitations of models such as size, scale, properties, and materials; and

(D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.

(4) Scientific investigation and reasoning. The student knows how to use a variety of tools **and safety equipment** to conduct science inquiry. The student is expected to:

(A) use appropriate tools to collect, record, and analyze information, including **journals/notebooks**, beakers, Petri dishes, meter sticks, graduated cylinders, hot plates, test tubes, **triple beam balances**, microscopes, thermometers, calculators, computers, timing devices, **and other equipment as needed to teach the curriculum**; and

(B) **use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.**

(5) Matter and energy. **The student knows the differences between elements and compounds.** The student is expected to:

(A) **know that an element is a pure substance represented by chemical symbols;**

(B) **recognize that a limited number of the many known elements comprise the largest portion of solid Earth, living matter, oceans, and the atmosphere;**

(C) **differentiate between elements and compounds** on the most basic level; and

(D) **identify the formation of a new substance by using the evidence of a possible chemical change such as production of a gas, change in temperature, production of a precipitate, or color change.**

(6) Matter and energy. The student knows matter has physical properties **that can be used for classification**. The student is expected to:

(A) **compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability;**

(B) **calculate density to identify an unknown substance; and**

(C) test the physical properties of minerals, including hardness, color, luster, and streak.

(7) Matter and energy. **The student knows that some of Earth's energy resources are available on a nearly perpetual basis, while others can be renewed over a relatively short period of time. Some energy resources, once depleted, are essentially nonrenewable.** The student is expected to:

(A) **research and debate the advantages and disadvantages of using coal, oil, natural gas, nuclear power, biomass, wind, hydropower, geothermal, and solar resources; and**

(B) **design a logical plan to manage energy resources in the home, school, or community.**

(8) Force, motion, and energy. ***The student knows force and motion are related to potential and kinetic energy.*** The student is expected to:

(A) ***compare and contrast potential and kinetic energy;***

(B) identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces;

(C) ***calculate*** average speed using distance and time measurements;

(D) measure and graph changes in motion; and

(E) ***investigate how inclined planes and pulleys can be used to change the amount of force to move an object.***

(9) Force, motion, and energy. ***The student knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form.*** The student is expected to:

(A) ***investigate methods of thermal energy transfer, including conduction, convection, and radiation;***

(B) ***verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler until all the substances attain the same temperature such as an ice cube melting; and***

(C) demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

(10) Earth and space. The student understands the structure of Earth, ***the rock cycle, and plate tectonics.*** The student is expected to:

(A) ***build a model to illustrate the structural layers of Earth, including the inner core, outer core, mantle, crust, asthenosphere, and lithosphere;***

(B) classify rocks as metamorphic, igneous, or sedimentary by the processes of their formation;

(C) ***identify the major tectonic plates, including Eurasian, African, Indo-Australian, Pacific, North American, and South American; and***

(D) ***describe how plate tectonics causes major geological events such as ocean basins, earthquakes, volcanic eruptions, and mountain building.***

(11) Earth and space. The student understands the ***organization*** of our solar system ***and the relationships among the various bodies that comprise it.*** The student is expected to:

(A) describe the physical properties, locations, and movements of the Sun, planets, Galilean moons, meteors, asteroids, and comets;

(B) ***understand that gravity is the force that governs the motion of our solar system; and***

(C) describe the history and future of space exploration, including the types of equipment and transportation needed for space travel.

(12) Organisms and environments. ***The student knows all organisms are classified into Domains and Kingdoms. Organisms within these taxonomic groups share similar characteristics which allow them to interact with the living and nonliving parts of their ecosystem.*** The student is expected to:

(A) understand that all organisms are composed of one or more cells;

(B) recognize that the presence of a nucleus determines whether a cell is prokaryotic or eukaryotic;

(C) recognize that the broadest taxonomic classification of living organisms is divided into currently recognized Domains;

(D) identify the basic characteristics of organisms, including prokaryotic or eukaryotic, unicellular or multicellular, autotrophic or heterotrophic, and mode of reproduction, that further classify them in the currently recognized Kingdoms;

(E) describe biotic and abiotic parts of an ecosystem in which organisms interact; and

(F) diagram the levels of organization within an ecosystem, including organism, population, ***community, and ecosystem.***

The entire text of the new Texas Essential Knowledge and Skills for Science, grade 7 are provided on the following pages. The new and expanded TEKS are indicated by the bold and italic type. For comparison purposes, the 1998 Science TEKS—no longer in effect—will be made available on the Division of Instructional Materials and Educational Technology (IMET) website: <http://www.tea.state.tx.us/imet>.

§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 instructional time**, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and

(B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:

(A) plan and implement **comparative and descriptive** investigations by **making observations**, asking **well-defined** questions, and using appropriate equipment and technology;

(B) design and implement **experimental** investigations by **making observations**, asking **well-defined** questions, formulating testable hypotheses, and using appropriate equipment and technology;

(C) collect and record data **using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers**;

(D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and

(E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and ***knows the contributions of relevant scientists***. The student is expected to:

(A) in all fields of science, analyze, ***evaluate***, and critique scientific explanations ***by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;***

(B) use models to represent aspects of the natural world such as human body systems and plant and animal cells;

(C) identify ***advantages and*** limitations of models such as size, scale, properties, and materials; and

(D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.

(4) Science investigation and reasoning. The student knows how to use a variety of tools ***and safety equipment*** to conduct science inquiry. The student is expected to:

(A) use appropriate tools to collect, record, and analyze information, including ***life science models, hand lens, stereoscopes***, microscopes, beakers, Petri dishes, ***microscope slides***, graduated cylinders, test tubes, meter sticks, ***metric rulers, metric tape measures***, timing devices, hot plates, balances, thermometers, calculators, ***water test kits***, computers, ***temperature and pH probes, collecting nets, insect traps, globes, digital cameras, journals/notebooks, and other equipment as needed to teach the curriculum;*** and

(B) ***use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.***

(5) Matter and energy. The student knows that interactions occur between matter and energy. The student is expected to:

(A) recognize that radiant energy from the Sun is transformed into chemical energy through the process of photosynthesis;

(B) ***demonstrate and explain the cycling of matter within living systems such as in the decay of biomass in a compost bin; and***

(C) ***diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids.***

(6) Matter and energy. The student knows that matter has physical and chemical properties ***and can undergo physical and chemical changes***. The student is expected to:

(A) ***identify that organic compounds contain carbon and other elements such as hydrogen, oxygen, phosphorus, nitrogen, or sulfur;***

(B) ***distinguish between physical and chemical changes in matter in the digestive system; and***

(C) recognize how large molecules are broken down into smaller molecules such as carbohydrates can be broken down into sugars.

(7) Force, motion, and energy. The student knows that there is a relationship among force, motion, **and energy**. The student is expected to:

(A) contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still;

(B) illustrate the transformation of energy within an organism such as the transfer from chemical energy to heat and thermal energy in digestion; and

(C) demonstrate and illustrate forces that affect motion in everyday life such as emergence of seedlings, turgor pressure, and geotropism.

(8) Earth and space. The student knows that natural events and human activity can impact Earth systems. The student is expected to:

(A) predict and describe how different types of catastrophic events impact ecosystems such as floods, hurricanes, or tornadoes;

(B) analyze the effects of weathering, erosion, and deposition on the environment in ecoregions of Texas; and

(C) model the effects of human activity on groundwater and surface water in a watershed.

(9) Earth and space. The student knows components of our solar system. The student is expected to:

(A) analyze the characteristics of objects in our solar system that allow life to exist such as the proximity of the Sun, presence of water, and composition of the atmosphere; and

(B) identify the accommodations, considering the characteristics of our solar system, that enabled manned space exploration.

(10) Organisms and environments. The student knows that there is a relationship between organisms and the environment. The student is expected to:

(A) observe and describe how different environments, including microhabitats in schoolyards and biomes, support different varieties of organisms;

(B) describe how biodiversity contributes to the sustainability of an ecosystem; and

(C) observe, record, and describe the role of ecological succession such as in a microhabitat of a garden with weeds.

(11) Organisms and environments. The student knows that *populations* and species *demonstrate variation* and inherit many of their unique traits *through gradual processes* over many generations. The student is expected to:

(A) *examine organisms or their structures such as insects or leaves and use dichotomous keys for identification;*

(B) *explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb; and*

(C) *identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch (*Geospiza fortis*) or domestic animals.*

(12) Organisms and environments. The student knows that living systems *at all levels of organization* demonstrate the complementary nature of structure and function. The student is expected to:

(A) *investigate and explain how internal structures of organisms have adaptations that allow specific functions such as gills in fish, hollow bones in birds, or xylem in plants;*

(B) *identify the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, excretory, reproductive, integumentary, nervous, and endocrine systems;*

(C) *recognize levels of organization in plants and animals, including cells, tissues, organs, organ systems, and organisms;*

(D) *differentiate between structure and function in plant and animal cell organelles, including cell membrane, cell wall, nucleus, cytoplasm, mitochondrion, chloroplast, and vacuole;*

(E) *compare the functions of a cell to the functions of organisms such as waste removal; and*

(F) *recognize that according to cell theory all organisms are composed of cells and cells carry on similar functions such as extracting energy from food to sustain life.*

(13) Organisms and environments. The student knows that a living organism must be able to *maintain balance in stable internal conditions* in response to external and internal stimuli. The student is expected to:

(A) *investigate how organisms respond to external stimuli found in the environment such as phototropism and fight or flight; and*

(B) *describe and relate responses in organisms that may result from internal stimuli such as wilting in plants and fever or vomiting in animals that allow them to maintain balance.*

(14) Organisms and environments. The student knows that reproduction is a characteristic of living organisms and that the instructions for traits are governed in the genetic material. The student is expected to:

(A) define heredity as the passage of genetic instructions from one generation to the next generation;

(B) compare the results of uniform or diverse offspring from sexual reproduction or asexual reproduction; and

(C) recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus.

The entire text of the new Texas Essential Knowledge and Skills for Science, grade 8 are provided on the following pages. The new and expanded TEKS are indicated by the bold and italic type. For comparison purposes, the 1998 Science TEKS—no longer in effect—will be made available on the Division of Instructional Materials and Educational Technology (IMET) website: <http://www.tea.state.tx.us/imet>.

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

(a) Introduction.

(1) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(2) Scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions become theories. Scientific theories are based on natural and physical phenomena and are capable of being tested by multiple, independent researchers. Students should know that scientific theories, unlike hypotheses, are well-established and highly reliable, but they may still be subject to change as new information and technologies are developed. Students should be able to distinguish between scientific decision-making methods and ethical/social decisions that involve the application of scientific information.

(3) Grade 8 science is interdisciplinary in nature; however, much of the content focus is on earth and space science. National standards in science are organized as multi-grade blocks such as Grades 5-8 rather than individual grade levels. In order to follow the grade level format used in Texas, the various national standards are found among Grades 6, 7, and 8. Recurring themes are pervasive in sciences, mathematics, and technology. These ideas transcend disciplinary boundaries and include change and constancy, patterns, cycles, systems, models, and scale.

(4) The strands for Grade 8 include:

(A) Scientific investigation and reasoning.

(i) To develop a rich knowledge of science and the natural world, students must become familiar with different modes of scientific inquiry, rules of evidence, ways of formulating questions, ways of proposing explanations, and the diverse ways scientists study the natural world and propose explanations based on evidence derived from their work.

(ii) Scientific investigations are conducted for different reasons. All investigations require a research question, careful observations, data gathering, and analysis of the data to identify the patterns that will explain the findings. Descriptive investigations are used to explore new phenomena such as conducting surveys of organisms or measuring the abiotic components in a given habitat. Descriptive statistics include frequency, range, mean, median, and mode. A hypothesis is not required in a descriptive investigation. On the other hand, when conditions can be controlled in order to focus on a single variable, experimental research design is used to determine causation. Students should experience both types of investigations and understand that different scientific research questions require different research designs.

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

(B) Matter and energy. Students recognize that matter is composed of atoms. Students examine information on the Periodic Table to recognize that elements are grouped into families. In addition, students understand the basic concept of conservation of mass. Lab activities will allow students to demonstrate evidence of chemical reactions. They will use chemical formulas and balanced equations to show chemical reactions and the formation of new substances.

(C) Force, motion, and energy. Students experiment with the relationship between forces and motion through the study of Newton's three laws. Students learn how these forces relate to geologic processes and astronomical phenomena. In addition, students recognize that these laws are evident in everyday objects and activities. Mathematics is used to calculate speed using distance and time measurements.

(D) Earth and space. Students identify the role of natural events in altering Earth systems. Cycles within Sun, Earth, and Moon systems are studied as students learn about seasons, tides, and lunar phases. Students learn that stars and galaxies are part of the universe and that distances in space are measured by using light waves. In addition, students use data to research scientific theories of the origin of the universe. Students will illustrate how Earth features change over time by plate tectonics. They will interpret land and erosional features on topographic maps. Students learn how interactions in solar, weather, and ocean systems create changes in weather patterns and climate.

(E) Organisms and environments. In studies of living systems, students explore the interdependence between these systems. Interactions between organisms in ecosystems, including producer/consumer, predator/prey, and parasite/host relationships, are investigated in aquatic and terrestrial systems. Students describe how biotic and abiotic factors affect the number of organisms and populations present in an ecosystem. In addition, students explore how organisms and their populations respond to short- and long-term environmental changes, including those caused by human activities.

(b) Knowledge and skills.

(1) Scientific investigation and reasoning. The student, *for at least 40% of instructional time*, conducts laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and

(B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to:

(A) plan and implement *comparative and descriptive* investigations by *making observations*, asking *well-defined* questions, and using appropriate equipment and technology;

(B) design and implement comparative and *experimental* investigations by *making observations*, asking *well-defined* questions, formulating testable hypotheses, and using appropriate equipment and technology;

(C) collect and record data *using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers*;

(D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and

(E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(3) Scientific investigation and reasoning. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and *knows the contributions of relevant scientists*. The student is expected to:

(A) in all fields of science, analyze, *evaluate*, and critique scientific explanations *by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student*;

(B) use models to represent aspects of the natural world such as an atom, a molecule, space, or a geologic feature;

(C) identify *advantages and* limitations of models such as size, scale, properties, and materials; and

(D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.

(4) Scientific investigation and reasoning. The student knows how to use a variety of tools *and safety equipment* to conduct science inquiry. The student is expected to:

(A) use appropriate tools to collect, record, and analyze information, including *lab journals/notebooks*, beakers, meter sticks, graduated cylinders, *anemometers*, *psychrometers*, hot plates, test tubes, spring scales, balances, microscopes, thermometers, calculators, computers, *spectroscopes*, timing devices, *and other equipment as needed to teach the curriculum*; and

(B) *use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.*

(5) Matter and energy. The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to:

(A) describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud;

(B) *identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;*

(C) interpret the *arrangement of* the Periodic Table, *including groups and periods*, to explain how properties are used to classify elements;

(D) recognize that chemical formulas are used to identify substances and determine the number of atoms of each element in chemical formulas containing subscripts;

(E) investigate how evidence of chemical reactions indicate that new substances with different properties are formed; and

(F) *recognize whether a chemical equation containing coefficients is balanced or not and how that relates to the law of conservation of mass.*

(6) Force, motion, and energy. The student knows that there is a relationship between force, motion, *and energy*. The student is expected to:

(A) demonstrate *and calculate* how unbalanced forces change the speed or direction of an object's motion;

(B) *differentiate between speed, velocity, and acceleration; and*

(C) *investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.*

(7) Earth and space. ***The student knows the effects resulting from cyclical movements of the Sun, Earth, and Moon.*** The student is expected to:

(A) ***model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons;***

(B) demonstrate and predict the sequence of events in the lunar cycle; and

(C) ***relate the position of the Moon and Sun to their effect on ocean tides.***

(8) Earth and space. The student knows characteristics of the universe. The student is expected to:

(A) describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification;

(B) ***recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star;***

(C) ***explore how*** different wavelengths of the electromagnetic spectrum such as light ***and radio waves*** are used to gain information about distances ***and properties of components*** in the universe;

(D) model and describe how light years are used to measure distances and sizes in the universe; and

(E) research how scientific data are used as evidence to develop scientific theories to describe the origin of the universe.

(9) Earth and space. The student knows that natural events can impact Earth systems. The student is expected to:

(A) ***describe the historical development of evidence that supports plate tectonic theory;***

(B) relate plate tectonics to the formation of crustal features; and

(C) ***interpret topographic maps and satellite views to identify*** land and erosional features and predict how these features may be reshaped by weathering.

(10) Earth and space. ***The student knows that climatic interactions exist among Earth, ocean, and weather systems.*** The student is expected to:

(A) recognize that the Sun provides the energy that drives convection within the atmosphere and oceans, producing winds and ocean currents;

(B) identify how global patterns of atmospheric movement influence ***local*** weather ***using weather maps that show high and low pressures and fronts;*** and

(C) identify the role of the oceans in the formation of weather systems such as hurricanes.

(11) Organisms and environments. ***The student knows that interdependence occurs among living systems and the environment*** and that human activities can affect these systems. The student is expected to:

(A) describe producer/consumer, predator/prey, and parasite/host relationships as they occur in food webs within marine, freshwater, and terrestrial ecosystems;

(B) investigate how organisms and populations in an ecosystem depend on and may compete for biotic and abiotic factors such as quantity of light, water, range of temperatures, or soil composition;

(C) explore how short- and long-term environmental changes affect organisms and traits in subsequent populations; and

(D) recognize human dependence on ocean systems and explain how human activities such as runoff, artificial reefs, or use of resources have modified these systems.