High School Science TEKS Review
Gerald Skoog, Reviewer

Feedback on the Science High School TEKS

1. Do the TEKS ensure that scientific concepts are presented in accurate and factual manner?

   Overall, the TEKS for high school science were accurately presented. In the pages, see notations in the draft material for each course made by the reviewer that recommend changes in certain expectations.

2. Is a complete and logical development of scientific concepts for each grade level or course followed?

   No major problems were identified in this area.

3. Have the correct vocabulary and terminology been used?

   Generally the correct vocabulary and terminology are used. The reviewer made some corrections, which are noted on the drafts, which are present in later pages.

4. Are the science process skill statements written at the appropriate grade level or course?
   See page 19 of this document for recommended changes regarding process skill statements for all high school courses except Engineering Design and Problem Solving.

5. Are the science concept/content statements grade-level appropriate?
   No major problems were noted.

6. Do the science TEKS have Student Expectations (SEs) that are aligned with the knowledge and skill statements?
   The alignment is satisfactory overall. Notations made by the reviewer appear on the draft that follows when perceived problems with the expectations exist.

7. Are the Student Expectations (SEs) clear and specific?
   The expectations are not clear and specific uniformly. See the reviewer's notations on the course drafts that follow.

High School Science, Grades 9-12

1. Do the TEKS ensure that scientific concepts are presented in an accurate and factual manner?

This review focused on the individual TEKS and the accompanying expectations for each of the science courses. The TEKS and expectations were reviewed for the accuracy and clarity of the statements. Perceived omissions were noted and recommended expectations were added.

Note the following directions before reading the response provided in this item.

- Changes are recorded in CAPS
- Parts that need to be deleted can be identified by the strikethroughs present
- Sections in the draft documents where there no changes were recommended were not included in this document.
- Expectations added from the *National Science Education Standards* are identified by the initials NSSE
- Recommendations for (b) **Introduction** and (c) (1) **Scientific Processes** starting on page XX of this document. It is recommended that item (1) in the (b) **Introduction** section should be retained in the drafts of each course inasmuch as they provide a description, or overview, of the entire course. The other sections in the (b) **Introduction** have been made the same for all science courses in the recommendations provided later in this document.

The review of the TEKS and expectations for each science course follows.

§112.42. Integrated Physics and Chemistry

(4) Science concepts. The student knows concepts of force and motion THAT ARE REFLFECTED OR ILLUSTRATED BY ACTIONS evident in everyday life. The student is expected to:

(6) Science concepts. The student knows that relationships exist between the structure and properties of matter. The student is expected to:

(B) relate chemical properties of substances to the arrangement of their ELECTRONS ~~atoms or molecules~~

ADD
DESCRIBE THE PATTERN FOLLOWED BY ATOMS IN INTERACTING WITH ONE ANOTHER BY TRANSFERRING OR SHARING ELECTRONS THAT ARE FURHTEST FROM THE NUCLEUS. RECOGNIZE THAT THESE OUTER ELECTRONS GOVERN THE CHEMICAL PROPERTIES OF THE ELEMENT. (NSSE)

EXPLAIN WHY CHEMICAL REACTIONS MAY RELEASE OR CONSERVE ENERGY. (NSSE) IF THIS EXPECTATION IS USED, IT PROBABLY FITS BEST WITH THE NEXT TEKS

(7) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:

(A) investigate changes of state as ~~it relates~~ THEY RELATE to the arrangement of particles of matter and energy transferS;

(D) analyze energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks and classify them as exothermic or endothermic reactions; THE CHANGES IN HEAT PACKS AND COLD PACKS ARE NOT NECESSARY CHEMICAL REACTIONS. HOWEVER, THEY MAY EITHER REPRESENT AN EXOTHERMIC OR ENDOTHERMIC PROCESS, BUT NOT A CHEMICAL REACTION. FOR EXAMPLE, IN A HEAT PACK HEAT IS RELEASED WHEN THE SUBSTANCE DISSOLVES.

(E) describe ~~types of~~ nuclear ~~reactions such~~ as fission and fusion and their role in applications such as medicine and energy production; and

End of Integrated Physics and Chemistry

§112.43. Biology

(4) Science concepts. The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions, and that viruses are different from cells. The student is expected to:

ADD THE FOLLOWING EXPECTATIONS:

PLANT CELLS CONTAIN CHLOROPOLASTS, THE SITE OF PHOTOSYNTHESIS (NSSE)

CELLS STORE AND USE INFORMATION TO GUIDE THEIR FUNCTIONS. THE GENETIC INFORMATION STORED IN DNA IS USED TO DIRECT THE SYNTHESIS OF THE THOUSANDS OF PROTEIN THAT EACH CELL REQUIRES. (NSSE p. 184)

(5) Science concepts. The student knows how an organism grows, and the importance of cell differentiation. The student is expected to:

(B) examine REPRESENTATIVE cells of plants ~~including~~ SUCH AS roots, stems, and leaves; and ~~of~~ animal CELLS such as blood, muscle, and epithelium;

(C) describe the various factors involved in cell differentiation such as the roles of DNA, ribonucleic acid (RNA), enzymes, and environmental factors; and

CHANGE C TO:
DESCRIBE THE THE ROLES OF DNA, RIBONUCLEIC ACID (RNA), ENZYMES, AND ENVIRONMENTAL FACTORS IN CELL DIFFERENTIATION

(D) recognize that disruptions of the cell cycle lead to diseases such as cancer.

(6) Science concepts. The student knows the mechanisms of genetics including the role of nucleic acids and the principles of Mendelian Genetics. The student is expected to:

((B) recognize that ~~the~~ ELEMENTS THAT MAKE UP THE genetic code ARE common to all organisms;

(H) ~~identify~~ DESCRIBE HOW techniques and technologies SUCH AS DNA FINGERPRINTING, GENETIC MODIFICATIONS AND CHROMOSOMAL ANALYSIS ARE used to study and manipulate the genetics of Organisms. (~~such as DNA fingerprinting, genetic modifications and chromosomal analysis.)~~

ADD
EXPLAING THE FOLLOWING: CHANGES IN DNA (MUTATIONS) OCCUR

SPONTANEOUSLY AT LOW RATES. SOME OF THESE CHANGES MAKE NO DIFFERENCE TO THE ORGANISM, WHEREAS OTHERS CAN CHANGE CELLS AND ORGANISMS. ONLY MUTATIONS IN GERM CELLS CAN CREATE THE VARIATIONS THAT CHANGES AN ORGANISM'S OFFSPRING. (NSSE p. 185)

(7) Science concepts. The student knows evolutionary theory is an explanation for the UNITY AND diversity of life. The student is expected to:

(D) recognize the ~~significance~~ RELATIONSHIP of natural selection to adaptation, and to the DEVELOPMENT OF diversity ~~of~~ IN AND AMONG species; and

ADD
EXPLAIN THAT THE GREAT DIVERSITY OF ORGANISMS IS THE RESULT OF MORE THAN 3.5 BILLION YEARS OF EVOLUTON THAT HAS FILLED EVERY AVAILABLE NICHE WITH LIFE FORMS. (NSSE P. 185)

EXPLAIN HOW NATURAL SELECTION AND ITS EVOLUTIONARY CONSEQUENCES PROVIDE A SCIENTIFIC EXPLANATION FOR THE FOSSIL RECORD OF ANCIENT LIFE FORMS, AS WELL AS FOR THE STRIKING MOLECULAR SIMILARITIES OBSERVED AMONG LIVING ORGANISMS. (NSSE p. 185)

DESCRIBE THE IMPLICATIONS OF THE CONCLUSION THAT THE MILLIONS OF DIFFERENT SPECIES OF PLANTS, ANIMALS, AND MICROORGANISMS THAT LIVE ON EARTH TODAY ARE RELATED BY DESCENT FROM COMMON ANCESTORS. (NSSE p. 185)

EXPLAIN HOW CERTAIN ANATOMICAL STRUCTURES ON FOSSILIZED VERTEBRATES AND COMPLETE OR NEARLY COMPLETE FOSSILS ARE USED AS EVIDENCE OF THE EVOLUTIONARY HISTORY OF VERTEBRATES.

DESCRIBE FOSSIL AND MOLECULAR EVIDENCE OF HUMAN EVOLUTION.

(**8) Science concepts.** The student knows that DIFFERENT TAXONOMIC METHODS USE A SYSTEM OF BRANCHES THAT ARE BASED ~~taxonomy is a branching classification based~~ on the shared characteristics of organisms and ~~can~~ change as new discoveries are made. The student is expected to:

(9) Science concepts. The student knows the significance of biomolecules ~~to~~ INVOLVED IN metabolic processes and energy transformations that occur in living organisms. The student is expected to:

(10) Science concepts. The student knows that biological systems are composed of multiple levels. The student is expected to:

(A) describe the functions ~~and analyze the relationships of~~ of systems in animals ~~including~~ (circulatory, digestive, nervous, endocrine, reproductive, integumentary,

skeletal, respiratory, muscular, excretory, and immune) and describe several interactions that occur between two or more systems.

(B) identify characteristics and investigate functions of plant systems such as transport, reproduction, and response; and

(C) analyze the levels of organization in biological systems and relate the levels to each other and to the whole system.

(11) Science concepts. The student knows that biological systems achieve and maintain equilibrium. The student is expected to:

(C) summarize the role of microorganisms in BOTH maintaining and disrupting THE equilibrium ~~including health and diseases in~~ IN HEALTHY organisms AND THE decay OF ORGANIC MATTER in an ecosystem; and

(D) describe HOW events and processes that occur during ecological succession ~~including changes in~~ CAN CHANGE populations and species diversity.

(12) Science concepts. The student knows that interdependence and interactions occur within an environmental system. The student is expected to:

(B) interpret relationships ~~among organisms including~~ SUCH AS predation, parasitism, commensalism, mutualism, and competition AMONG ORGANISMS;

(F) DESCRIBE HOW HUMAN DESTRUCTION OF HABITATS THREATEN CURRENT GLOBAL STABILITY.

§112.45. Chemistry

(4) Science concepts. The student knows the characteristics of matter and can analyze the relationships between chemical and physical changes and properties. The student is expected to: NO CHANGES RECOMMENDED FOR EXPECTATIONS GIVEN IN DRAFT FOR THIS TEKS

(5) Science concepts. The student understands the historical development of the Periodic Table and can apply its predictive power. The student is expected to:

(E) KNOW THAT THE PERIODIC TABLE IS A CONSEQUENCE OF THE REPEATING PATTERNS OF OUTERMOST ELECTRONS AND THEIR PERMITTED ENERGIES (NSSE p. 179)

(6) Science concepts. The student knows and understands the historical development of atomic theory**.** The student is expected to: NO CHANGES RECOMMENDED FOR EXPECTATIONS GIVEN IN DRAFT

(7) Science concepts. The student knows how atoms form ionic, metallic and covalent bonds. The student is expected to: NO CHANGES RECOMMENDED FOR EXPECTATIONS GIVEN IN DRAFT

(8) Science concepts. The student can quantify the changes that occur during chemical reactions**.** The student is expected to: NO CHANGES RECOMMENDED FOR EXPECTATIONS GIVEN IN DRAFT

NOTE: SOME SCIENCE TEACHERS HAVE RAISED QUESTIONS ABOUT THE EMPHASIS ON STOICHIOMETIC CALCULATIONS IN CHEMISTRY NOW THAT 4 YEARS OF SCIENCE ARE REQUIRED FOR GRADUATION. ALSO, WHEN CHEM STUDY AND THE CHEMICAL BOND APPROACH WERE DEVELOPED BY PRIMARILY UNIVERSITY CHEMISTRY PROFESSORS, STOICHIOMETRIC CALCULATIONS WERE NOT EMPHASIZED IN THE NSF-FUNDED PROGRAMS.

NO EDITS, ADDITIONS, OR DELETES FOR TEKS 9 THROUGH 11

TEKS AND/OR EXPECTATIONS RELATED TO NUCLEAR CHEMISTRY NEED TO BE ADDED. LANGUAGE FOR THESE TEKS AND EXPECTATIONS CAN BE TAKEN FROM THE FOLLOWING CONCEPTUAL STATEMENTS IN *THE NATIONAL SCIENCE EDUCATION STANDARDS:*

THE NUCLEAR FORCES THAT HOLD THE NUCLEUS OF AN ATOM TOGETHER, AT NUCLEAR DISTANCES, ARE USUALLY STRONGER THAN THE ELECTRIC FORCES THAT WOULD MAKE IT FLY APART. NUCLEAR REACTIONS CONVERT A FRACTION OF INTERACTING PARTICLES INTO ENERGY, AND THEY CAN RELEASE MUCH GREATER AMOUNTS OF ENERGY

THAN ATOMIC INTERACTIONS. FISSION IS THE SPLITTING OF A LARGE NUCLEUS INTO SMALLER PIECES. FUSION IS THE JOINING OF TWO NUCLEI AT EXTREMELY HIGH TERMPERATURE AND PRESSURE, AND IS THE PROCESS RESPONSIBLE FOR THE ENERGY OF THE SUN AND OTHER STARS.

RADIOACTIVE ISOTOPES ARE UNSTABLE AND UNDERGO SPONTANEOUS NUCLEAR REACITONS, EMITTING PARTICLES AND/OR WAVELIKE RADIATION. THE DECAY OF ANY ONE NUCLEUS CANNOT BE PREDICTED, BUT A LARGE GROUP OF IDENTICAL NUCLEI DECAY AT A PREDICTABLE RATE. THIS PREDICTABILITY CAN BE USED TO ESTIMATE THE AGE OF MATERIALS THAT CONTAINRADIOACTIVE ISOTOPES. (p. 178)

End of Chemistry

§112.47. Physics

I HAVE NO EDITS OR DELETIONS FOR THE TEKS AND EXPECTATIONS FOR PHYSICS. I RECOMMEND ADDING THE FOLLOWING AS AN ADDITIONAL TEKS OR AN EXPECTATION FOR AN EXISTING TEKS

IN SOME MATERIALS, SUCH AS METALS, ELECTRONS FLOW EASILY, WHEREAS IN INSULATING MATERIALS SUCH AS GLASS THEY CAN HARDLY FLOW AT ALL. SEMICONDUCTING MATERIALS HAVE INTERMEDIATE BEHAVIOR. AT LOW TEMPERATURES SOME MATERIALS BECOME SUPERCONDUCTORS AND OFFER NO RESISTANCE TO THE FLOW OF ELECTRONS. (NSSE p. 181)

End of Physics

§112.44. Environmental Systems

(4) Science concepts.

I HAVE NO EDITS, DELETIONS, OR ADDITONS TO THE TEKS AND EXPECTATIONS THAT ARE RELATED TO THE SCIENCE CONCEPTS IN THE DRAFT FOR THE ENVIRONMENTAL SCIENCE COURSE. THE WORK COMPLETED BY THIS COMMITTEE IS COMMENDABLE.

§112.46. Aquatic Science

(C) collect and evaluate global environmental data using technology, such as maps, visualizations, satellite data, GPS/GIS, weather balloons, buoys, etc.

THIS IS AN IMPORTANT EXPECTATION. GPS/GIS TECHNOLOGY IS BEING USED WIDELY AND STUDENTS NEED TO SEE HOW THIS AND TECHNOLOGY CAN BE USED IN SCIENTIFIC RESEACH. EXPECTATIONS THAT PARELLEL THIS ONE SHOULD BE PRESENT IN THE EARTH AND SPACE SCIENCE COURSE, ENVIRONMENTAL SCIENCE COURSE, BIOLOGY, AND OTHER COURSES AS APPROPRIATE.

(5) Science concepts. The student conducts long term studies on local aquatic environments.
Local natural habitats are to be preferred over artificial or virtual habitats. The student is expected to:

ADD (5) (E) EXPLAIN CHANGES OBSERVED AND/OR RECORDED IN AQUATIC ENVIRONMENTS OVER A LONG PERIOD OF TIME.

I HAVE NO OTHER ADDITIONS, DELETIONS, OR EDITS. THE TEKS AND EXPECTATONS FOR THIS COURSE FORM A RELEVANT SCOPE AND SEQUENCE.

End of Aquatic Science

§112.48. Astronomy

(4) Science concepts.

I HAVE NO EDITS, DELETIONS, OR ADDITIONS FOR THE ASTRONOMY TEKS AND EXPECTATIONS FOR THE SCIENCE CONCEPTS LISTED. THE COMMITTEE DID AN EXCELLENT JOB IN CONCEPTUALIZING AND COMMUNICATING THE TEKS AND EXPECTATIONS.

§112.XX. Earth and Space Science
(a) General requirements. Students shall be awarded one credit for successful completion of this course. Required prerequisites: three units of science, one of which may be taken concurrently, and three units of mathematics, one of which may be taken concurrently. This course is recommended for students in grade 12 but may be taken by students in grade 11.

THE INTRODUCTION FOR THIS COURSE IS WRITTEN SPECIFICALLY FOR EARTH AND SPACE SCIENCE AND PROVIDES AN EXCELLENT OVERVIEW OF THE COURSE. INTRODUCTIONS IN MOST OF THE OTHER DRAFTS FOR HIGH SCHOOL SCIENCE COURSES WERE QUITE UNIFORM AND, AS A RESULT, REVIEWED AS ONE ENTITY. AS STATED IN THIS REVIEWER'S RESPONSE TO ITEM 4 FOR THE REVIEW, A STANDARD SET OF STATEMENTS ARE RECOMMENDED FOR THE COURSES WHERE THE INTRODUCTION (b) WAS NOT WRITTEN SPEFICALLY FOR THE INDIVIDUAL COURSE.

(b) Introduction.

(1) Earth and Space Science (ESS) is a capstone course that builds on prior scientific knowledge and skills to provide high school students an understanding of the Earth System and cycles in space and time. This Earth and Space Science capstone course will:

o apply and integrate the science concepts and principles learned in previous grades;
o examine authentic situations that extend beyond the boundaries of the classroom;
o engage in acquiring, processing, and analyzing scientific data;
o build upon reading, writing, research, and quantitative skills learned in previous grades, and
o serve as a culminating science course in a student's high school experience.

(2) The course focuses on three major science concepts: the Earth in Space and Time, Solid Earth, and Fluid Earth. These concepts would normally be found as topics among the sciences of geology, oceanography, meteorology, cosmology, and astronomy, and within the significant secondary sciences of tectonics, geochemistry, geophysics, stratigraphy, geochronology, paleontology, planetary geology, marine geology, climatology, and physical oceanography. No attempt was made to be comprehensive; instead, the most important and relevant topics were selected and focused upon to help develop the concepts discussed below.

(A) **Earth in Space and Time.** Earth has a long, complex, and dynamic history that scientists from many disciplines investigate. Continuous improvement in observational and computational technologies leading to improved conceptual

models has allowed scientists to further our understanding of the origin, evolution, and properties of the integrated Earth and planetary systems. These topics are best understood using data, models, and a systems approach within a chronological framework. Interactions among several forms of energy, cosmic and Earth materials, and living organisms over billions of years formed the planet that humanity depends upon for resources and sustainability of life.

(B) **Solid Earth.** The geosphere is a collection of complex, interacting, dynamic subsystems linking Earth's interior to its surface, including the hydrosphere, atmosphere, cryosphere, and biosphere. The geosphere is composed of materials existing in many different states and forms that move at various rates within and between Earth's systems. The uneven distribution of heat energy in Earth's subsystems is responsible for system interactions that occur across a broad range of time scales. .The flow of energy and matter within and between Earth's subsystems is responsible for the origin and distribution of resources as well as geologic hazards that impact society.

(C) **Fluid Earth.** The fluid Earth consists of the hydrosphere and atmosphere subsystems interacting with the biosphere and geosphere. The global ocean is the heat reservoir for the planet, storing solar energy and redistributing it as heat in the atmosphere and ocean, thus influencing weather and climate. Geochemical and biogeochemical cycles are present within and interact among the hydrosphere, atmosphere, biosphere, and geosphere subsystems. Fluid Earth interactions are responsible for Earth's past and present climate. Understanding these interactions is critical for predicting future climate changes that have implications for society.

(3) The course has three strands used throughout each of the three concepts: systems, energy, and relevance.

(A) **Systems.** A system is a collection of interacting physical, chemical and biological processes that involves the flow of matter and energy on different temporal and spatial scales. The Earth system is composed of the geosphere, hydrosphere, atmosphere, cryosphere, and biosphere subsystems within a larger planetary and stellar system. A comprehensive understanding of the Earth system requires recognition of the interdependence and evolution of these subsystems.

(B) **Energy.** The uneven distribution of Earth's internal and external heat energy is the driving force for the movement of matter within and between the subsystems of Earth. An understanding of these complex, dynamic, and continuous interactions in Earth's subsystems can be derived by recognizing Earth's energy sources and defining their energy distribution within the Earth system.

(C) **Relevance**. The interacting components of the Earth system change by both natural and human-influenced processes. Natural processes include hazards such as flooding, earthquakes, volcanoes, hurricanes, meteorite impacts, and climate change. Human-influenced processes, such as pollution and nonsustainable use

of Earth's natural resources, may damage the Earth system. Examples include climate change, soil erosion, air and water pollution, and biodiversity loss. The time scale of these changes and their impact on human society must be understood to make wise decisions concerning the use of the land, water, air, and natural resources. Proper stewardship of Earth will prevent unnecessary degradation and destruction of Earth's subsystems and diminish detrimental impacts to individuals and society.

(4) In Earth and Space Science, students conduct classroom, laboratory, and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of concepts that include Earth in space and time, solid Earth, and fluid Earth.

RECOMMENDATION: SUBSTITUTE FOR (5) (6) & (7) STATEMENTS (b) (2) (3) (4) & (5) FROM THE INTRODUCTION SECTION RECOMMENDED FOR USE IN THIS SECTION OF ALL HIGH SCHOOL SCIENCE COURSES. THESE STATEMENTS FOLLOW THE DELETED PORTION OF THIS DRAFT.

~~**(5)** Scientific explanations must be based on naturally occurring phenomena, and must be~~
~~capable of testing by multiple independent researchers. If scientific explanations are based on purported forces that are outside of nature, scientists have no way of testing those explanations. Unless a proposed scientific explanation is framed in a way that some observational evidence could potentially refute it, that explanation cannot be subject to scientific testing.~~
~~**ESS**~~

~~**(6)** Students should understand a system in terms of its components and how these components relate to each other and to the system. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed, measured as patterns, and described or presented in models. These patterns help to predict what will happen next and can change over time.~~

~~**(7)** Investigations and tests are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that explanations, models, and conclusions built from these investigations may change as new observations are made. Models are tools for understanding the natural world, and explanations are continually tested in science to confirm reliability and explanatory power. Models have limitations and, based on new discoveries, are constantly being modified to more closely reflect the natural world.~~

(c) Knowledge and skills.
c) Knowledge and skills.

(2) Science is a way of knowing about the natural world. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Scientific

explanations may be expressed as a

- Fact: In science, an observation that has been repeatedly confirmed. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Hypothesis: A testable statement about the natural world that can be used to build more complex inferences and explanations. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Theory: In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. (NAS, *Teaching about Evolution and the Nature of Science* p.5
- Law: A descriptive generalization about how some aspect of the natural world behaves under stated circumstances. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Model: A tentative scheme or structure that corresponds to real objects, events, or classes of events, and that have explanatory power. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (NSES, p. 117)

Scientific explanations must adhere to criteria such as: a proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current scientific knowledge. (NSES, p. 176) There are other ways of knowing and the methods of science cannot answer all questions.

(3) A system is a defined collection of structures and process that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed, measured as patterns. These patterns help to make inferences about past events, predict what will happen next and can change over time. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(4) Investigations and tests are used to learn about the natural world. Students should understand that certain types of questions can be answered by investigations, and that explanations, models, and conclusions built from these investigations may change as new observations are made. Models are tools for understanding the natural world, and explanations are continually tested in science to confirm reliability and explanatory power. Models have limitations and, based on new discoveries, are constantly being modified to more closely reflect the natural world.

(5) Scientific explanations must be based on naturally occurring phenomena, and must be capable of testing by multiple independent researchers. If scientific explanations are based on purported forces that are outside of nature, scientists have no way of testing those explanations. Unless a proposed scientific explanation is framed in a way that some observational evidence could potentially refute it, that explanation cannot be subject to scientific testing.

(1) Scientific processes.
(2) Scientific processes.
(3) Scientific processes.

SCIENCE CONCEPTS
I HAVE NO ADDITIONS, DELETIONS, OR EDITS FOR THE TEKS AND RELATED EXPECTATIONS.

THE COMMITTEE DID A COMMENDABLE JOB IN CONCEPTUALIZING AND COMMUNICATING THE CONTENT-RELATED TEKS AND EXPECTATIONS. IN PARTICLULAR, THE WRITING THAT CHARACTERIZED EACH OF THE TEKS NUMBERED 4-15 AND THEIR EXPECTATIONS WERE WELL CONCEPTUALIZED AND COMMUNICATED VERY CLEARLY THE EXPECTATION

§112.XX. Engineering Design and Problem Solving

I HAVE NO RECOMMENDATIONS FOR ANY SECTION OF THE DRAFT PROPOSED FOR THIS COURSE. I DO HAVE CONCERNS ABOUT THE LENGTHY LIST OF TEKS AND EXPECTATIONS FOR THE COURSE. ARE THERE TOO MANY?

Scientific Processes for High School Science

The process skill statements in the draft versions of the grade 9-12 science courses are very similar. Likewise the statements in the (b) Introduction are basically the same except for (b) (1) where each specific course is described.

The statements in the (b) Introduction focus on the nature of science and systems. The statements appearing in this section for each of courses are very similar, but there are differences. Likewise, the Scientific processes section that follows the introduction section is very similar in all the courses except Engineering Design and Problem Solving, which is organized differently than the other science courses. The comments and recommendations that follow do not apply to the Engineering course.

It seems important that statements and TEKS regarding the nature of science, systems and scientific processes should be consistent in all courses inasmuch as all or most of these courses will be taught in the same campus where should have continuous and consistent opportunities to learn the scientific processes embedded in these TEKS and from curriculum and instruction that is informed by the Introduction section in each course.

This reviewer recommends that the (b) Introduction section, with the exception of part (1), which provides an overall description of the course, and the (c) Scientific processes section be the same for all courses. Because these two sections for the courses are mostly the same, this recommendation seems reasonable. This reviewer has prepared a modified version of these two sections that incorporates most of the differences present in the different courses. The reviewer recommends that this modified version be given serious consideration for use in all courses except Engineering Design and Problem Solving.

(b) Introduction.
(2) Science is a way of knowing about the natural world. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Scientific explanations may be expressed as a

- Fact: In science, an observation that has been repeatedly confirmed. (NAS, Teaching about Evolution and the Nature of Science p.5)
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including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (NSES, p. 117)

Scientific explanations must adhere to criteria such as: a proposed explanation must be logically consistent; it must abide by the rules of evidence; it must be open to questions and possible modification; and it must be based on historical and current scientific knowledge. (NSES, p. 176) There are other ways of knowing and the methods of science cannot answer all questions.

(3) A system is a defined collection of structures and process that interact. All systems have basic properties that can be described in terms of space, time, energy, and matter. Change and constancy occur in systems and can be observed, measured as patterns. These patterns help to make inferences about past events, predict what will happen next and can change over time. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(4) Investigations and tests are used to learn about the natural world. Students should understand that investigations can answer certain types of questions. Explanations, models, and conclusions built from these investigations may change as new observations are made. Models are tools for understanding the natural world, and explanations are continually tested in science to confirm reliability and explanatory power. Models have limitations and, based on new discoveries, are constantly being modified to more closely reflect the natural world.

(5) Scientific explanations must be based on naturally occurring phenomena, and must be capable of testing by multiple independent researchers. If scientific explanations are based on purported forces that are outside of nature, scientists have no way of testing those explanations. Unless a proposed scientific explanation is framed in a way that some observational evidence could potentially refute it, that explanation cannot be subject to scientific testing.

(c) Knowledge and skills.

(1) Scientific processes. The student conducts laboratory and field investigations for at least 40% of instructional time using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations;

(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials; and

(C) use the school's technology and information systems in a wise and ethical manner.

(2) Scientific processes. The student uses a systematic approach to solve scientific field

and laboratory investigations. The student is expected to:

(A) plan and implement both short- and long-term investigations employing procedures that include asking well-defined questions, formulating testable hypotheses, identifying variables, selecting equipment and technologytesting the hypotheses, and reaching reliable conclusions;

(B) collect and record data and make measurements with accuracy and precision. Express data using scientific notations and SI unites. Identify and quantify uncertainties and their effects in measured data.

(C) demonstrate use of a wide variety of apparatuses, equipment, techniques, and procedures, such as satellite imagery and other remote sensing data, GIS, GPS, computer, probeware, microscopes, telescopes, and others for collecting quantitative and qualitative data;

(D) organize, analyze, evaluate, make inferences, develop conclusions, and predict trends from data;

(E) use mathematical procedures such as algebra, statistics, scientific notation, and significant figures to analyze data; and

(F) express and manipulate physical variables using mathematical processes and interpret the results conceptually within a scientific framework.

(G) communicate valid conclusions using several formats, such as lab reports, labeled drawing, graphic organizers, journals, summaries, oral reports, technical reports, podcasts, power point presentations, presentations, and technical posters.

(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) analyze and evaluate scientific explanations using empirical scientific data and evidence, logical reasoning, and experimental and observational testing;

(B). recognize and analyze alternative explanations, claims, and predictions that are based on student-generated data in laboratory investigations and projects

(C) Recognize the benefits and limitations of using models and modeling to study scientific phenomena

(D) analyze and evaluate current events, news reports, or marketing materials based on data and scientific knowledge;

(E) evaluate the impact of research on scientific thought, society, and public policy;

(F) explore careers in the sciences and science-related fields and collaboration among scientists and with non-scientists

(E) Describe the contributions of a variety of historical and contemporary scientists and the impacts of their research on scientific thought, society, and the environment; and

(F) demonstrate quantitative literacy and technical writing skills in addition to learning the core knowledge of Earth and Space Science.

Strengths and Weaknesses

The "strengths and weaknesses" expectation in Chemistry 112.45 (c) (3) and Astronomy 112.48 (c) (3) is not present in the expectations of any of the draft versions of the other High School science courses and was not included in the edited version of Scientific Processes prepared for this review. This expectation states:

> Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.

As the title Scientific Processes indicates, expectations in this category focus on the process rather than a specific subject or topic. As a result, students are expected to demonstrate the skills or processes defined in the expectation. Unfortunately, this expectation has not been interpreted in this manner. Instead a topic (evolution generally) has been the focus, or target, rather than the need to provide a variety of opportunities for students to learn to "use scientific evidence to analyze, review, and critique scientific explanations" as stated in the expectation. The tendency to focus on evolution rather than the scientific process embedded in the expectation has led to confusion among policy makers, teachers, students, the public, and textbook publishers. Also, the tendency to focus on the topic of evolution rather than the specified scientific processes has led to allegations that the evidence for evolutionary theory is lacking and tainted by controversy. The National Academy of Science's recent report Science, Evolution, and Creationism, speaks to these allegations and the call to "teach the controversy" regarding evolution by stating there are questions about "how evolution occurs, not whether evolution occurs." This report also asserted that arguments "suggesting that there are fundamental weaknesses in the science of evolution are unwarranted based on the overwhelming evidence that supports the theory."

The draft version of the TEKS for Biology and some of the other science courses has the following expectation in the Scientific Processes section:

> Analyze and evaluate scientific explanations, using empirical evidence, logical reasoning, and experimental and observational testing.

The revised version of the Scientific Processes provided earlier in this document includes this statement, but also states that data bases also should be analyzed and evaluated. This

expectation is aligned with Standards 1A.E and 1.A.4 in the Texas Readiness Standards, which state:

> Formulate appropriate questions to test understanding of natural phenomena.
>
> Rely on reproducible observations of empirical evidence when constructing, analyzing, and evaluating explanations of natural events and processes. (p. 25)

An emphasis on the expectation stated in Biology (c) (3) (A) in all high school science courses as this reviewer recommends would help students meet these two important Texas College Readiness Standards as well as provide them with skills that will contribute to their effectiveness in their future careers and lives. Furthermore, the emphasis on this expectation in all science courses would signal to teachers, publishers, parents, and students that there is an expectation that students should have continued opportunities to learn a set of important skills rather than the expectation of anti-evolutionists that the "strengths of weaknesses" of evolution will be targeted in one or two courses.

How and what one learns about the nature of science as well as the nature and history of the natural world has consequences. When the first cases of AIDS appeared, there were no survivors regardless of medical or other types of interventions. All died. Today, HIV positive individuals have a high probability of surviving. What has changed? Scientific investigations have led to the knowledge needed to slow or combat AIDS. Causality and contingencies were considered. Scientific knowledge and methods were applied. Applications of key research in the area evolutionary science have been very important in combating AIDS.

The use of DNA testing and results is being used routinely to determine the guild and innocence of individuals in courts. The American public supports this use of DNA tests and results. Comparative studies of the DNA of different species have expanded our knowledge of the evolution of life. The American public has been slower to accept the results of such studies and their accompanying conclusions. As stated by Sean B. Carroll in the Making of the Fittest: DNA and the Ultimate Forensic Record of Evolution,

> "It is beyond ironic to ask juries to rely on human genetic variation and DNA evidence in determining the life and liberty of suspects, but to neglect or to undermine the teaching of the basic principles upon which such evidence, and all of biology is founded.

This reviewer, in agreeing with Carroll, strongly recommends that the efforts to have the "strengths and weaknesses" expectations included in the final version of the High School Science Texas Essential Knowledge and Skills be rejected and the material recommended by this reviewer in the Introductory and Scientific Processes sections be approved.

Gerald Skoog
October 27, 2008

K-5 Science TEKS Review
Gerald Skoog, Reviewer

Feedback on the Science TEKS grades K-5

1. Do the TEKS ensure that scientific concepts are presented in accurate and factual manner.

   Overall, the TEKS for grades K-6 were accurately presented. See notations in the draft material for each course made by the reviewer that recommend changes in certain expectations.

2. Is a complete and logical development of scientific concepts for each grade level or course followed?

   There is considerable redundancy in the stated expectations that prevent a logical development of some concepts. See the reviewer's notations in the draft material for each course.

3. Have the correct vocabulary and terminology been used?
   Generally the correct vocabulary and terminology are used. The reviewer made some corrections, which are noted on the drafts.

4. Are the science process skill statements written at the appropriate grade level or course?
   See notations of drafts. Generally, the statements were appropriate.

5. Are the science concept/content statements grade-level appropriate?
   As noted in response 1, there was much redundancy in the expectations that need to eliminated to make them more grade appropriate. The concepts and content described in the Introduction in sections 1-5 were grade appropriate.

6. Do the science TEKS have Student Expectations (SEs) that are aligned with the knowledge and skill statements.
   The alignment is satisfactory overall. Notations were made by the reviewer on the draft when perceived problems with the expectations existed.

7. Are the Student Expectations (SEs) clear and specific?
   The expectations are not clear and specific uniformly. See the reviewer's notations on the course drafts.

Kindergarten

TEKS 5-9 Science Content

NO CHANGES RECOMMENDED FOR THESE TEKS

Grade 1

TEKS 5-9 Science Content

NO CHANGES RECOMMENDED FOR THESE TEKS

Grade 2

IN (A) INTRODUCTION (2) IN GRADE 1 STUDENTS ARE ASKED TO SEPARATE LIVING ORGANISMS AND NONLIVING ORGANISMS INTO GROUPS WHEREAS IN GRADE 2 STUDENTS ARE ASKED TO DISTINGUISH BETWEEN CHARACTERISTICS OF LIVING ORGANISMS AND NONLIVING OBJECTS. IT WOULD SEEM DIFFICULT TO MEET THE EXPECTATION IN GRADE 1 WITHOUT KNOWING WHAT IS EXPECTED IN GRADE 2. IN GRADE 1 STUDENTS ARE EXPECTED TO IDENTIFY BASIC NEEDS OF LIVING THINGS WHEREAS IN GRADE 2 STUDENTS ARE EXPECTED TO COMPARE THE LIFELONG NEEDS OF PLANTS AND ANIMALS. THESE EXPECTATIONS OVERLAP.

THE TEKS IN GRADE 2 APPEAR TO BE ARTICULATED WITH THOSE IN GRADE 3, BUT PROBLEMS WITH REDUNDANCY EXIST. FOR EXAMPLE IN GRADE 1 STUDENTS CLASSIFY OBJECTS ON THE BASIS OF THE PROPERTIES OF THE MATERIALS THEY ARE MADE OF. THEY ALSO OBSERVE, IDENTIFY, AND RECORD STATES OF MATTER SUCH AS FOR A ROCK, MILK, AND AIR. IN GRADE 2 STUDENTS CLASSIFY MATTERS BY PHYSICAL PROPERTIES (COLOR, TEXTURE, FLEXIBILITY). IN GRADE 1 STUDENTS IDENTIFY COMMON OBJECTS ATTRACTED TO MAGNETS WHEREAS IN GRADE 2 STUDENTS LEARN AND DESCRIBE HOW A MAGNET CAN BE USED TO PUSH OR PULL AN OBJECT. SEEMINGLY BOTH OF THESE EXPECTATIONS COULD BE ACHIEVED AT EITHER GRADE 1 OR GRADE 2. BY LIMITING EACH OF THESE EXPECTATIONS TO EXPERIENCES IN SEPARATE GRADES OPPORTUNITIES FOR LEARNING ARE BEING PASSED UP. THE PROBLEM OF REDUNDANCY CONTINUES TO OCCUR IN LATER GRADES.

THE TEKS FOR GRADE 2 ARE STATED CORRECTLY, BUT CONSIDERATION NEEDS TO BE GIVEN TO REVISING THEM TO ELIMINATE THE REDUNDANCY.

Grade 3 (my comments are in CAPS; deletions can be identified by the strikethroughs.

(b) **Knowledge and Skills**
NO CHANGES RECOMMENDED FOR (1), (2), OR (4).

(3) Scientific investigation and reasoning. The student knows that information, critical thinking, and scientific problem solving are used in making decisions. The student is expected to:
(B) draw inferences and evaluate accuracy of product claims found in advertisements and labels, such as toys and food;
THE REQUIREMENT TO DRAW INFERENCES AND EVALUATE THESE CLAIMS MAY BE TOO COMPLEX FOR GRADE 3 STUDENTS. I HAVE TAUGHT STUDENTS IN HIGH SCHOOL CHEMISTRY THAT HAD DIFFICULTY IN DISTINGUISHING BETWEEN AN OBSERVATION AND AN INFERENCE

(C) connect grade level appropriate science concepts with the history of science and contributions of scientists such as George Washington Carver, Maria Mitchell, and Alejandro Acevedo-Gutiérrez; and GOOD IDEA, BUT IS IT PLAUSIBLE?

(D) represent the natural world using models such as volcanoes or sun/earth/moon, and identify their limitations including size/scale and properties/materials.
I DOUBT THAT 3RD GRADERS HAVE THE MATH SKILLS AND LEVEL OF REASONING TO CONSIDER SCALE OTHER THAN THE MODEL IS BIGGER OR SMALLE THAN THE OBJECT BEING MODELED. THESE TEKS MIGHT BE MORE DOABLE IF THE EXPECTATION WAS THAT MODELS WERE TO BE MADE OF SOMETHING THAT STUDENTS COULD TOUCH AND SEE FIRSTHAND. EXAMPLE: A LARGE BONE; TEETH FROM A CARNIVORE AND FROM A HERBIVORE.

(5) Matter and Energy
(B) THIS EXPECTATION REQUIRES STUDENTS TO CLASSIFY MATTER AS A SOLID, LIQUID, OR GAS. STUDENTS WERE EXPECTED TO CLASSIFY MATTER IN GRADES 2 AND 3. IN GRADE 3 THE TERMS SOLID, LIQUID, AND GAS WERE USED. AS A RESULT, IT SEEMS THAT STUDENTS SHOULD HAVE MET THIS EXPECTATION IN GRADE 2.

(6) Force, motion, and energy.
GRADE 1 EXPECTATION (A) REQUIRES STUDENTS TO KNOW THAT ENERGY EXISTS IN MANY DIFFERENT FORMS SUCH AS MAGNETISM, LIGHT, AND SOUND. IN GRADE 2 THE EXPECTATION REQUIRES STUDENT TO GIVE EXAMPLES OF HOW DIFFERENT FORMS OF ENERGY SUCH AS LIGHT, SOUND, AND HEAT ARE IMPORTANT IN EVERYDAY LIFE. IN GRADE 3 STUDENTS ARE EXPECTED TO CLASSIFY AND COMPARE DIFFERENT FORMS OF ENERGY (MAGNETISM, LIGHT, SOUND, HEAT) IN EVERYDAY LIFE. IT WOULD SEEM THAT STUDENTS WOULD HAVE BEGAN TO CLASSIFY THESE FORMS OF ENERGY IN GRADE 2. WHY LEAVE THE EXPECTATION RELATED TO CLASSIFICATION UNTIL GRADE 3.

(8) Organisms and environments. The student knows that organisms have characteristics that help them survive and describes patterns, cycles, systems, and relationships within their environments. The student is expected to:

(A) investigate structures and functions of plants and animals; THIS EXPECTATION IS TOO VAGUE AND IS NOT CONNECTED TO THE TEKS ABOVE

(B) observe and describe the habitats of plants and animals within an ecosystem such as where they grow, reproduce, and compete for food, air, water, space, and light;
THIS EXPECTATION WOULD BE CLEARER AND TIED IN WITH TEKS 8 IF STATED AS: DESCRIBE THE RELATIONSHIP BETWEEN THE CHARACTERISTICS OF CERTAIN ANIMALS (JACK RABBIT, WOLF, EAGLE, ETC.) AND THEIR HABITAT. DESCRIBE THIS RELATIONSHIP FOR CERTAIN PLANTS (CACTUS, GRASS, ETC.)

(C) describe environmental changes such as floods and droughts where some organisms thrive and others perish, or move to new locations; and THIS EXPECTATION NEEDS TO BE MORE CLOSELY RELATED TO THE TEKS BY EXPECTING STUDENTS TO BE ABLE TO DESCRIBE OR IDENTIFY CHARACTERISTICS THAT HELPED A SPECIFIC ORGANISM SURVIVE A SPECIFIC ENVIRONMENTAL CHANGE.

CONSIDERATION SHOULD BE GIVEN TO INTRODUCING THE TERM ADAPTATION HERE RATHER THAN WAITING UNTIL GRADE 3

End of Grade 3

GRADE 4

(a) Introduction

(2) …what can cause changes in states of matter. THIS WAS EMPHASIZED IN GRADE 3 (b) 5C

(3) …differentiate among the different forms of energy. THIS WAS EMPHASIZED IN GRADE 3 IN (a) c.

(**(b) Knowledge and Skills**

NO CHANGES RECOMMENDED FOR (1), (2) OR (4)

(3) Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(B) draw inferences and evaluate accuracy of services and product claims found in advertisements and labels, such as toys, food, and sunscreen; DIFFICULT FOR A 3RD GRADER TO DISTINGUISH BETWEEN AN INFERENCE AND AN OBSERVATION. THE EXPECTATION SHOULD REQUIRE ONLY EVALUATION.

(C) represent the natural world using models, such as rivers, stream tables or fossils. Identify their limitations, including accuracy, size, distance, and accessibility; and DISTANCE AND ACCESSIBILITY ARE REASONS THAT MODELS MIGHT BE USED, BUT CAN'T BE CONSIDERED A LIMITATION OF A MODEL.

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

(A) observe, compare and contrast basic physical properties of matter including size; mass; relative hardness; volume, states-solid, liquid, gas; shape; color; temperature; magnetism; and the ability to sink or float; THE UNDERLINED PROPERTIES WERE EMPHASIZED IN GRADE 3. SPIRALING CONCEPTS THROUGH CURRICULUM MATERIALS AND GRADES IS A SOUND PRACTICE. HOWEVER, THE EXPECTATIONS SHOULD BE DIFFERENT OR MORE COMPLEX

(B) predict the changes caused by the addition or reduction of heat, such as, ice becoming liquid water, and condensation forming on the outside of a glass of ice water; and

NOT MUCH DIFFERENT THAN AN EXPECTATION IN GRADE 3

(C) compare and contrast a variety of mixtures and solutions, such as rocks in sand, sand in water, or salt in water or instant tea in water.

SIMILAR TO 5 D IN GRADE 3

(6) Force, motion and energy. The student knows that energy, force and motion can be

observed, described, and predicted in nature. The student is expected to:
(A) differentiate among forms of energy including sound, electricity, magnetism, wind, solar, light, and heat;
SIMILAR TO EXPECTATION IN GRADE 3; STUDENTS AT THIS LEVEL SHOULD BE ABLE TO EXPLORE THE RELATIONSHIP BETWEEN ELECTRICITY AND MAGNETISM.

(G) explore ways that opposite poles of magnets attract while like poles repel and that magnets are attracted to some metals.
WHEN STUDENTS MANIPULATED MAGNETS IN GRADE 3 IT SEEMS THEY WOULD HAVE LEARNED ABOUT THE REPULSION AND ATTRACTION OF POLES AND THAT MAGNETS ARE ATTRACTED TO SOME, BUT NOT ALL METALS.

(7) Earth and space. The students know that Earth materials have properties that are constantly changing due to the Earth's forces. The student is expected to:
(A) compare and contrast observable effects on school playground of weathering and erosion by water and wind;
IN SOME WAYS, THE EXPECTATIONS FOR A RELATED EARTH AND SPACE TEKS SEEM TO REQUIRE MORE KNOWLEDGE AND GO INTO MORE DEPTH FOR THIS PARTICULAR TEKS.
(B) compare and contrast sand, silt, clay, humus, and loam, using properties, such as, color, particle size, texture, capacity to retain water, and the ability to support the growth of plants, including those in our food supply;

(C) recognize that some rocks are formed from the deposition of sediments;
(F) use models to observe fossils found in rock layers.
THIS EXPECTATION NEEDS TO BE REWORDED AS MODELS AREN'T USED TO OBSERVE FOSSILS IN ROCK LAYERS. MODELS ARE USED TO REPRESENT FOSSILS THAT ARE INACCESSIBLE FOR SOME REASON. SUBSTITUTE EXPECTATION?? COMPARE THE PROPERTIES OF A REAL FOSSIL WITH THAT OF A MODEL OF A FOSSIL.

(8) Earth and space. The student knows that weather changes from day to day and over the
seasons, and is also responsible for many catastrophic events. The student is expected to:
(B) explain the role of the Sun and ocean in the water cycle.
THIS EXPECTATION WAS STATED IN GRADE 3

(9) Earth and space. The student knows the relationship among the Earth, moon, and Sun.
The student is expected to:

(B) compare and contrast the relative size, position and motion of the Earth, moon, and planets; and position of the stars, including the Sun; and
THIS EXPECTATION WAS STATED IN GRADE 3

(10) 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:

(D) predict the effects of changes in habitats caused by living organisms including humans that can be beneficial or harmful; and
SHOULD BE REWORDED AS IT IS STATED AWKWARDLY; DESCRIBE THE BENEFICIAL AND/OR HARMFUL CHANGES IN HABITATS CAUSED BY HUMANS.

(E) explore how adaptations SUCH AS DIFFERENT BIRD BEAKS OR LEAVES ON DIFFERENT PLANTS ~~enable~~ HELP organisms to survive in ~~their~~ SPECIFIC environment, ~~such as comparing birds' beaks and leaves on plants.~~

End of Grade 4

Science, Grade 5

(a) Introduction.
((2) Within in the living environment the students learn that adaptations can improve the survival RATE of members of a species. Students learn that THERE ARE NATURALLY OCCURING cycles THAT ARE IMPORTANT FOR LIVING THINGS. ~~occur naturally to support the living environment.~~

(3) Within the physical environment the students learn THAT slow and rapid changes occur on the Earth's surface, and that predictable patterns EXIST ~~occur~~ in the sky and our solar system.

(b) Knowledge and skills.

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

(A) describe, plan and implement simple experimental investigations testing one variable;
CONSIDERATION SHOULD BE GIVEN TO EMPHASIZING VARIABLES IN 3RD OR 4TH GRADE, WHICH IS DONE IN THE FOSS PROGRAM, WHICH IS USED IN TEXAS

(3) Scientific investigation and reasoning. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:

(A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information; THIS EXPECTATION SEEMS OUT OF PLACE FOR 5TH GRADERS, WHO ARE STILL THINKING AT THE CONCRETE LEVEL. FURTHERMORE, THE REQUIRED TEKS IN GRADES K-5 HAVE NOT REQUIRED OR EXPECTED THE TYPE OR DEPTH OF KNOWLEDGE NEEDED TO IDENTIFY STRENGTHS AND WEAKNESS OF HYPOTHESES AND THEORIES. FURTHERMORE, STUDENTS HAVE NOT BEEN EXPECTED TO KNOW AND BE ABLE TO DIFFERENTIATE BETWEEN THEORIES AND HYPOTHESES. IF THIS TEKS IS REQUIRED, THE TEKS IN GRADES K-5 NEED TO BE REVISED TO REQUIRE A BROADER AND DEEPER KNOWLEDGE OF THE SCIENTIFIC CONTENT AND PROCESSES. STUDENTS AT THIS LEVEL ARE CAPABLE OF MEETING THE RECOMMENDED REVISION, WHICH FOLLOWS.

POSSIBLE REVISION: USE SCIENTIFIC EVIDENCE AND DATA SETS TO DEVELOP AND EVALUATE SCIENTIFIC EXPLANATIONS.

(B) draw inferences based on information related to promotional materials for products and services such as nutritional labels; and
5TH GRADERS ARE LIKELY TO HAVE DIFFICULTY IN DIFFERENTIATING BETWEEN INFERENCES AND OBSERVATIONS. STATE THE EXPECATION A: EVALUATE THE ACCURACY OF THE INFORMATION….

(C) represent the natural world using models and identify their limitations.
THIS EXPECTATION IS TOO VAGUE. SUBSTITUTE: DRAW OR DEVELOP A MODEL THAT REPRESENTS HOW SOMETHING WORKS OR LOOKS THAT CAN'T BE SEEN (EXAMPLE: ELECTRICAL CIRCUIT IN A COLORED LIGHT BULB; HOW A SODA DISPENSING MACHINE WORKS, ETC.) IDENTIFY THE LIMITATIONS OF THE MODEL DEVELOPED.

(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:
NO CHANGES RECOMMENDED

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

(A) classify matter based on physical properties including: mass, magnetism, physical state (solid, liquid, gas), relative density (sinking and floating), solubility, and the ability to be a conductor or insulator of heat, and electricity; and THIS EXPECTATION OVERLAPS SOMEWHAT WITH THE EXPECTATIONS IN EARLIER GRADES

(7) 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 light, heat, electrical, solar,THESE FORMS OF ENERGY WERE DIFFERENTIATED IN GRADE 4; and
sound energy and recognize that energy is the ability to cause motion or create change;
IT IS DIFFICULT FOR STUDENTS TO GRASP THE CONCEPT OF ENERGY INASMUCH AS IT'S NOT VISIBLE. THUS, IT IS DIFFICULT TO DEFINE IN AN UNDERSTANDABLE MANNER. DESPITE THIS, IT SEEMS ENERGY SHOULD BE DEFINED IN AN EARLIER GRADE INASMUCH AS THE TERM IS USED REPEATEDLY IN EARLIER GRADES.

(B) demonstrate the flow of electricity in circuits requires a complete loop through which an electric current can pass and can BE USED TO produce light, heat, and sound; and CIRCUITS WERE EMPHASIZED IN GRADE 4 AND THE NEED FOR A COMPLETE LOOP TO MAKE A CIRCUIT SHOULD BE EMPHASIZED THEN

(C) demonstrate THAT **1)** light travels in a straight line until it strikes an object or

travels from one medium to another and demonstrate **2)** light can be reflected BY mirrors AND OTHER SHINY SURFACES **3)** THAT LIGHT IS BENT OR refracted BY ~~an object through~~ water, WHICH CAN BE DEMONSTRATED BY PLACING A STICK IN A GLASS OF WATER.

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

(A) differentiate between weather and climate; and

(B) explain the role of the ocean in the water cycle. DID IN GRADE 4 (8) (B)

(11) Earth and space. The student knows the natural world consists of useful resources. The student is expected to:

(A) identify Earth's renewable resources including air, plants, water, animals and nonrenewable resources including coal, oil, natural gas; THIS EXPECTATION IS VERY SIMILAR TO THAT FOUND IN GRADE 3 (7) (D) AND GRADE 4 7(E)

(B) sequence past events that led to the formation of soils and fossil fuels; and

(C) ~~examine~~ COMPARE THE ADVANTAGES AND DISADVANTAGES OF alternative energy resources such as wind, solar, hydroelectric, and biofuels.

(12) Organisms and environments. The student knows that adaptations affect an organism's ability to survive. The student is expected to:

(A) explain how organisms use their adaptations to modify their environment to insure survival such as beavers using their tails to build dams and animals burrowing during forest fires and how these changes may affect the environment. NOT A GOOD EXAMPLE. MOST STUDENTS HAVE NEVER SEEN A BEAVER (I HAVEN'T) OR A FOREST FIRE. RESTATE: INDENTIFY ADAPTATIONS OF AN ANIMAL IN YOUR NEIGHBORHOOD AND DESCRIBE HOW THESE ADAPTATIONS HELP THE ANIMAL LIVE AND SURVIVE.

(13) Organisms and environments. The student knows that interactions occur between organisms and the environment. The student is expected to:

(A) describe how the flow of energy derived from the Sun, used by producers to create food through photosynthesis, is transferred through a food chain and food web to consumers and decomposers. VERY SIMILAR TO GRADE 4 (10) (b) EXCEPT FOR THE ADDITION OF THE TERMS CONSUMERS AND DECOMPOSERS.

(14) Organisms and environments. The student knows the development of plants and animals occurs in cycles. The student is expected to:

(A) DESCIRBE THE DIFFERENCES IN THE metamorphosis ~~in~~ OF butterflies AND FROGS WITH THE metamorphosis in crickets and grasshoppers; and direct development such as in flowering plants and mammals. I WONDER ABOUT THE USE OF "DIRECT DEVELOPMENT" HERE.

(15) Organisms and environments. The student knows that a system is a collection of cycle, structures, and processes that interact. The student is expected to:

(A) identify the significance of the carbon dioxide/oxygen cycle on land and in the ocean and water cycle in the environment including the plant's role in sustaining animal life and the Sun's role as the driving force in these cycles.
THE CARBON DIOXIDE/OXYGEN CYCLE IS NOT INVOLVED IN THE WATER CYCLE.

SUBSITUTE EXPECTATION: IDENTIFY AND DESCRIBE 2 OR 3 CYCLES THAT OCCUR IN NATURE AND EXPLAIN WHY THEY ARE ESSENTIAL FOR LIFE.

End of Grade 5

Science TEKS Grade 6-8 Review
Gerald Skoog, Reviewer

Feedback on the Science TEKS grades 6-8

1. Do the TEKS ensure that scientific concepts are presented in accurate and factual manner.

   Overall, the TEKS for grades 6-8 were accurately presented. See notations in the draft material for each course made by the reviewer that recommend changes in certain expectations.

2. Is a complete and logical development of scientific concepts for each grade level or course followed?

   There is a slight amount redundancy in the stated expectations that prevent a logical development of some concepts. See the reviewer's notations in the draft material for each course.

3. Have the correct vocabulary and terminology been used?
   Generally the correct vocabulary and terminology are used. The reviewer made some corrections, which are noted on the drafts.

4. Are the science process skill statements written at the appropriate grade level or course?
   See notations of drafts. Generally, the statements were appropriate. Some additions were made.

5. Are the science concept/content statements grade-level appropriate?
   The concepts and content described in the (3) Strands A, B, C, D, and E were grade appropriate and well-written.

6. Do the science TEKS have Student Expectations (SEs) that are aligned with the knowledge and skill statements.
   The alignment is satisfactory overall. Notations were made by the reviewer on the draft when perceived problems with the expectations existed.

7. Are the Student Expectations (SEs) clear and specific?
   The expectations are not clear and specific uniformly. See the reviewer's notations on the course drafts.

REVIEW OF TEKS FOR MIDDLE SCHOOL SCIENCE, GRADES 6-8

Recommended changes are printed in CAPS
Recommended deletions are crossed out

Science, Grade 6

(a) Introduction.

NO CHANGES ARE RECOMMENDED FOR (a) (1) (2) (3) (A) (i) (ii). & (iii). (3) (A) (iv) SHOULD BE ADDED AS FOLLOWS:
(iv) STUDENTS SHOULD BE ABLE TO (1) DEFINE SCIENCE, (2) DISTINGUISH BETWEEN THE TERMS FACT, HYPOTHESIS, THEORY, LAW & MODEL AND (3) USE THESE TERMS AS DEFINED AS FOLLOWS:
Science is a way of knowing about the natural world. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Scientific explanations may be expressed as a

- Fact: In science, an observation that has been repeatedly confirmed. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Hypothesis: A testable statement about the natural world that can be used to build more complex inferences and explanations. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Theory: In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Law: A descriptive generalization about how some aspect of the natural world behaves under stated circumstances. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Model: A tentative scheme or structure that corresponds to real objects, events, or classes of events, and that have explanatory power. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (NSES, p. 117)

NO CHANGES ARE RECOMMENDED FOR (3) (B), (C), (D) & (E).

(b) Knowledge and Skills
(5) Matter and energy. The student knows the difference between elements and compounds. The student is expected to:

(A) know the characteristics of matter; THIS EXPECTATION IS VAGUE. ARE

CHARACTERISTICS THE SAME AS PROPERTIES? ALSO A SIMILAR EXPECTATION WAS GIVEN IN GRADE 2 (5) (A) WHERE STUDENTS ARE EXPECTED TO CLASSIFY MATTER BY PHYSICAL PROPERTIES. THE CHARACTERISTICS OF PROPERTIES CONTINUED TO BE EMPHASIZED IN GRADES 3, 4, AND 5.

(D) compare and contrast elements and compounds; and RECONSIDER THE WORDING USED HERE. BECAUSE OF THE EXPECTATIONS IN SECTION (6), THIS EXPECTATION MAY BE UNECESSARY OR REPITITIOUS.

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

(A) classify elements as metals, nonmetals or metalloids by the physical properties such as luster, conductivity or malleability; CLASSIFYING METALLOIDS IN AN ACTIVITY MAY BE SOMEWHAT DIFFICULT TO DO. IT'S LESS OF A PROBLEM USING THE PERIODIC TABLE. CHANGE THE EXPECTATION TO "COMPARE METALS AND NONMETALS ON THE BASIS OF PHYSICAL PROPERTIES SUCH AS …..

(B) identify the density of substances such as metal, wood, or plastic; IDENTIFY MAY NOT BE BEST VERB TO USE. IS THE EXPECTATION THAT THE STUDENT COMPARE OR CALCULATE THE DENSITIES OF THESE SUBSTANCES?

(C) demonstrate that new substances can be made when two or more substances are chemically combined and compare the properties of the new substances to the original substance;

(D) recognize elements combine to form compounds that ~~can be~~ ARE represented by a chemical formula;

(E) identify the physical properties of minerals including hardness, color, luster, and explain how minerals can be tested for these different physical properties; and THIS EXPECTATION IS APPROPRIATE IF MINERALS HAVE BEEN DEFINED AND DIFFERENTIATED.

(9) Force, motion, and energy. The student knows that many of the Earth's energy resources are available on a perpetual basis, while others can be replenished over a relatively short period of time. Some energy sources, once depleted, are essentially nonrenewable. The student is expected to:

(A) distinguish between renewable, nonrenewable, and inexhaustible resources; RENEWAL AND NONRENEWABLE RESOURCES WERE IDENTIFIED IN GRADE 5 (11) (a) AND IN THE EXPECTATIONS OF EARLIER GRADES. THIS IS AN IMPORTANT EXPECTATION, BUT THERE IS TOO MUCH REPETITION. THE

FOLLOWING EXPECTATION SEEMS SUFFICIENT

(B) investigate and debate the advantages and disadvantages of using coal, oil, natural gas, nuclear power, wood, wind, hydro power, geothermal, and solar resources; and

(C) design a logical plan to manage energy resources in the home, school or community. THIS IS AN APPROPRIATE EXPECTATION, BUT TIME TO ACCESS NEEDED INFORMATION FROM VARIOUS SOURCES AND TO DEVELOP THE DESIGN WILL BE NEEDED.

(10) Earth and space. The student understands the cyclical nature of Earth systems. The
student is expected to:

(A) classify rocks ~~a~~ AS metamorphic, igneous, and sedimentary based on the processes that create them;

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

(A) compare the relative sizes and distances between objects in the solar system including the sun, planets and their moons, meteors, asteroids, and comets; THESE COMPARISONS OF THE SUN, PLANETS, AND THEIR MOONS (THIS SUGGESTS THE SUN MAY HAVE MOONS) WERE COMPLETED IN GRADE 4 (9) (b). ALSO, BECAUSE OF THE MAGNITUDE OF THE DISTANCES AND THE IRREGULARITY OF THE DISTANCES OF ASTEROIDS AND COMETS TO THE EARTH, A RELATIVE COMPARISON OF DISTANCES MAY BE DIFFICULT. A MORE APPROPRIATE EXPECTATION IS: DESCRIBE THE PROPERTIES, LOCATIONS, AND MOVEMENTS OF THE SUN, PLANETS, MOONS OF SPECIFIC PLANETS, METEORS, ASTEROIDS, AND COMETS.

(B) identify characteristics of the components of the solar system; and THE REWORDING PROVIDED FOR (A) COULD REPLACE THIS EXPECTATION. IF KEPT, EXPECTATION (B) SHOULD USE A DIFFERENT WORD THAN COMPONENTS.

(12) Organisms and environments. All organisms are classified into Kingdoms. Organisms within the Kingdoms share similar structures, which allow them to respond to the living and nonliving parts of their ecosystem. The student is expected to:

(B) analyze how structure relates to function in the classification of living EXTINCT ORGANISMS ARE CLASSIFIED ALSO organisms; THE RELATIONSHIP OF

STRUCTURE TO FUNCTION IS AN IMPORTANT CONCEPT IN BIOLOGY. HOWEVER, THIS EXPECTATION AS STATED IS CONFUSING. SUBSTITUTE EXPECTATION: DESCRIBE AND PROVIDE EXAMPLES OF HOW STRUCTURE ARE USED IN THE CLASSIFICATION OF ORGANISMS.

(C) identify responses in organisms to internal stimuli like hunger and thirst and external stimuli like temperature and light;
VERY FEW ORGANISMS EXPERIENCE HUNGER AND THIRST DESPITE THEIR NEED FOR FOOD AND WATER.

(E) predict whether an organism can survive in a particular ecosystem; ALTERNATIVE: ANALYZE HOW CHANGES TO A PARTICULAR ECOSYSTEM COULD THREATEN THE SURVIVAL OF A SPECIFIC ORGANISM LIVING THERE

(G) distinguish between characteristics of an organism resulting from inheritance and from interactions with the environment. BECAUSE OF THE DUAL INFLUENCE OF GENES AND ENVIRONMENT IN ORGANISMS THIS EXPECTATION COULD BE DIFFICULT TO ACHIEVE. ALTERNATIVE EXPECTATION: DESCRIBE HOW INTERACTIONS OF A SPECIFIC PLANT OR ANIMALS WITHIN A GIVEN ENVIRONMENT MAY INFLUENCE ITS PHYSICAL OR BEHAVIORAL CHARACTERISTICS.

Science, Grade 7

(a) Introduction.

(a) Introduction.
NO CHANGES RECOMMENDED FOR SECTIONS (1) AND (2).
PART (1V) SHOULD BE ADDED TO STRAND A AND STATE THE FOLLOWING:

(iv) STUDENTS SHOULD BE ABLE TO (1) DEFINE SCIENCE, (2) DISTINGUISH BETWEEN THE TERMS FACT, HYPOTHESIS, THEORY, LAW & MODEL AND (3) USE THESE TERMS AS DEFINED AS FOLLOWS:
Science is a way of knowing about the natural world. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Scientific explanations may be expressed as a

- Fact: In science, an observation that has been repeatedly confirmed. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Hypothesis: A testable statement about the natural world that can be used to build more complex inferences and explanations. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Theory: In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Law: A descriptive generalization about how some aspect of the natural world behaves under stated circumstances. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Model: A tentative scheme or structure that corresponds to real objects, events, or classes of events, and that have explanatory power. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (NSES, p. 117)

NO CHANGES RECOMMENDED FOR SECTION (3) STRANDS (A), (B), (C), (D) AND (E)
NOTE: THERE ARE TWO (A)'S LISTED UNDER (a) Introduction. THIS REVIEWER HAS FOUND THE LABELING OF THE PARTS OF THESE DOCUMENTS CUMBERSOME BECAUSE OF THE ()'S AND DIFFERNTIATION BETWEEN LETTERS THAT ARE IN LARGE CAPS AND SMALL CAPS. I THINK A NUMBERING SYSTEM WOULD BE LESS CUMBERSOME!!!

(b) Knowledge and Skills

NO CHANGES ARE RECOMMENDED FOR PARTS (1), (2), (3) & (4). HOWEVER CONSIDERATION SHOULD BE GIVEN TO MAKING (2) C, D, E, AND F THE SAME IN GRADES 7 AND 8. THE VERSION GIVEN IN GRADE 7 IS PREFERABLE.

CHANGES ARE WRITTEN IN CAPS
DELETIONS ARE IDENTIFIED BY STRIKETHROUGHS

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

NO CHANGES RECOMMENDEDED FOR THE 4 EXPECTATIONS FOR THIS TEKS

(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 THAT are made UP of one or more carbon atoms and ~~other~~ elements such as hydrogen, oxygen, phosphorus, nitrogen or sulfur;

(B) identify and classify substances as acids, bases or neutral substances;

(C) investigate how matter can undergo a physical change ~~such as~~ in A PROCESS SUCH AS digestion;

(D) ~~demonstrate a~~ DESCRIBE THE chemical changes THAT OCCUR WHEN compounds AND/OR ELEMENTS form new substances ~~such as~~ in ~~the~~ processes ~~of~~ SUCH AS photosynthesis, cellular respiration, or chemical digestion; and

(E) describe how large molecules such as proteins, lipids, and carbohydrates are essential for chemical changes within cells such as combining amino acids to form proteins or simple sugars to make a complex carbohydrate.
ALTERNATIVE EXPECTATION: EXPLAIN HOW LARGE MOLECULES SUCH AS PROTEINS, LIPIDS, AND CARBOHYDRATES ARE FORMED FROM SIMPLER SUBSTANCES SUCH AS AMINO ACIDS AND SIMPLE SUGARS

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

(A) relate forces to basic processes in living organisms including the flow of blood, and the interactions between body systems, such as motion of muscles and bones; THIS EXPECTATION DOESN'T SEEM APPROPRIATE. ALTERNATIVE: DEMONSTRATE THAT WHENEVER AN OBJECT SPEEDS UP, SLOWS DOWN, OR CHANGES DIRECTION, AN UNBALANCED FORCE IS ACTING ON THE OBJECT.

(B) demonstrate and illustrate forces that affect motion in everyday life, such as DONE BY FRICTION OR GRAVITY.

(C) ~~recognize and~~ USE A diagram TO SHOW HOW LIGHT REFLECTING OFF A SPECIFIC OBJECT IS REFRACTED IN THE LENS OF A HUMAN EYE ~~how an object is seen by its light refracting through the lens of the eye.~~

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

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

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

(C) model relationships between ground water and surface water in a watershed.

(9) Earth and space science. The student knows components of our solar system. The student is expected to: THIS TEKS, OR SOME VERSION OF IT, IS PRESENT IN SEVERAL EARLIER GRADES. IT'S TIME FOR SOMETHING DIFFERENT HERE! THERE ARE MANY CONCEPTS RELATED TO THE STRUCTURE OF THE EARTH SYSTEM THAT SHOULD BE EMPHASIZED IN GRADES 7 & 8. SOME OF THESE CONCEPTS FROM *THE NATIONAL SCIENCE EDUCATION STANDARDS* (NSSE) ARE AS FOLLOWS:

THE SOLID EARTH IS LAYERED WITH A LITHOSPHERE; HOT, CONVECTING MANTLE: AND DENSE METALLIC CORE. (P. 160)

LITHOSPHERIC PLATES ON THE SCALES OF CONTINENTS AND OCEANS CONSTANTLY MOVE AT RATES OF CENTIMETERS PER YEAR IN RESPONSE TO MOVEMENTS IN THE MANTLE. MAJOR GEOLOGICAL EVENTS SUCH AS EARTHQUAKES, VOLCANIC ERUPTIONS, AND MOUNTAIN BUILDING, RESULT FROM THESE PLATE MOVEMENTS. (P. 160) EXPECTATIONS RELATED TO PLATE TECTONICS IN GRADE 8 MAY NEED TO EMPHASIZED IN GRADE 7

SOME CHANGES IN THE SOLID EARTH CAN BE DESCRIBED AS THE "ROCK CYCLE." (p. 160)

THE EARTH PROCESSES WE SEE TODAY, INCLUDING EROSION, MOVEMENT OF LITHOSPHERIC PLATES, AND CHANGES IN ATMOSPHERIC COMPOSITION ARE SIMILAR TO THOSE THAT OCCURRED IN THE PAST. EARTH HISTORY IS ALSO INFLUENCED BY OCCASIONAL CATASTROPHES, SUCH AS THE IMPACT OF AN ASTEROID OR COMET. (p. 160)

It's obvious that if any of the aforementioned NSSE standards are used, they need to be reworded to conform to the style used in the TEKS document.

(A) compare the characteristics of Earth to objects in the solar system that allow life to exist; and CONFUSING. ALTERNATIVE: EVALUATE WHETHER THE CHARACTERISTICS OF ANY OF THE PLANETS OF THE SUN HAVE THE CONDITIONS CONSIDERED NECESSARY FOR LIFE AS FOUND ON EARTH.

(B) describe the history and future of space exploration THIS EXPECTATION DOESN'T FIT THE EXISTING TEKS. AS ALREADY STATED, CONSIDERATION NEEDS TO BE GIVEN TO COMPLETELY REVISING THIS TEKS AND THE ACCOMPANYING EXPECTATIONS.

(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 organisms including producers, consumers, and decomposers interact together in an environment and how each use and may compete for existing resources;

(B) observe and describe how different environments, including microclimates in your schoolyard and biomes, support different varieties of organisms; and

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

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

(A) collect organisms, SUCH AS INSECTS OR PLANTS, or their structures, ~~such as insects or leaves,~~ and use dichotomous keys for identification;

(B) explain DESCRIBE the variationS IN THE CHARACTERISTICS OF A SAMPLE OF A SPECIFIC ORGANISM AND ~~comparing~~ COMPAIRE ~~the~~ traits such as external features (SHAPE, COLOR, SIZE, HARDNESS, ETC), behaviors or physiology of THE organisms ~~of different populations or species that enhance their survival;~~

(C) identify some changes in genetic traits IN DOMESTIC CROPS AND ANIMALS AS WELL AS OTHER ORGANISMS SUCH AS REPTILES OR MAMMALS that can HAVE occurED over several generations through natural selection and selective breeding; and

(D) describe the characteristics of two species that may HAVE adaptED to one another through generations such as humming birds and tubular flowers or the Yucca moth and

Yucca plant.

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

(A) investigate and explain how internal structures of organisms ARE ADAPTED TO ~~allow them to~~ perform specific functions, such as gills in fish, hollow bones in birds, or xylem in plants; OR EXPLAIN HOW HOLLOW BONES IN BIRDS OR THICK, WAXY LEAVES ON A DESERT PLANT ILLUSTRATE HOW STRUCTURE IS RELATED TO STRUCTURE IN ORGANISMS.

(B) ~~recognize that according to cell theory all organisms are composed of cells and that they carry on similar functions such as extracting energy from food to sustain life;~~ RECOGNIZE THAT SPECIALIZED CELLS PERFORM SPECIALIZED FUNCTIONS IN MULTICELLULAR ORGANISMS. (NSSE p. 156)

(C) DESCRIBE HOW A SPECIALIZED CELL SUCH AS A MUSCLE CELL OR EGG ILLUSTRATES THE CONCEPT THAT STRUCTURE IS RELATED TO FUNCTION.

(C) ~~compare the functions of a cell to the functions of organisms such as getting rid of waste;~~

(D) differentiate between structure and function in plant and animal cell organelles ~~including such as the~~ (cell membrane, cell wall, nucleus, cytoplasm, mitochondria, chloroplast, and vacuole);

(E) ~~identify~~ DESCRIBE how structure complements function at different levels of organization in ~~plant and animal cells, tissues, organs, organ systems, and organisms;~~ ANIMAL STRUCTURES USED FOR MOVEMENT OR PROTECTION.

(F) identify the main functions of the HUMAN systems ~~of the human organism including the~~
(circulatory, respiratory, skeletal, muscular, digestive, excretory, and reproductive systems); and

(G~~) model and~~ describe interactions among HUMAN systems ~~in human organisms~~ including THE circulatory and respiratory, skeletal and muscular, and digestive and excretory. IT WOULD BE DIFFICULT TO MODEL THESE INTERACTIONS.

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

(A) investigate how organisms respond THROUGH PHOTOTROPISM, HIBERNATION, DORMANCY, MIGRATION, AND OTHER METHODS to external

stimuli found in the environment, ~~such as phototropism and fight or flight; and~~

(B) describe ~~and connect~~ INTERNAL CHANGES THAT OCCUR IN PLANTS AND ANIMALS IN RESPONSE TO CERTAIN EXTERNAL STIMULI SUCH AS EXTREME HEAT OR LACK OF WATER. ~~in organisms that may result from internal stimuli such as wilting in plants and fever or vomiting in animals that allow them to maintain equilibrium.~~

(14) Organisms and environments. The student knows that reproduction is a characteristic of living organisms and that the instructions for traits are contained 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) construct models to ~~identify~~ DEMONSTRATE that sexual reproduction results in more variation i~~n~~ AMONG offspring and asexual reproduction results in more uniform CHARACTERISTICS IN offspring; and

(C) recognize that inherited traits of individuals are GOVERNED BY the genetic materials found in chromosomes and genes. SHOULD DNA BE INTRODUCED IN GRADE 7?

End of Grade 7

Science, Grade 8

(a) Introduction.
NO CHANGES RECOMMENDED FOR SECTIONS (1), (2), AND (3) (A) STRANDS (i), (ii) and (iii) Add (iv) AS FOLLOWS:

(iv) STUDENTS SHOULD BE ABLE TO (iv) STUDENTS SHOULD BE ABLE TO (1) DEFINE SCIENCE, (2) DISTINGUISH BETWEEN THE TERMS FACT, HYPOTHESIS, THEORY, LAW & MODEL AND (3) USE THESE TERMS AS DEFINED AS FOLLOWS:
Science is a way of knowing about the natural world. Scientific explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements. Scientific explanations may be expressed as a

- Fact: In science, an observation that has been repeatedly confirmed. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Hypothesis: A testable statement about the natural world that can be used to build more complex inferences and explanations. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Theory: In science, a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Law: A descriptive generalization about how some aspect of the natural world behaves under stated circumstances. (NAS, *Teaching about Evolution and the Nature of Science* p.5)
- Model: A tentative scheme or structure that corresponds to real objects, events, or classes of events, and that have explanatory power. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations. (NSES, p. 117)

NO CHANGES RECOMMENDED FOR SECTION (3) STRANDS (B), (C), (D) AND (E)

(b) Knowledge and Skills
NO CHANGES ARE RECOMMENDED FOR (b) KNOWLEDGE AND SKILLS (1), (2), (3). AND (4). HOWEVER CONSIDERATION SHOULD BE GIVEN TO MAKING (2) C, D, E, AND F THE SAME IN GRADES 7 AND 8

RECOMMENDED WORD CHANGES ARE WRITTEN IN CAPS. RECOMMENDED DELETIONS ARE REPRESENTED BY STRIKETHROUGHS.

(5) Matter and energy. The student knows that matter is composed of atoms and has

chemical and physical properties. The student is expected to to:

(A) ~~describe the structure of atoms including the masses, electrical charges and locations of~~ KNOW THAT ATOMS ARE MADE OF protons, neutrons and electrons;

(B) COMPARE PROTONS, NEUTRONS, AND ELECTRON IN TERMS OF MASS, ELECTRICAL CHARGE, AND LOCATION WITHIN AN ATOM

(C) ~~identify~~ KNOW that THE NUMBER OF protons IN THE NUCLEUS DETERMINES AN ATOM'S ELECTRON CONFIGURATION AND, AS A RESULT, DEFINES THE ~~determine an~~ element's identity~~, and~~ (NUMBER OF valence electrons, CHEMICAL PROPERTIES SUCH AS REACTIVITY) ~~determine its chemical properties including reactivity~~;

(C) ~~interpret~~ USE the arrangement of ELEMENTS, GROUPS, AND PERIODS ON the periodic table ~~including groups and periods,~~ to explain ~~how~~ WHY physical properties, such as malleability and conductivity, are SIMILAR IN SOME ELEMENTS AND, AS A RESULT, used to classify elements;

(D) investigate and EXPLAIN WHY THE PRODUCTION OF A GAS, A CHANGE IN TEMPERATURE, THE FORMATION OF A PRECIPITATE OR A COLOR CHANGE ~~produce~~ IS evidence of a chemical reaction ~~such as production of a gas, change in temperature, formation of a precipitate or color change~~; and

(E) write CORRECT chemical formulas and BALANCED CHEMICAL equations ~~to~~ THAT REPRESENTS what happens in a chemical reaction AND the law of conservation of mass. ~~through balancing equations~~.

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

(A) model and illustrate how the tilt of the Earth on its axis as it rotates and revolves around the sun causes changes in seasons and the length of a day;

(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 such as stars, nebulae and galaxies;

(B) KNOW THAT THE SUN IS A MEDIUM-SIZED STAR LOCATED NEAR THE EDGE OF A DISC SHAPED GALAXY OF STARS (AAAS BENCHMARK)

(C) KNOW THAT THE SUN IS MANY THOUSANDS OF TIMES CLOSER TO THE EARTH THAN ANY OTHER STAR AND THAT LIGHT FROM THE SUN TAKES A FEW MINUTES TO REACH THE EARTH (AAAS BENCHMARKS)

(D) 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;

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

(D) research how data are used AS EVIDENCE to develop scientific theories ~~of~~ TO EXPLAIN the origin of the universe.

(9) Earth and space. The student knows that natural events can alter 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;

(C) explain the relationship between plate tectonics and the rock cycle; and

(D) interpret topographic maps to identify land and erosional features and predict how these features ~~can~~ MAY be reshaped by weathering.

(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:

(D) describe how human activities have modified THE EARTH'S NITROGEN, WATER, AND CARBON CYCLES AND, IN DOING SO, MODIFIED THE soil, water, air quality and climate systems ~~using Earth's nitrogen, water, and carbon cycles; and~~

End of Grade 8