

## Gloria Chatelain 8/20/2020: Content Advisor Feedback

Please review the proposed revisions to the Texas Essential Knowledge and Skills (TEKS) for

- the four high school courses: Biology, Chemistry, Integrated Physics and Chemistry (IPC), and Physics, and
- scientific process for kindergarten–grade 12 (scientific and engineering practices).

### GUIDING QUESTIONS- HIGH SCHOOL COURSES

1. Does each course follow a complete and logical development of science concepts presented? If not, what suggestions do you have for improvement?  
*Yes; there is a complete and logical development of science concepts. Recommend reviewing the “Introduction” section for K-8 in the spring, please see next question for clarification.*
2. Do the standards for the course(s) adequately address scientific concepts? If not, please give examples of how the standards might be improved.  
*Yes; the standards adequately address necessary science concepts. However, the “Introduction” of the K-8 TEKS requires updating. When the K-8 Workgroup convenes in spring of 2021, please refer to the TEKS High School courses (from Workgroup B) to maintain consistency. High school revised their “Introductions” (plus recommended edits on next page, see Question 3).*
4. Are there any gaps or concepts missing that should be addressed? Are there specific areas that need to be updated to reflect current research?  
*No: great job on updating.*
5. Do the high school courses course(s) sufficiently prepare students for postsecondary success? If not, please provide suggestions for improving the standards.  
*Yes; courses prepare students for post secondary success.*
6. Does each course include sufficient standards focused on laboratory and field investigation?  
*Yes; courses reflect sufficient standards re: lab and field investigations.*
7. Are the student expectations clear and specific? If not, please give examples of how the language might be improved.  
**Several recommendations to improve language:**  
*1) In the “Scientific and Engineering Practices” (6), use caution with copyright regarding “Cross-Cutting Concepts” ...see Question 3 on next page.*  
*2) In Biology SE 7D, recommend to change the term “gene modification” to “genetic engineering.” Rationale: Gene modification conjures up gene editing, a technology that gives scientists the ability to change an organism’s DNA, this may not be appropriate for a first year biology student. This cannot set the stage for researching “designer babies” with germline genetic editing, and that might require a statement in the TEKS Guide.*  
*.Biology SE 7D is listed below (see genetic modification).*

(D)	<p><u>investigate molecular technologies such as PCR, gel electrophoresis, and gene modification that are applicable in current research and engineering practices.</u></p>	<p>Rationale: Provides students the opportunity to apply biological concepts to real-world events and current research that has an impact on their lives. A similar standard was deleted during streamlining in 2017. Also incorporates engineering applications of science.</p> <p>(6)(H)</p>
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**3) In Biology SE 10 A-B, recommend revert to original verbs, change “explain” to “analyze and evaluate.”**

(10)	<p>Science concepts—<u>biological evolution</u>. The student knows evolutionary theory is a scientific explanation for the unity and diversity of life <u>that has multiple mechanisms</u>. The student is expected to:</p>	
(A)	<p><u>explain</u> <del>analyze and evaluate</del> how natural selection produces change in populations; <u>and</u> not <u>in</u> individuals;</p>	<p>Rationale: change verbs to match the level of knowledge expected</p> <p>(7)(C)</p>
(B)	<p><u>explain and</u> analyze <del>and evaluate</del> how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success;</p>	<p>Rationale: for most students, this will be the first introduction to these ideas and they will lack the necessary background knowledge to evaluate natural selection. It is more appropriate for students to apply the principles of natural selection that are being introduced by explaining how they work.</p> <p>(7)(D)</p>

**Recommend to change verbs (ex. explain)...and revert back to “analyze and evaluate.”**

**Rationale:** Kids understand adaptations, they have had them in K-8. They studied populations in middle school, ex. in 8<sup>th</sup> grade they studied environmental factors that affect organisms and traits in subsequent populations. They have the background to understand this concept.

**4) In Biology, SE 10C, recommend changing the wording:**

(C)	<p>analyze and evaluate the relationship of natural selection to adaptation, <u>speciation and divergent evolution</u> <del>and to the development of diversity in and among species</del>; and</p>	<p>Rationale: revised to clarify the expectation of what students should know about how diversity is achieved</p> <p>(7)(E)</p>
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**Recommend changing to: “analyze and evaluate how natural selection may lead to speciation.”**

**Rationale:** Changing this to a more generalized wording still maintains this mechanism for diversity, speciation is a result of divergent evolution, without using the words “divergent evolution.”

8. Are there student expectations that are not essential or unnecessarily duplicative and can be eliminated? If so, please identify by course and student expectation number, e.g., Physics 4.B.  
*No; did not find any duplicate content.*

### GUIDING QUESTIONS- SCIENTIFIC AND ENGINEERING PRACTICES

1. Are the student expectations in the science and engineering practices clear and specific? If not, please give examples of how the language might be improved. *See Question 3.*
2. Do the science and engineering practices sufficiently prepare students to engage in investigative and engineering design processes? If not, please provide suggestions for improving the standards.  
*Yes; but recommend that the **TEKS Guide** elaborate on several concepts, Ex. KS 1... teachers do not know what “**phenomena**” means, and also “**design solutions using appropriate tools and models**”....design solutions might need clarification for primary grades.*
3. Are there any gaps or practices missing that should be addressed? *Yes: in K-5, state the % of lab requirement in the “Scientific & Engineering Practices”. It was done for Grades 6-12...see TEKS 1. Unclear why Group B (see opening page discussion) suggested we keep it in the “Intro” sections for K-5.*

### High School TEKS (b) Introduction

(b)	<b>Introduction.</b>
(1)	<b>Biology.</b> <i>By the end of 12th grade, students are expected to gain sufficient knowledge of the scientific and engineering practices across the disciplines of science to make informed decisions using critical thinking and scientific problem solving. Students in Biology focus on patterns, processes, and relationships of living organisms through four main concepts: biological structures, functions, and processes; mechanisms of genetics; biological evolution; and interdependence within environmental systems. In Biology, students conduct laboratory and field investigations, use scientific practices during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Biology study a variety of topics that include: structures and functions of cells and viruses; growth and development of organisms; cells, tissues, and organs; nucleic acids and genetics; biological evolution; taxonomy; metabolism and energy transfers in living organisms; living systems; homeostasis; and ecosystems and the environment.</i>

Reverse the order of these 2 sentences above. Place sentence #2 first (and repeat for Chemistry, IPC, and Physics). See example below:

“Students in Biology focus on patterns, processes and relationships of living organisms through four main concepts: biological structures, functions, and processes; mechanisms of genetics; biological evolution; and interdependence within environmental systems.  
 And by the end of 12<sup>th</sup> grade, students are expected to gain sufficient knowledge .....

**Rationale:** *The standard should state what a student will learn in Biology before the scientific and engineering practices’ expectations. It is confusing to start with 12<sup>th</sup> grade. This change should be reflected on Pg. 2-Biology, Pg. 11-Chemistry, Pg. 22-IPC, and Pg. 29-Physics.*

## High School TEKS Introduction” (2) Nature of Science

(2)	<p>Nature of science. <u>According to the National Science Teaching Association (NSTA), the “nature of science is a critical component of scientific literacy that enhances students’ understandings of science concepts and enables them to make informed decisions about scientifically-based personal and societal issues.” 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.”</u> 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 currently scientifically testable.</p>	<p>Used a quotation for nature of science as opposed to a definition of science. The new definition emphasizes literacy.</p>
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**Rationale:** Sentence 1, recommend refrain from using NSTA, this is a teacher organization.

Reword Section (2)... According to the current wording, it is describing the “*Nature of Science*” as a function of “*literacy*”... perhaps define the *Nature of Science* first...What is Science? Define that first, then add additional info regarding scientific literacy.

And, include the word “*phenomena*” in opening sentence...that is what science is, observing and studying phenomena. In the above wording, it is mentioned in the “last line.”

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## High School TEKS Introduction” (6) Scientific Cross-Cutting Concepts

(6) (↔)	<p><u>Scientific cross-cutting concepts. Science is a series of cross cutting concepts such as Science systems, and models, and patterns. A system is a collection of cycles, structures, and processes that interact.</u> All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, <u>while models allow for boundary specification and a tool for understanding the ideas presented;</u> 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.</p>	<p>To clarify language around systems, define the cross-cutting concepts, and include additional specificity regarding scalability of models.</p>
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**Rationale:** Regarding copyright issues, can the term “cross-cutting concepts” be used since it is directly from NGSS curriculum? Previously we used the term “**recurring themes**”...*ideas that transcend disciplinary boundaries.*

Whatever the outcome, recommend rewording sentence #1; some teachers may not understand the term “cross-cutting concepts.”

End Here. Thank you to all Workgroup Participants.