Guidelines for 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).

- The consideration given to the work group recommendations, survey results, SBOE feedback, and content advisor recommendations is apparent in these revisions. The consensus end goal to provide Texas teachers and students with clear and rigorous standards that encompass both disciplinary core concepts and scientific and engineering practices is also evident.

Guiding Questions- High School Courses

- Introductions – agree with revisions and rationale for updated/streamlined language for all courses
    - Chemistry – characteristics of matter KS and SEs removed (taught prior) yet still mentioned in Intro; concepts in Chemistry are most diverse and while interconnected unfortunately are difficult to group into 4 main areas of study as in the other courses
- Overall there is an increase in rigor based on verbs used for expectations and an improvement in wording for clarity and specificity
    - Biology 8A & 8B for example makes the expectations clearer, most teachers cover these topics in this way but makes this explicit
    - Chemistry 6A – how trends such as electronegativity can predict bonding gives better conceptual understanding
- Vertical alignment (assumed and intended) is also evident as stated in rationales

1. Does each course follow a complete and logical development of science concepts presented? If not, what suggestions do you have for improvement?

- **Biology**
    - 11 – placement of these expectations separate from the other cell structure, function, and processes KSs? – 11A – photosynthesis and respiration are usually taught as further understanding of and after cellular structures (functions of chloroplasts and mitochondria); should 11B (formerly 9B) be moved to coincide with new 5A (formerly 9A) – enzymes are often taught as an extension of biomolecules
    - 12 – placement of KS12 with overarching concepts of structure, function, and processes
- **Chemistry** – many interconnected yet separate concepts – this course most difficult to structure within a few overarching concepts

- **IPC** – many real-world connections and applications given – provides a good hands-on and relevant bridge from MS to concepts deepened in Chem and Physics
    - 5 – energy transfer and conservation – order of the expectations – should conservation in a closed system come first?

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, overall disciplinary concepts are addressed. Alignment with K12 Framework and CCRS is good. A few areas for potential improvement are noted elsewhere in this review.

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?

- **Biology -**
    - 11A - specify both aerobic and anaerobic respiration (fermentation) as mentioned in framework and CCRS to ensure both are addressed in instruction
    - 13 – carrying capacity not mentioned specifically (is in framework) – 10B mentions finite supply of resources but in terms of natural selection; 13B – focus will be disruption – students should also understand loss of energy and matter as progress through ecosystem leads to fewer higher-level consumers
    - Feedback mechanisms (similar expectation removed in 2017) is in both framework and CCRS – could this be added to KS12?

5. Do the high school courses course(s) sufficiently prepare students for postsecondary success? If not, please provide suggestions for improving the standards.

- With the revisions presented and some few additional adjustments, yes. Revisions overall align well with CCRS and K12 Framework.

6. Does each course include sufficient standards focused on laboratory and field investigation?

- Intention to adjust expectations for rigor and application of scientific and engineering practices is clear. Further guidance provided in the TEKS Guide and PD from TEA/ESCs will be needed to help teachers implement these standards using investigations.
    - IPC has several standards with increased rigor of verbs such as design, plan, and conduct - will need examples of potential performance tasks that would meet criteria for teachers to have confidence in facilitating these investigations
    - Physics – agree with need to include additional scientific and engineering practices – perhaps creating and using models or simulations?

7. Are the student expectations clear and specific? If not, please give examples of how the language might be improved.

- **Biology** –
    - 5D (viruses) – agree with the rationale that the expectation should be more general but not sure the revised language accomplishes the purpose – how

    - viruses spread and cause disease could be interpreted differently (i.e. spread as in transmission via oral droplets, physical contact, sexual activity vs spread by using cellular structures to reproduce); revisit the intended outcome of this expectation for specificity
    - 6B – what is the intended outcome for student understanding? what environmental factors should students understand have an effect on cell differentiation? clarify this for boundary of instruction
    - 13D – environmental change, including natural and human induced changes,
- **IPC** –
    - 6 – atomic structure – is this specific enough? do students know atomic structure well enough to understand bonding, reactivity – should this be specified here?

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.

- While there is still concern for timing to sufficiently address these expectations at the depth required, the work group did a good job clarifying and revising the expectations.

- Biology – the expectations that were eliminated are **common genetic code** 6B, regulation of gene expression 6D, **taxonomy and kingdoms** (8A-C), levels of organization (10C – now built in to KS5 & 12), microorganisms 11A, **succession 11B**, **adaptations 12B**, dihybrid crosses, and viral reproduction cycles → these are all expectations that should be taught sufficiently in MS (need to make sure vertical alignment addresses these **in bold**) or they are unnecessary for all students to understand – agree with elimination of these to increase time for instruction in greater depth of remaining concepts
- Chemistry – characteristics of matter (physical and chemical properties and changes and classifications) → need to ensure addressed sufficiently in prior courses so as not to be a gap in understanding

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.

    - Yes, the expectations for what students should be able to do are clear and specific. However, I agree with comments to provide additional guidance for classroom instruction in the TEKS Guide.
    - KSs and SEs are grouped in an approachable way for teachers – 1 → scientific problem solving (questioning, experimental design, and data collection); 2 → analysis of data; 3 → development and communication of scientific explanations; 4 → scientific impact on society

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, expectations have been adjusted to provide scaffolding and improved consistency throughout K-12 science courses. Additional SEs were added to KSs

for students to deepen their practice and understanding of scientific and engineering processes and practices (i.e. addition of evaluating a design, inclusion of impact of **current** research and scientific innovation on society)
- Alignment of STEM career exploration through K-12 is valuable for students to see relevance and connection of scientific practices to their own lives and future possible careers

3. Are there any gaps or practices missing that should be addressed?
    - None.