Vertical Alignment of Scientific and Engineering Practice: Asking Questions and Defining Problems

TEKS in Focus highlights key concepts and student expectations to assist educators in implementing the science Texas Essential Knowledge and Skills (TEKS). The vertical progression of a concept within the science TEKS is provided along with the detailed explanations provided in TEKS Guide. The science TEKS include scientific and engineering practices in strand one. To create a cohesive learning experience, educators should integrate scientific and engineering practices with content. Embedding these practices into the content provides students with the context in which to ask questions, develop models, and analyze data. This approach ensures that students develop critical thinking and problem-solving skills by applying scientific and engineering practices in real-world scenarios while learning the content.

Detailed explanations are provided for bold words in the student expectation. Detailed explanations call out a specific word or phrase in a student expectation to clarify what students should know and be able to do in reference to that word or phrase. Detailed explanations may include an instructional boundary that specifies Tier 1 (baseline) instructional expectations for all students.

Scientific and Engineering Practice 1A

Science TEKS	Term or Phrase	Detailed Explanations from TEKS Guide
The student is expected to ask questions and define problems based on observations or information from text, phenomena, **models**, or **investigations**;	**models**	K–12: Students should experience a variety of models related to scientific and engineering concepts. As scientists, students will use models of phenomena, systems, processes, relationships, and structures to ask questions. Models in science might include drawings, diagrams, clay, or a sand table. As engineers, students will use models (prototypes) to define problems and test possible solutions.
	investigations	K–5: Students will act as scientists using descriptive investigations to observe and ask questions about a process or behavior related to a phenomenon, model, or science experience. Students will act as engineers, using investigations to inform design decisions and further define problems. Students should ask questions and define problems based on any investigations provided by the teacher (K–5) and any student developed descriptive investigations (1–5) and experimental investigations (5). 6–12: Students will act as scientists using comparative or experimental investigations to observe, ask questions about, and collect data to define a phenomenon, model, or experience. Students will act as engineers, using investigations to inform design decisions and further define problems.

TEKS Guide Glossary Terms:

Glossary terms and definitions are consistent across kindergarten through high school in the TEKS Guide. The definitions are intended to give educators a common understanding of the terms regardless of what grade level they teach. Glossary definitions are not intended for use with students.

phenomena: detectable events that are observed through the senses or technology; can be explained through scientific laws, ideas, principles, and theories

TEKS Guide Further Explanation:

The further explanation is designed to be a resource for educators that helps them better understand the topic their students are learning. Further explanations may be written at a more complex level than would be expected for students at the grade level.

Models:

Both scientists and engineers use models. Physical models show how things look or work in the real world. Conceptual models represent relationships and describe how things work or fit together. Mathematical models use mathematical equations, theories, formulas, and proofs. Simulations allow for the control of variables and mimic real-world processes. Examples of models include sketches, diagrams, mathematical relationships, simulations, physical models, and prototypes, and they are used to make predictions about the behavior of a system.

Investigations:

Like scientists, engineers must identify relevant variables, decide how they will be measured, and collect data for analysis. Their investigations help them identify how effective, efficient, and durable their designs may be under various conditions.

Some investigations involve simple observations as scientists try to understand a process or behavior. This type of investigation is called a descriptive investigation. A comparative investigation involves comparing a process or behavior in two different settings. A correlative investigation attempts to determine how related two variables are. Another kind of investigation is called an experimental investigation. An experimental investigation involves a test with identified variables. Some variables stay the same throughout the experiment, the scientist manipulates one variable, and another variable responds to the manipulated variable. Scientists observe the relationship between the variables during the experiment. This kind of experiment can also be called a controlled experiment.

TEKS in Focus spotlights concepts or student expectations monthly to bolster TEKS alignment, rigor, and collective understanding. It does not suggest an order or timing but helps with comprehension of TEKS changes, serving as a guide when relevant to classroom instruction.