

Snapshots: Physics

Snapshots are ideas for classroom activities that address the intent of the Texas Essential Knowledge and Skills for Science. Snapshots may cover part of a TEKS statement, but not necessarily the whole statement. Snapshots represent one way, out of many possible ways, of addressing specific TEKS statements.

The TEKS for Science listed here are from *Chapter 112. Texas Essential Knowledge and Skills for Science. Subchapter C. High School. §112.47. Physics. (a) Introduction and (b) Knowledge and skills.* The high school TEKS for Science can be viewed and downloaded on the Texas Education Agency website or purchased in book form through our online catalog.

(b) Introduction.

(1) In Physics, students conduct field and laboratory investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include: laws of motion; changes within physical systems and conservation of energy and momentum; force; thermodynamics; characteristics and behavior of waves; and quantum physics. This course provides students with a conceptual framework, factual knowledge, and analytical and scientific skills.

(2) Science is a way of learning about the natural world. Students should know how science has built a vast body of changing and increasing knowledge described by physical, mathematical, and conceptual models, and also should know that science may not answer all questions.

(3) A system is a collection of cycles, structures, and processes that interact. Students should understand a whole in terms of its components and how these components relate to each other and to the whole. 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 and measured as patterns. These patterns help to predict what will happen next and can change over time.

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

(c) Knowledge and skills.

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

The student is expected to:

- a. demonstrate safe practices during field and laboratory investigations; and
- b. make wise choices in the use and conservation of resources and the disposal or recycling of materials.

(2) Scientific processes. The student uses scientific methods during field and laboratory investigations.

The student is expected to:

- a. plan and implement experimental procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;
- b. make quantitative observations and measurements with precision;
- c. organize, analyze, evaluate, make inferences, and predict trends from data;
- d. communicate valid conclusions;
- e. graph data to observe and identify relationships between variables; and
- f. read the scale on scientific instruments with precision.

(3) Scientific processes. 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;
- b. express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems;
- c. evaluate the impact of research on scientific thought, society, and the environment;
- d. describe the connection between physics and future careers; and
- e. research and describe the history of physics and contributions of scientists.

(4) Science concepts. The student knows the laws governing motion.

The student is expected to:

- a. generate and interpret graphs describing motion including the use of real-time technology;

Snapshot:

- Describe and interpret, both graphically and verbally, data sets gathered from motion detectors.

- b. analyze examples of uniform and accelerated motion including linear, projectile, and circular;
- c. demonstrate the effects of forces on the motion of objects;

Snapshot:

- Design and conduct demonstrations illustrating Newton's laws of motion, such as the rolling motion of inline skate wheels, pulling a tablecloth from under dishes on a table, and the stopping distance of a car.

- d. develop and interpret a free-body diagram for force analysis; and

Snapshot:

- Draw a free-body diagram for an everyday situation for uniform and accelerated motion. Identify the forces present and describe their effects on the motion of the object.

- e. identify and describe motion relative to different frames of reference.

(5) Science concepts. The student knows that changes occur within a physical system and recognizes that energy and momentum are conserved.

The student is expected to:

- a. interpret evidence for the work-energy theorem;

Snapshot:

- Use the work-energy theorem to calculate the energy stored in a rubberband. Use this data to predict the kinetic energy of a projectile.

- b. observe and describe examples of kinetic and potential energy and their transformations;

Snapshot:

- Gather data to describe the energy transformation that occurs when gravitational potential energy is converted to kinetic energy, including the energy lost due to friction and other sources.

- c. calculate the mechanical energy and momentum in a physical system such as billiards, cars, and trains; and
- d. demonstrate the conservation of energy and momentum.

Snapshot:

- Verify that momentum and energy are both conserved in a collision between moving objects.

(6) Science concepts. The student knows forces in nature.

The student is expected to:

- a. identify the influence of mass and distance on gravitational forces;

Snapshot:

- Explain how the weight of a student would vary on different planets based on mass and planet radius.

- b. research and describe the historical development of the concepts of gravitational, electrical, and magnetic force;
- c. identify and analyze the influences of charge and distance on electric forces;
- d. demonstrate the relationship between electricity and magnetism;

Snapshot:

- Graph the relationship between turn density and total current of an electromagnet.

- e. design and analyze electric circuits; and

Snapshot:

- Examine the attributes of series and parallel circuits. Design, construct, and analyze a functional series, parallel, or combination circuit.

- f. identify examples of electrical and magnetic forces in everyday life.

Snapshot:

- Research and identify uses of electrical and magnetic forces in everyday life, such as electromagnets for moving heavy loads and residential security systems. Prepare a presentation explaining the concepts involved.

(7) Science concepts. The student knows the laws of thermodynamics.

The student is expected to:

- a. analyze and explain everyday examples that illustrate the laws of thermodynamics; and

Snapshot:

- Identify factors that determine where energy transformations occur in the classroom. Recommend modifications that would change the rate at which these energy transformations occur.

- b. evaluate different methods of heat energy transfer that result in an increasing amount of disorder.

(8) Science concepts. The student knows the characteristics and behavior of waves.

The student is expected to:

- a. examine and describe a variety of waves propagated in various types of media and describe wave characteristics such as velocity, frequency, amplitude, and behaviors such as reflection, refraction, and interference;

Snapshot:

- Find the relationship between the tension in a coiled spring and the velocity of a transverse wave.

- b. identify the characteristics and behaviors of sound and electromagnetic waves; and

Snapshots:

- Use tuning forks to set up standing waves in open/closed tubes. Determine the wavelength and speed of sound.
- Use a diffraction grating and the principles of interference to determine wavelength of a light source.

- c. interpret the role of wave characteristics and behaviors found in medicinal and industrial applications.

Snapshot:

- Research and compare the following types of medical devices: ultrasound, MRI, CT scan, and x-ray. Explain their differences using properties of waves.

(9) Science concepts. The student knows simple examples of quantum physics.

The student is expected to:

- a. describe the photoelectric effect; and
b. explain the line spectra from different gas-discharge tubes.

Snapshot:

- Use a diffraction grating, a neon gas discharge tube, and the double slit equation to determine wavelength of the spectral colors produced. Relate the colors to the frequency of light observed. Compare the frequency to the absorption spectrum for neon.