

Texas Essential Knowledge and Skills

Integrated Physics and Chemistry

Introduction.

- (1) In Integrated Physics and Chemistry, students conduct field and laboratory investigations, use scientific methods during investigations, and make informed decisions using critical-thinking and scientific problem-solving. This course integrates the disciplines of physics and chemistry in the following topics: motion, waves, energy transformations, properties of matter, changes in matter, and solution chemistry.
- (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.

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 investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology;
 - (B) collect data and make measurements with precision;
 - (C) organize, analyze, evaluate, make inferences, and predict trends from data; and
 - (D) communicate valid conclusions.
- (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) draw inferences based on data related to promotional materials for products and services;
 - (C) evaluate the impact of research on scientific thought, society, and the environment;
 - (D) describe connections between physics and chemistry, and future careers; and
 - (E) research and describe the history of physics, chemistry, and contributions of scientists.
- (4) Science concepts. The student knows concepts of force and motion evident in everyday life. The student is expected to:
- (A) calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines;
 - (B) investigate and describe applications of Newton's laws such as in vehicle restraints, sports activities, geological processes, and satellite orbits;
 - (C) analyze the effects caused by changing force or distance in simple machines as demonstrated in household devices, the human body, and vehicles; and
 - (D) investigate and demonstrate mechanical advantage and efficiency of various machines such as levers, motors, wheels and axles, pulleys, and ramps.
- (5) Science concepts. The student knows the effects of waves on everyday life. The student is expected to:
- (A) demonstrate wave types and their characteristics through a variety of activities such as modeling with ropes and coils, activating tuning forks, and interpreting data on seismic waves;
 - (B) demonstrate wave interactions including interference, polarization, reflection, refraction, and resonance within various materials;
 - (C) identify uses of electromagnetic waves in various technological applications such as fiber optics, optical scanners, and microwaves; and

- (D) demonstrate the application of acoustic principles such as in echolocation, musical instruments, noise pollution, and sonograms.
- (6) Science concepts. The student knows the impact of energy transformations in everyday life. The student is expected to:
- (A) describe the law of conservation of energy;
 - (B) investigate and demonstrate the movement of heat through solids, liquids, and gases by convection, conduction, and radiation;
 - (C) analyze the efficiency of energy conversions that are responsible for the production of electricity such as from radiant, nuclear, and geothermal sources, fossil fuels such as coal, gas, oil, and the movement of water or wind;
 - (D) investigate and compare economic and environmental impacts of using various energy sources such as rechargeable or disposable batteries and solar cells;
 - (E) measure the thermal and electrical conductivity of various materials and explain results;
 - (F) investigate and compare series and parallel circuits;
 - (G) analyze the relationship between an electric current and the strength of its magnetic field using simple electromagnets; and
 - (H) analyze the effects of heating and cooling processes in systems such as weather, living, and mechanical.
- (7) Science concepts. The student knows relationships exist between properties of matter and its components. The student is expected to:
- (A) investigate and identify properties of fluids including density, viscosity, and buoyancy;
 - (B) research and describe the historical development of the atomic theory;
 - (C) identify constituents of various materials or objects such as metal salts, light sources, fireworks displays, and stars using spectral-analysis techniques;
 - (D) relate the chemical behavior of an element including bonding, to its placement on the periodic table; and
 - (E) classify samples of matter from everyday life as being elements, compounds, or mixtures.
- (8) Science concepts. The student knows that changes in matter affect everyday life. The student is expected to:
- (A) distinguish between physical and chemical changes in matter such as oxidation, digestion, changes in states, and stages in the rock cycle;
 - (B) analyze energy changes that accompany chemical reactions such as those occurring in heat packs, cold packs, and glow sticks to classify them as endergonic or exergonic reactions;
 - (C) investigate and identify the law of conservation of mass;
 - (D) describe types of nuclear reactions such as fission and fusion and their roles in applications such as medicine and energy production; and

- (E) research and describe the environmental and economic impact of the end-products of chemical reactions.
- (9) Science concepts. The student knows how solution chemistry is a part of everyday life. The student is expected to:
- (A) relate the structure of water to its function as the universal solvent;
 - (B) relate the concentration of ions in a solution to physical and chemical properties such as pH, electrolytic behavior, and reactivity;
 - (C) simulate the effects of acid rain on soil, buildings, statues, or microorganisms;
 - (D) demonstrate how various factors influence solubility including temperature, pressure, and nature of the solute and solvent; and
 - (E) demonstrate how factors such as particle size, influence the rate of dissolving.