

Integrated Coordinated Science Standards

Standards that all students are expected to achieve in the course of their studies are unmarked.

Standards that all students should have the opportunity to learn are marked with an asterisk (*).

Earth Science Standards

Processes

3. Plate tectonics operating over geologic time has changed the patterns of land, sea, and mountains on Earth's surface. As the basis for understanding this concept:
 - a. Students know features of the ocean floor (magnetic patterns, age, and sea-floor topography) provide evidence of plate tectonics.
 - b. Students know the principal structures that form at the three different kinds of plate boundaries.
 - c. Students know how to explain the properties of rocks based on the physical and chemical conditions in which they formed, including plate tectonic processes.
 - d. Students know why and how earthquakes occur and the scales used to measure their intensity and magnitude.
 - e. Students know there are two kinds of volcanoes: one kind with violent eruptions producing steep slopes and the other kind with voluminous lava flows producing gentle slopes.
 - f. * Students know the explanation for the location and properties of volcanoes that are due to hot spots and the explanation for those that are due to subduction.

Biogeochemical Cycles

7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles. As a basis for understanding this concept
 - a. Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.
 - b. Students know the global carbon cycle: the different physical and chemical forms of carbon in the atmosphere, oceans, biomass, fossil fuels, and the movement of carbon among these reservoirs.

- c. Students know the movement of matter among reservoirs is driven by Earth's internal and external sources of energy.
- d. * Students know the relative residence times and flow characteristics of carbon in and out of its different reservoirs.

California Geology

- 9. The geology of California underlies the state's wealth of natural resources as well as its natural hazards. As a basis for understanding this concept:
 - b. Students know the principal natural hazards in different California regions and the geologic basis of those hazards.
 - c. Students know the importance of water to society, the origins of California 's fresh water, and the relationship between supply and need.
 - d. * Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.

Physics Standards

Heat and Thermodynamics

- 3. Energy cannot be created or destroyed, although in many processes energy is transferred to the environment as heat. As a basis for understanding this concept:
 - f. * Students know the statement "Entropy tends to increase" is a law of statistical probability that governs all closed systems (second law of thermodynamics).

Waves

- 4. Waves have characteristic properties that do not depend on the type of wave. As a basis for understanding this concept:
 - a. Students know waves carry energy from one place to another.
 - b. Students know how to identify transverse and longitudinal waves in mechanical media, such as springs and ropes, and on the earth (seismic waves).
 - d. Students know sound is a longitudinal wave whose speed depends on the properties of the medium in which it propagates.

- e. Students know radio waves, light, and X-rays are different wavelength bands in the spectrum of electromagnetic waves whose speed in a vacuum is approximately 3×10^8 m/s (186,000 miles/second).
- f. Students know how to identify the characteristic properties of waves: interference (beats), diffraction, refraction, Doppler effect, and polarization.

Electric and Magnetic Phenomena

- 5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:
 - d. Students know the properties of transistors and the role of transistors in electric circuits.
 - i. Students know plasmas, the fourth state of matter, contain ions or free electrons or both and conduct electricity.
 - j. * Students know electric and magnetic fields contain energy and act as vector force fields.
 - m. * Students know static electric fields have as their source some arrangement of electric charges.

Chemistry Standards

Atomic and Molecular Structure

- 1. The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept:
 - a. Students know how to relate the position of an element in the periodic table to its atomic number and atomic mass.
 - b. Students know how to use the periodic table to identify metals, semimetals, nonmetals, and halogens.
 - c. Students know how to use the periodic table to identify alkali metals, alkaline earth metals and transition metals, trends in ionization energy, electronegativity, and the relative sizes of ions and atoms.
 - d. Students know how to use the periodic table to determine the number of electrons available for bonding.
 - e. Students know the nucleus of the atom is much smaller than the atom yet contains most of its mass.

- f. * Students know how to use the periodic table to identify the lanthanide, actinide, and transactinide elements and know that the transuranium elements were synthesized and identified in laboratory experiments through the use of nuclear accelerators.

Chemical Bonds

2. Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds from electrostatic forces between electrons and protons and between atoms and molecules. As a basis for understanding this concept:
 - a. Students know atoms combine to form molecules by sharing electrons to form covalent or metallic bonds or by exchanging electrons to form ionic bonds.
 - b. Students know chemical bonds between atoms in molecules such as H_2 , CH_4 , NH_3 , H_2CCH_2 , N_2 , Cl_2 , and many large biological molecules are covalent.
 - c. Students know salt crystals, such as $NaCl$, are repeating patterns of positive and negative ions held together by electrostatic attraction.

Acids and Bases

5. Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept:
 - a. Students know the observable properties of acids, bases, and salt solutions.
 - c. Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.

Chemical Thermodynamics

7. Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept:
 - b. Students know chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.
 - c. Students know energy is released when a material condenses or freezes and is absorbed when a material evaporates or melts.

Biology Standards

Ecology

6. Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:
 - a. Students know bio diversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
 - b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
 - c. Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
 - d. Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.
 - e. Students know a vital part of an ecosystem is the stability of its producers and decomposers.
 - f. Students know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.
 - g. * Students know how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.

Evolution

8. Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:
 - a. Students know how natural selection determines the differential survival of groups of organisms.
 - b. Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.
 - e. Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.