

Science Standards

The *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve* represents the content of science Education and includes the essential skills and knowledge students will need to be scientifically literate citizens in the twenty-first century. This content will be taught so that students have the opportunity to build connections that link science to technology and societal impacts. Science, technology and societal issues are strongly connected to community health, population, natural resources, environmental quality, natural and human-induced hazards, and other global challenges. The standards should be viewed as the foundation for understanding these issues.

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 (*). Those opportunities should be offered at every high school.

PHYSICS

1. **Motion and Forces.** Newton's laws predict the motion of most objects.
As a basis for understanding this concept students know: 1 a/b/c/d/e/f/g/ and h/i*/j*/k*/l*/m*.*
2. **Conservation of Energy and Momentum.** The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects.
*As a basis for understanding this concept students know: 2 a/b/c/d/e/f/g and h**
3. **Heat and Thermodynamics.** 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 students know: 3 a/b/c/d/e/f/g and h.*
4. **Waves.** Waves have characteristic properties that do not depend on the type of wave.
As a basis for understanding this concept students know: 4 a/b/c/d/e and f.
5. **Electric and Magnetic Phenomena.** Electric and magnetic phenomena are related and have many practical applications.
As a basis for understanding this concept students should know: 5 a/b/c/d/e/f/g/h/ and j/k*/l*/m*/n*/o*.*

CHEMISTRY

1. **Atomic and Molecular Structure.** The periodic table displays the elements in increasing atomic number and show how periodicity of the physical and chemical properties of the elements relate to atomic structure.
As a basis for understanding this concept students know: 1 a/b/c/d/e/f/g/h and i/j*.*
2. **Chemical Bonds.** Biological, chemical and physical properties of matter 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 students know: 2 a/b/c/d/e and f/g*/h*.*
3. **Conservation of Matter and Stoichiometry.** The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants.
As a basis for understanding this concept students know: 3 a/b/c/d/e/and f/g*.*
4. **Gases and Their Properties.** The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases.
As a basis for understanding this concept students know: 4 a/b/c/d/e/f and g/h*/i*.*
5. **Acids and Bases.** Acids, bases, and salts are three classes of compounds that form ions in water solutions.
As a basis for understanding this concept students know: 5 a/b/c/d and e/f*/g*.*
6. **Solutions.** Solutions are homogenous mixtures of two or more substances.
As a basis for understanding this concept students know: 6 a/b/c/d/e and f.*
7. **Chemical Thermodynamics.** Energy is exchanged or transformed in all chemical reactions and physical changes in matter.
As a basis for understanding this concept students know: 7 a/b/c/d/e and f.*
8. **Reaction Rates.** Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules.
As a basis for understanding this concept students know: 8 a/b/c and d.*
9. **Chemical Equilibrium.** Chemical equilibrium is a dynamic process at the molecular level.
As a basis for understanding this concept students know: 9 a/b and c.*

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- Organic Chemistry and Biochemistry.** The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes, and chemical properties and provide the biochemical basis of life.
As a basis for understanding this concept students know: 10 a/b/c and d/e*/f*.*
- Nuclear Processes.** Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and human-made isotopes, nuclear fission, and nuclear fusion.
As a basis for understanding this concept students know: 11 a/b/c/d/e and f/g.*

BIOLOGY AND LIFE SCIENCES

- Cell Biology.** The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.
As a basis for understanding this concept students know: 1 a/b/c/d/e/f/g/h and i/j*.*
- Genetics.** Mutation and sexual reproduction lead to genetic variation in a population.
As a basis for understanding this concept students know: 2 a/b/c/d/e/f and g.
- Genetics.** A multi-cellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization.
As a basis for understanding this concept students know: 3 a/b/ and c/d*.*
- Genetics.** Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.
As a basis for understanding this concept students know: 4 a/b/c/d/e and f.*
- Genetics.** The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.
As a basis for understanding this concept students know: 5 a/b/c and d/e*.*
- Ecology.** Stability in an ecosystem is a balance between competing effects.
As a basis for understanding this concept students know: 6 a/b/c/d/e/f and g.*
- Evolution.** The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time.
As a basis for understanding this concept students know: 7 a/b/c/d and e/f*.*
- Evolution.** Evolution is the result of genetic changes that occur in constantly changing environments.
As a basis for understanding this concept students know: 8 a/b/c/d/e and f/g*.*
- Physiology.** As a result of the coordinated structures and function of organ systems, the internal environments of the human body remain relatively stable (homeostatic) despite changes in the outside environment.
As a basis for understanding this concept students know: 9a/b/c/d/e/f/g/h and i.*
- Physiology.** Organisms have a variety of mechanisms to combat disease.
As a basis for understanding this concept students know: 10 a/b/c/d/e and f.*

EARTH SCIENCES

- Earth's Place in the Universe.** Astronomy and planetary exploration reveal the solar system's structure, scale and change over time.
As a basis for understanding this concept students know: 1 a/b/c/d/e and g.*
- Earth's Place in the Universe.** Earth-based and space-based astronomy reveal the structure, scale and changes in stars, galaxies, and the universe over time.
As a basis for understanding this concept students know: 2 a/b/c/d and e/f*/g*.*
- Dynamic Earth Processes.** Plate tectonics operation over geological time has changed patterns of land, sea, and mountains on the Earth's surface.
As a basis for understanding this concept students know: 3 a/b/c/d/e and f.*
- Energy in the Earth System.** Energy enters the Earth system primarily as a solar radiation and eventually escapes as heat.
As a basis for understanding this concept students know: 4 a/b/c and d.*
- Energy in the Earth System.** Heating of the Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.
As a basis for understanding this concept students know: 5 a/b/c/d/e and f/g*.*

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6. **Energy in the Earth's System.** Climate is the long-term average of a region's weather and depends on many factors.
As a basis for understanding this concept students know: 6 a/b/c and d.*
7. **Biochemical Cycles.** Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as a part of biogeochemical cycles.
As a basis for understanding this concept students know: 7 a/b/c and d.*
8. **Structure and Composition of the Atmosphere.** Life has changed Earth's atmosphere, changes in the atmosphere affect conditions for life.
As a basis for understanding this concept students know: 8 a/b and c.
9. **California Geology.** The geology of California underlies the state's wealth of natural resources as well as natural hazards.
As a basis for understanding this concept students know: 9 a/b/c and d.*
10. **Investigation and Experimentation.** Asking meaningful questions and conducting careful investigations makes scientific progress.
As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations students will: 10 a/b/c/d/e/f/g/h/i/j/k/l/m/n.