

California Science Standards

The most important standards for ALL of our students.

Earth Sciences

Earth's Place in the Universe

1. Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:

a. Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.

b. Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.

c. Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.

f. Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.

2. 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:

a. Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.

b. Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.

c. Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.

d. Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.

Dynamic Earth 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,b,d,e. Students know how Earthquakes, volcanoes, and the sea floor provide evidence of plate tectonic processes.

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.

Energy in the Earth System

4. Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:

b. Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.

c. Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.

5. Heating of 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:

a. Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.

b. Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.

d. Students know properties of ocean water, such as temperature and salinity, can be used to explain the layered structure of the oceans, the generation of horizontal and vertical ocean currents, and the geographic distribution of marine organisms.

e. Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.

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Earth Sciences (Cont'd)

6. Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:

a. *Students know* weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.

b. *Students know* the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.

c. *Students know* how Earth's climate has changed over time, corresponding to changes in Earth's geography, atmospheric composition, and other factors, such as solar radiation and plate movement.

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.

Structure and Composition of the Atmosphere

8. Life has changed Earth's atmosphere, and changes in the atmosphere affect conditions for life. As a basis for understanding this concept:

a. *Students know* the thermal structure and chemical composition of the atmosphere.

b. *Students know* how the composition of Earth's atmosphere has evolved over geologic time and know the effect of outgassing, the variations of carbon dioxide concentration, and the origin of atmospheric oxygen.

c. *Students know* the location of the ozone layer in the upper atmosphere, its role in absorbing ultraviolet radiation, and the way in which this layer varies both naturally and in response to human activities.

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:

a. *Students know* the resources of major economic importance in California and their relation to California's geology.

b. *Students know* the principal natural hazards in different California regions and the geologic basis of those hazards.

Investigation and Experimentation

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. 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:

a. Select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

d. Formulate explanations by using logic and evidence.

e. Solve scientific problems by using quadratic equations and simple trigonometric, exponential, and logarithmic functions.

h. Read and interpret topographic and geologic maps.

k. Recognize the cumulative nature of scientific evidence.