

Chemistry - Grades Nine Through Twelve

Science Content Standards.

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:
 - a. Students know the observable properties of acids, bases, and salt solutions.
 - b. Students know acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances.
 - c. Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.
 - d. Students know how to use the pH scale to characterize acid and base solutions.
 - e. * Students know buffers stabilize pH in acid-base reactions.

Chemical Thermodynamics

- Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept:
 - a. Students know how to describe temperature and heat flow in terms of the motion of molecules (or atoms).
 - 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.

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:
 - a. Students know large molecules (polymers), such as proteins, nucleic acids, and starch, are formed by repetitive combinations of simple subunits.
 - b. Students know the bonding characteristics of carbon that result in the formation of a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.
 - c. Students know amino acids are the building blocks of proteins.

Biology/Life Sciences - Grades Nine Through Twelve

Science Content Standards.

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:
 - a. Students know cells are enclosed within semi permeable membranes that regulate their interaction with their surroundings.
 - b. Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
 - c. Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.
 - d. Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.
 - e. Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

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:
 - a. Students know the genetic basis for Mendel's laws of segregation and independent assortment.
- The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:
 - a. Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.

Ecology

- 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 water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.

- d. Students know a vital part of an ecosystem is the stability of its producers and decomposers.
- e. 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.
- f. 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.

Earth Sciences - Grades Nine Through Twelve

Science Content Standards.

Energy in the Earth System

- Energy enters the Earth system primarily as solar radiation and eventually escapes as heat. As a basis for understanding this concept:
 - a. Students know the fate of incoming solar radiation in terms of reflection, absorption, and photosynthesis.
 - b. Students know the different atmospheric gases that absorb the Earth's thermal radiation and the mechanism and significance of the greenhouse effect.
- 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:
 - c. Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.
 - d. Students know the relationship between the rotation of Earth and the circular motions of ocean currents and air in pressure centers.
 - e. Students know rain forests and deserts on Earth are distributed in bands at specific latitudes.
- Climate is the long-term average of a region's weather and depends on many factors. As a basis for understanding this concept:
 - f. Students know weather (in the short run) and climate (in the long run) involve the transfer of energy into and out of the atmosphere.
 - g. Students know the effects on climate of latitude, elevation, topography, and proximity to large bodies of water and cold or warm ocean currents.

Biogeochemical 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 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.

California Geology

- 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.
 - c. Students know the importance of water to society, the origins of California 's fresh water, and the relationship between supply and need.