



Physics

Connections to Other Sciences

Here are some examples of how the concepts you studied in this chapter relate to other sciences.

Atomic Spectrums

Biology Photosynthesis in plants occurs when light of a particular frequency strikes the plant and raises an electron to a higher energy state. The energy that is absorbed in this way is used to form the molecules for building plant structures. Different plants will only absorb certain spectral lines.

Chemistry Flame tests are used in chemistry to detect the presence of certain metal ions based on each element's characteristic emission spectrum. In principle, any element can be identified by its unique spectral signature.

Earth Science The presence of specific gases in the atmosphere of planets gives clues to their composition and nature. For example, the spectral signature of methane gas on Mars gives rise to speculation of life on that planet.

Duality of Nature

Biology Euglena, a common single cell organism, exhibits characteristics of both plants and animals. Like a plant, Euglena has chloroplasts for producing its own food, but like an animal, Euglena will also ingest food for energy.

Chemistry Chemists rely on both the wave and particle aspects of electrons to understand bonding between atoms. Ionic bonding seems to rely on the transfer of an electron as a particle to another atom, while covalent bonding seems to share the wave function of an electron between atoms.

Earth Science Volcanoes both raise and lower the global temperature by two different mechanisms. The large amount of ash and other aerosols ejected into the atmosphere serves to block incoming radiation from the Sun, which lowers temperatures. However, the ejection of carbon dioxide and water vapor contributes to greenhouse gases, which raise temperatures.

Electrostatics

Biology Static electric charges often build up on the fur of animals such as cats, when the fur is rubbed. It is speculated that the fibers of spider webs may also be electrically charged, helping them ensnare their prey.

Chemistry Ionic bonding between charged ions of salts is responsible for the formation of salt crystals. The electrostatic attraction between polarized water molecules explains much of the behavior of water on the macroscopic level.

Earth Science Volcanic eruptions are often accompanied by static electric discharges (lightning) in the clouds of ash caused by the interaction of ash particles that are ejected from the volcano.

Quantization or Fundamental Building Blocks

Biology The basis for life, DNA, is composed of the fundamental building blocks of the organic bases, guanine, cytosine, adenine and thymine, connected to a phosphate-sugar backbone.

Chemistry The quantization of the subatomic particles of an atom determines the chemical characteristics of that element, as well as how it interacts with other elements.

Earth Science The crystals that are the fundamental building blocks of igneous rock such as quartz and feldspar, are composed of repeating units locked into a specific pattern.

Nuclear Radiation

Biology Radioactive elements and nuclear (gamma) radiation are used to treat numerous diseases. Radiation from sources in the environment (for example, radon gas) may lead to genetic mutations.

Chemistry Using radioactive isotopes as tags to follow the steps in chemical reactions has proven to be a valuable tool, particularly in areas of biochemistry where the pathways can become extremely complex.

Earth Science The half-life of certain radioactive elements is the basis for one of the primary arguments establishing the age of Earth as approximately 4.5 billion years.

