

Forms of Energy: Chemical Energy

Energy stored in the structural units of chemical substances (chemical bonds).

The elements of the periodic table are most often found “mixed” together in associations called chemical bonds. A chemical bond can be described as an interaction involving the outer electrons of two or more atoms. Often when these bonds are broken energy is released—**chemical energy**. This energy can be released in the form of heat (**thermal energy**), light (**radiant energy**), and even **electrical energy**.

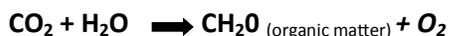
Energy is obtained from the chemical bonds in our food using a process called **respiration**.



Our digestive system is designed to break the bonds of food molecules releasing the associated chemical energy. We use this energy to create **mechanical energy** (movement), or to construct new tissue (create new chemical bonds). A significant amount of the energy released from our food is lost in the form of heat.

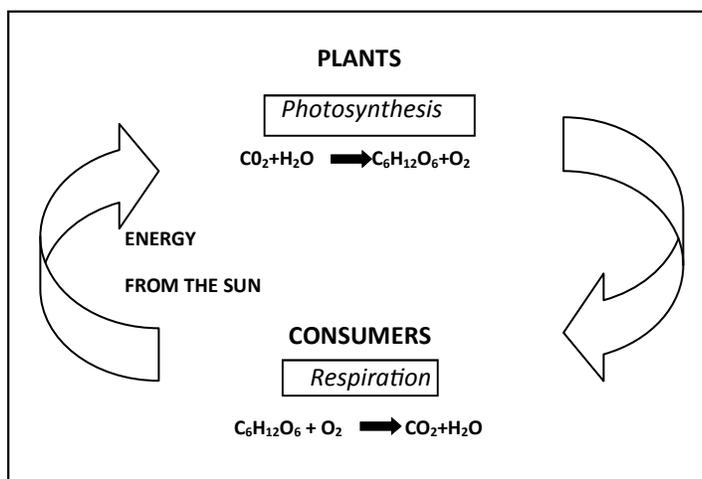
When substances (wood, **coal**, gasoline, etc.) are “burned” the chemical bonds are also broken in a related process called **combustion**. This process yields energy in the form of both heat and light.

Energy from the Sun drives all the life processes we observe on our planet. Without the Sun’s energy, life on Earth could not exist. In general, plants use the energy from the Sun and simple raw chemical materials to build complex chemical structures in a process called **photosynthesis**. These molecules are used to construct the plant’s tissues and carry out the plant’s life processes (see basic photosynthesis equation below).



The Sun provides the energy for this process. A fundamental concept in chemistry is that all reactions are freely reversible. The law of energy conservation indicates that if a reaction requires energy when it proceeds in one direction, then it will produce energy when reversed.

When consumers (such as humans) eat the tissues of a plant we essentially reverse the process of photosynthesis by breaking apart the molecules the plant had constructed. We generate the energy our bodies need by reversing the reaction of photosynthesis. So the end result is that the energy we get from our food is simply transformed energy from the Sun! For that matter, when we burn coal or gasoline we are using ancient deposits of plant matter (**fossil fuels**) to produce energy for our needs. In many ways all energy on Earth is a result of the Sun.



Photosynthesis and respiration capture and release chemical energy.

Glossary of Terms

Chemical energy: The potential energy released by breaking the bonds in molecules

Coal: A solid fossil fuel mined from the Earth's surface and underground which is often used to produce electricity through combustion. There are several different qualities of coal including anthracite, bituminous, and lignite

Combustion: A high-temperature chemical reaction resulting from the combination of a fuel with oxygen which releases carbon dioxide and water mixed with other substances (smoke) as well as thermal and light energy

Electrical energy: Kinetic energy as a result of moving electrons

Energy: The ability to do work

Fossil fuels: Highly combustible substances generally found underground that were formed as the result of high levels of heat and pressure on decaying organic matter from millions of years ago. Fossil fuels include liquid oil, solid coal, and gaseous natural gas and are often burned to generate energy and power

Mechanical energy: The energy an object has from its motion or its potential for motion

Photosynthesis: The biological process by which certain organisms (primarily plants) convert radiant energy (primarily from the Sun) into stored chemical energy

Radiant energy/Radiation: Transmission or emission of kinetic energy as waves through space. Light is one type of radiant energy. Electromagnetic radiation can be classified by the electromagnetic spectrum

Respiration: The process in which an organism uses oxygen for its life processes and gives off carbon dioxide

Thermal energy: Kinetic energy associated with the movement of molecules; commonly produced from combustion. Heat is the transfer of thermal energy from bodies of higher kinetic energy to lower kinetic energy

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