

Different Forms of Energy

Mechanical energy, the kind of energy used by machines, lumps together kinetic energy and potential energy (that is, energy with levers, gears, and wheels that use kinetic or potential energy to convert into work). Examples of mechanical energy are the pendulum, a levered-up rock, and similar devices. At the instant the pendulum is released, it has gravitational potential energy and no kinetic energy. At the bottom of the swing, it has kinetic energy but no potential energy. It just keeps going, trading energy back and forth between these two forms. A levered-up rock can fall, thereby doing work.

Other forms in which mechanical energy is seen include landslides, avalanches, and rain. To make rain, the Sun evaporates water, which condenses into clouds. This water then falls as rain. It does work if it can be captured behind a dam, after which its gravitational potential energy is converted to electrical energy as water falls through turbines in the dam.

Earthquakes, which release energy (stored as rock strain) along fractures, exhibit large-scale land motion. Tsunamis (so-called tidal waves) are water waves caused by underwater Earthquakes and are also forms of mechanical energy.

Nuclear energy becomes available when unstable nuclei spontaneously change by throwing off particles. The decay of the neutron into a proton, an electron, and an antineutrino is an illustration of the conversion of nuclear mass energy into kinetic energy. This form of energy is discussed in detail in Chapters 6 and 14.

Thermal energy is energy internal to the body, due to motion of the atoms making up the body. Hot springs such as those found all over Iceland, in Yellowstone Park, in the

Geysers, California, region, and in the city of Klamath Falls, Oregon, are of high temperature because of contact with the hot rock making up the basement of the continent. Volcanoes, such as Mauna Loa, are reservoirs of thermal energy. The steam that drives the piston in a steam engine has thermal energy. The hot gases in the cylinder of an internal combustion have thermal energy.

Electrical energy is energy stored in the back-and-forth motion of electrons in electric utility lines. Lightning involves the transformation of electrical energy into thermal energy and light energy.

Chemical energy is energy that has been stored in chemical form, such as in fuels or sugars or as energy stored in car batteries. Gasoline is a chemical that combines with oxygen and a little thermal energy to release the great amount of thermal energy stored in the chemical structure of the gasoline. Other such chemicals include sucrose, methane, ethanol, and methanol.

Radiant energy, or electromagnetic energy, is simply the energy carried by electromagnetic radiation (we call this radiation light when it is visible or near the visible region). It is this energy that makes the chemical storage of photosynthesis possible. Chemical energy can be converted into radiant energy by phosphorescent organisms, some deep water fish, and fireflies.⁽³⁾

Both *work* and *heat*, the transfer of thermal energy between objects at different temperatures, involve the interaction of two things. Work involves a force and a displacement. Heat is a transfer between two different objects. Heat is not a form of energy like those listed above. It is a designation for energy being transferred, not an amount contained in a body.

Energy is what is transferred in doing work and in transferring heat.

Most of these forms of energy are treated in subsequent chapters.