

What is Energy?

GUIDE FOR READING

- ◆ How are work and energy related?
- ◆ What are the two basic kinds of energy?
- ◆ What are some of the different forms of energy?

Brilliant streaks of lightning flash across the night sky. The howl of the wind and the crashing of thunder drown out the sound of falling rain. Then a sound like a railroad locomotive approaches. As the sound grows louder, a small town experiences the power and fury of a tornado. Whirling winds of more than 250 kilometers per hour blow through the town. Roofs are lifted off of buildings. Cars are thrown about like toys. Then, in minutes, the tornado is gone.

The next morning, as rescuers survey the damage, a light breeze delicately carries falling leaves past the debris. How strange it is that the wind is violent enough to destroy buildings

one night and barely strong enough to carry a leaf the next morning. Wind is just moving air, but it possesses energy. As you read on, you'll find out what energy is.



What Is Energy?

When wind moves a leaf, or even a house, it causes a *change*. In this case, the change is in the *position of the object*. Recall that *work is done when a force moves an object through a distance*. The ability to do work or cause change is called *energy*. So the wind has energy.

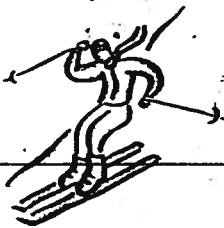
When an object or organism does work on another object, some of its energy is transferred to that object. You can think of work, then, as the transfer of energy. When energy is transferred, the object upon which the work is done gains energy. Energy is measured in joules—the same units as work.

Kinetic Energy

There are two general kinds of energy. The two kinds of energy are kinetic energy and potential energy. Whether energy is kinetic or potential depends on whether an object is moving or not.

The examples you have read about so far have involved things that were moving. A moving object can collide with another object and move it some distance. In that way, the moving object does work. For example, a bowling ball knocks over a bowling pin.

Because the moving object can do work, it must have energy. The energy of motion is called kinetic energy. The word kinetic comes from the Greek word *kinetos*, which means "moving."





Potential Energy

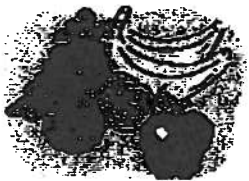
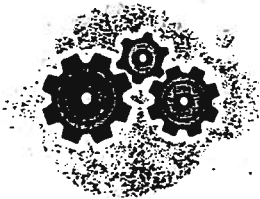
Sometimes when you transfer energy to an object, you change its position or shape. For example, you lift a book up to your desk or you compress a spring to wind a toy. Unlike kinetic energy, which is the energy of motion, potential energy is stored. It might be used later on when the book falls to the floor or the spring unwinds. Energy that is stored and held in readiness is called potential energy. This type of energy has the *potential* to do work.

An archer gives potential energy to a bow by pulling it back. The stored energy can send an arrow whistling to its target. The potential energy associated with objects that can be stretched or compressed is called **elastic potential energy**.

You give a different type of potential energy to an object when you lift it. Potential energy that depends on height is **gravitational potential energy**.

Different Forms of Energy

The examples of energy you have read about so far involve objects being moved or physically changed. But both kinetic energy and potential energy have a variety of different forms. Some of the major forms of energy are **mechanical energy**, **thermal energy**, **chemical energy**, **electrical energy**, **electromagnetic energy**, and **nuclear energy**.



Mechanical Energy The school bus you ride in, a frog leaping through the air, and even the sounds you hear all have mechanical energy. Mechanical energy is the energy associated with the motion or position of an object. Mechanical energy can occur as kinetic energy or potential energy.

Chemical Energy Chemical compounds, such as chocolate, wood, and wax, store chemical energy. Chemical energy is potential energy stored in chemical bonds that hold chemical compounds together. Chemical energy is stored in the foods you eat and in a match that is used to light a candle. Chemical energy is even stored in the cells of your body.

Electrical Energy When you receive a shock from a metal door-knob, you experience electrical energy. Moving electric charges produce electricity, and the energy they carry is called electrical energy. You rely on electrical energy from batteries or power lines to run electrical devices such as radios, lights, and computers.



Nuclear Energy Another type of potential energy, called nuclear energy, is stored in the nucleus of an atom and is released during nuclear reactions. One kind of nuclear reaction occurs when a nucleus splits (nuclear fission). Another kind occurs when nuclei fuse, or join together (nuclear fusion). These reactions release tremendous amounts of energy. Nuclear power plants use fission reactions to produce electricity. Nuclear fusion occurs in the sun and other stars.