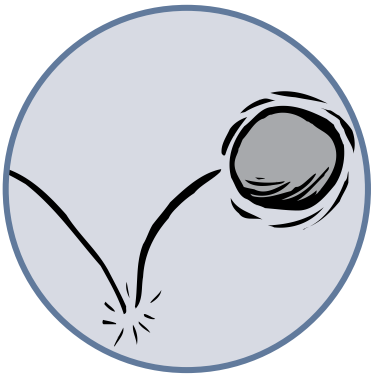
Energy Basics



A common definition of energy is the ability to do work (or to organize or change matter). Work involves force and motion. You can see evidence of energy when something moves or changes (when work is done). Light, thermal energy, and sound are other ways we can detect energy. People might think of energy as a substance such as fuel or a force or power, but in scientific terms energy is a state or condition that can be quantified and measured.

Scientists use energy to describe certain properties of an object or a series of objects. It is similar to how you can describe an object's weight or size, and you can assign a value to quantify an object's energy.

Energy is transferred from one object to another during work (when there is movement or change). The amount of energy that is present before and after work is the same (scientists say energy is conserved). For example, let's say you drop a ball. Scientists can measure the energy before, during, and after the fall. The amount of energy remains constant throughout the process—it is just in different states. Likewise, when an object is thrown, a spring released, or something burned, the energy can be measured and will remain constant. This is the reason behind the statement, "Energy can neither be created nor destroyed, it can only be converted from one form to another." Scientists have found that the amount of energy in a closed system remains constant.

Wherever you look, you can see examples of energy transfers. When you turn on a light, you see the result of energy being transferred from the sun to the plants to the coal to electricity and finally to the light you see. During each of these transfers, energy changes form. There are two main forms of energy—kinetic energy (motion) and potential energy (position). To further classify energy, these forms are sometimes described as thermal (heat), elastic, electromagnetic (light, electrical, magnetic), gravitational, chemical (food), and nuclear energy. See the KEEP Activity Guide for more information on kinetic and potential energy.

During energy transfers, it might seem that energy does go away or become reduced. For example, a bouncing ball stops bouncing, a battery dies, or a car runs out of fuel. The energy still exists but it has become so spread out that it is essentially unavailable. Burning a piece of wood releases light and thermal energy (commonly called heat). The light and heat become dispersed and less useful. Another way to describe this process is to say the energy is concentrated in the wood (chemical energy) and becomes less concentrated in the forms of thermal and light energy.

Energy has often been called the currency of life. It flows through Earth's processes, creating wind, providing light, and enabling plants to create food from water and air (carbon dioxide). Humans have tapped into this flow to generate electricity, fuel our cars, and heat our homes. The sun provides Earth with most of its energy. It is important for students to recognize and appreciate this source of energy and to explore the transformations that bring the sun's light into their home in the form of light, heat, food, and fuel. We are fortunate to have many "concentrated" sources of energy. Besides the sun, there is chemical energy found in fossil fuels such as coal and oil and in nuclear resources.

While the amount of energy in our world remains constant, as we use it (transfer it to one form to another), it becomes spread out and less useful. Energy also gives us the ability to work. Through education and becoming aware of what energy is and how we use it, we can learn (i.e., work) to use our concentrated resources more wisely and ensure that they will be available for future generations.

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