

Forms of Energy

Energy is the ability to do work.

Energy comes in many different forms, including mechanical energy, light energy, thermal energy, sound energy, electrical energy, chemical energy, and nuclear energy.

Energy can be changed from one form to another.

When energy changes form, the same amount of energy exists after the change as there was before the change.

Mechanical Energy

Mechanical energy is the energy that an object has due to its position or motion. Mechanical energy can be classified as potential energy or kinetic energy.

- **Potential energy** is energy that is *stored* in an object. The different types of mechanical potential energy are related to the *position* of the object.
- **Gravitational potential energy** is related to the object's height above the ground. The higher an object is above the ground, the higher the potential energy of the object.
- **Elastic potential energy** is related to how far an object is stretched. For example, rubber bands have elastic potential energy.
- **Kinetic energy** is energy of *motion*. The amount of kinetic energy that an object has depends on the mass and velocity (or speed) of the object. For example, a car moving at 60 miles per hour has more kinetic energy than the same car moving at 30 miles per hour.

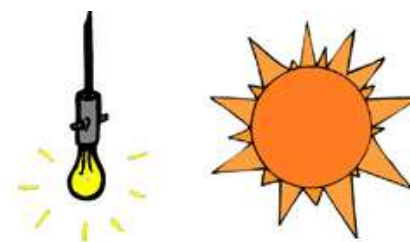


Energy can be **transformed** back and forth between potential and kinetic energy. Energy transformations must always obey the law of conservation of energy.

The total amount of energy in this yo-yo stays the same at all times, but the amount of kinetic and potential energy changes with the position of the yo-yo. When the yo-yo is at its highest position (before it falls), all of its energy is in the form of potential energy. As the yo-yo falls, the potential energy is transformed into kinetic energy because it is moving. When the yo-yo goes back up, the kinetic energy is transformed back into potential energy again.

Radiant Energy and Light

Radiant energy is a form of kinetic energy that is transmitted as electromagnetic waves. Because radiant energy travels as electromagnetic waves, it does not require a medium to travel through. An example of radiant energy is light rays. The radiant energy from the Sun is the primary source of energy for the Earth.



Light energy is a type of radiant energy which is often transferred and produced by other types of energy. Light energy can come from the Sun; this type of energy is referred to as solar energy.

Light energy can be transferred from (and to) other energy types, such as:

- electrical energy changes into light energy in a light bulb
- light energy is absorbed by plants and transformed into chemical energy (food) through photosynthesis

Thermal Energy and Heat



Thermal energy is the energy of an object due to the random motion of its particles. The faster the particles move, the greater the thermal energy, and the greater the temperature.

Heat energy is thermal energy that is transferred from warmer objects to colder objects. Heat energy is often produced when energy changes from one form to another.

Geothermal energy is energy that is produced by heat stored in the Earth, or the combination of absorbed heat from underground, the atmosphere, and the oceans.

Sound Energy

Sound energy, or **acoustic energy**, is the energy of sound waves as they travel.

Sound energy can be produced by other forms of energy, such as:

- mechanical energy, when drums are played
- electrical energy, when a radio is turned on



The speed of a sound wave depends upon the properties of the medium through which the wave is traveling. Sound travels quicker through a solid substance than through a liquid or through air. Sound waves cannot travel through a vacuum because there is nothing for the waves to be transmitted through.

Electrical Energy



Electrical energy moves charged particles from one place to another. When a conductor—something that electrons can move through—makes a path from one end of a battery to the other, or from one side of an outlet to another, electrons begin flowing through it, creating **electricity**. The path along which they flow is a circuit.

These moving electrons flow through wires as a current, or a continuous flow of electrically charged particles. These currents can do work, converting their electrical energy to another type of energy (e.g., heat, light, sound, mechanical).

Electrical energy is the primary way that energy is stored for people to use. Power plants produce electrical energy that can be converted into many other forms of energy. People use electrical energy by using batteries or by plugging an appliance into a power outlet on a wall. The electrical energy that flows through the plug and wires transfers into:

- light energy when it reaches a lamp
- mechanical energy when it reaches a fan
- sound energy when it reaches a radio
- heat energy when it reaches a toaster

Chemical Energy

Chemical energy is the energy found in substances due to the arrangement of its particles. It is a type of potential energy, or stored energy.

Chemical energy is present in several situations of energy transfer, such as:

- chemical energy in fuels (gasoline, wood) may be converted into heat, light, and motion when the fuel is burned.
- chemical energy in batteries is converted to electrical energy to power various objects, such as a flashlight.
- chemical energy in food is converted to several forms of energy (heat, etc.) when digested by an organism.
- plants use light energy from the Sun to make chemical energy in the form of sugars.



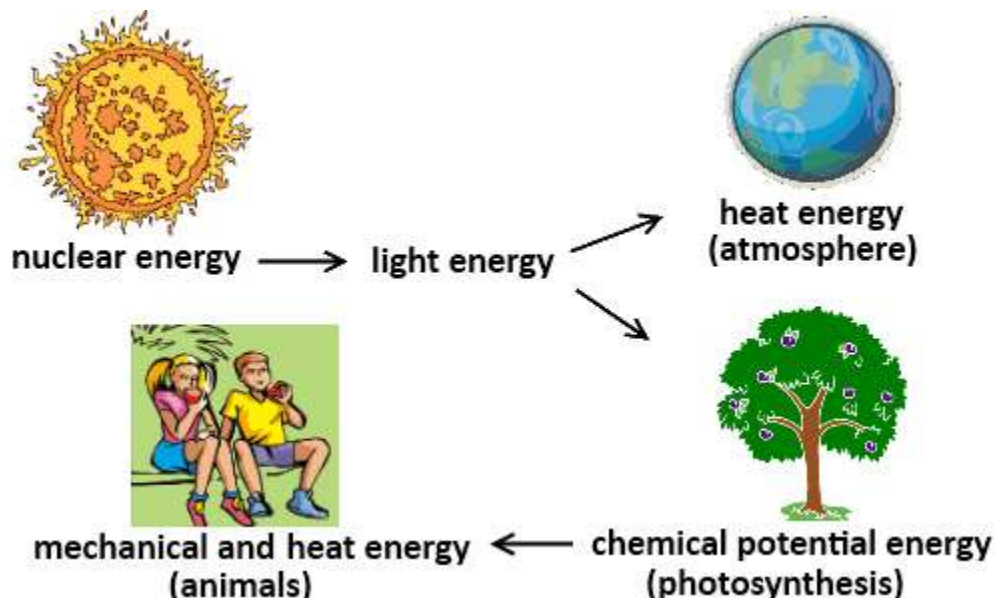
Nuclear Energy

Nuclear energy is a form of potential energy that comes from changes in the nucleus of an atom. Nuclear reactions can produce very large amounts of energy as heat and light.

- If two or more small nuclei join together, it is known as **fusion**.
- If the nucleus of a large atom breaks apart, it is known as **fission**.

Solar energy is produced through fusion reactions taking place in the Sun. Energy from the Sun is transformed through many forms as it travels to the Earth and is used by plants and animals.

Energy Transformations from the Sun



Law of Conservation of Energy

The **law of conservation of energy** states that the amount of energy in a system remains constant and that energy cannot be created or destroyed. When energy changes form, the same amount of energy will exist after the change as there was before the change.

A light bulb can convert electrical energy into heat and light. If 70 Joules of electrical energy are supplied to a light bulb, the sum of the heat and light energy that is produced should also be 70 Joules.

Document courtesy of Mr. Stewart

<https://sites.google.com/site/mrstewartjfr/energy-notes>