

The Nature and Types of Energy

Then energy is defined as the *capacity for doing the work or the ability required to do the work*.

Unlike matter, energy cannot be seen, weighed, touched or smelled but it can be felt, for example, when say we are tired. In reality, it is invisible. Every body has certain optimum energy. If the energy rises above this level, we feel full of energy and if it falls below this level, we feel we are tired.

Forms of Energy

There are various forms of energy like solar energy, heat energy, electrical energy, mechanical energy, wind energy, sound energy, light energy, thermal energy, and chemical energy. Among these, some important ones are:

Solar energy or radiant energy, comes from sun, is far the most important energy of all the energies, without which, there will not be any life on this planet. It is Earth's primary source of energy that harbors the growth of vegetation through photosynthesis, it heats the Earth's surface and the atmosphere, and it manipulates the global climate.

Thermal energy (heat energy) *is the energy associated with random motion of atoms and molecules*. It is simply calculated from temperature measurements. Thermal energy is an **extensive property that** means it depends on the amount of matter. For example, a bucket filled with hot water has more thermal energy than a cup filled with the same hot water.

Chemical energy is the energy stored in the structural units of chemical substances. When a substance undergoes a chemical reaction, chemical energy is released, stored or converted to other forms of energy.

Type of Energy

There are basically two types of energy; (a) kinetic energy, and (b) potential energy.

Kinetic energy is the energy associated with moving objects. When the object moves, it gains kinetic energy and when it stops moving, its kinetic energy goes to zero. The kinetic energy function of the mass (m) and the speed(u) of an object, which is mathematically expressed as

$$\begin{aligned}\text{kinetic energy} &= \frac{1}{2} \text{ mass} \times \text{speed}^2 \\ &= \frac{1}{2} m \times u^2\end{aligned}$$

Higher the mass or higher the speed means higher the kinetic energy.

Example-1

Suppose that you are traveling on an expressway with 50 mph and another car with same weight as your car zoomed by you with 80 mph. Which car has the higher kinetic energy?

Answer-1

Kinetic energy depends on both mass and speed. Since both cars have the same mass, the only difference is the speed. The second car has higher speed than your car and therefore has higher kinetic energy. If an accident happens, the second car will do more destruction upon collision because this kinetic energy will be transferred to the target.

Example-2

Suppose again that you are traveling on an expressway with 50mph. In the next lane a big truck is also traveling with the same speed. Who has more kinetic energy?

Answer-2

This time the speed of the car and truck is the same, but truck weighs much more than a car and hence possesses more kinetic energy.

This gives you an idea about the kinetic energy. If you are interested to know exactly how much the kinetic energy a particular object possesses, you can calculate it with the help of the above equation knowing the mass and the speed.

Potential Energy

The potential energy is the energy that exists by virtue of an object's position.

- For instance, a book on the edge of the table has more potential energy because of its higher altitude and will make a big noise when it falls on the floor compared the same book on the floor
- A rock on the top of the cliff has more potential energy than the same rock at the foot of the cliff due its higher altitude
- Reservoirs have more potential energy. As the water gushes through the dam, its potential energy is converted to kinetic energy that is used to generate electricity – *hydroelectric power*

Chemical energy can be considered as a form of potential energy because it is associated the relative positions and arrangements of atoms within a substance.

All forms of energy can be converted from one form to another without the loss of any energy, some examples are

- When you turn the flashlight on, electrical energy is converted to light energy

- When you start rolling bowling ball, its potential energy is converted to kinetic energy
- When you jog, chemical energy in your body is converted to kinetic energy
- When you turn the light switch on in your home, electrical energy is transformed into light energy
- When you start you car, electrical energy is converted to mechanical energy, and when you start driving the car, mechanical energy is converted into kinetic energy, heat energy, friction energy, sound energy, etc.
- When massive body of water runs through the dam, the potential energy is converted to kinetic energy.

From the above few examples, it can be concluded that when one form of energy disappears, the exactly equal amount of energy appears in some other form. That means the energy is conserved and stated in the form of **law of conservation of energy**: *The total energy of the universe is constant.*