

TEACHER OVERVIEW: ENERGY AND ENERGY TRANSFORMATIONS

WHAT ARE THE TYPES OF ENERGY?

Whenever something moves, you can see the change in energy in that system. Energy can make things move or cause change in the position or state of an object. Energy can be defined as the capacity to cause a change or the ability to do work. Work is done when a force moves an object over a given distance. In scientific terms, energy is classified into two major types: kinetic and potential energy. Kinetic energy is defined as the energy of a moving object. A moving car, a waterfall, or a book falling off a table are examples of objects that have kinetic energy. Potential energy is defined as the energy in matter due to its position or the arrangement of its part.

Forms of Potential Energy:

- **Gravitational Potential Energy:** The kind of potential energy that results when something is separated from the earth.
- **Chemical Potential Energy:** The energy stored in the bonds of atoms and molecules. It is the energy that holds these particles together.
- **Elastic Potential Energy:** The energy stored in objects by the application of a force that results in the deformation of an elastic object.
- **Nuclear Energy:** The energy stored in the nucleus of an atom—the energy that binds the nucleus together.

Forms of Kinetic Energy:

- **Mechanical Energy:** The energy associated with the motion or position of an object.
- **Thermal Energy:** The internal energy of substances caused by vibration and movement of atoms and molecules within the substance.
- **Electrical Energy:** The energy of moving electrical charges.
- **Radiant Energy:** Electromagnetic energy that travels in waves which possess both electrical and magnetic properties.
- **Sound Energy:** The energy that is associated with the vibrations of matter and travels in longitudinal waves through an object (including air and water).

THE LAW OF CONSERVATION OF ENERGY

Within a closed system, the amount of energy must remain constant. Energy is neither created nor destroyed, but it can be transferred from one form to another. Thus when the water located at the top of a waterfall plunges over the edge, the potential energy of that water is converted to kinetic energy. The energy of an air molecule moving in the wind can be converted to mechanical energy when moving the rotor of a windmill, which then can be converted into electricity by a wind turbine generator. In almost all of these processes, some of the energy is also converted to heat energy.

The production of all energy sources impact the natural environment in different ways. As the world's population and health continues to increase, there will be a greater demand for energy. The Energy Information Agency projects a 50 percent increase in the world's energy consumption from 2020 to 2050. To meet this tremendous growth, we need to better understand the exploration and production of energy and how we might produce and use energy more economically and efficiently.

ENERGY TRANSFORMATION

An energy transformation is the change of energy from one form to another. Energy transformations occur everywhere every second of the day. There are many different forms of energy such as electrical, thermal, nuclear, mechanical, electromagnetic, sound, and chemical. Because the law of conservation of energy states that energy is always conserved in the universe and simply changes from one form to another, many energy transformations are taking place constantly.

Examples of Energy Transformations:

- A toaster transforms electrical energy into thermal energy.
- A blender transforms electrical energy into mechanical energy.
- The sun transforms nuclear energy into ultraviolet, infrared, and gamma energy - all forms of electromagnetic energy.
- Our bodies convert chemical energy from food into mechanical and electrical energy to allow us to move.
- A natural gas stove converts chemical energy from burning into thermal energy used to cook food.

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Students often struggle to understand the interactions that underlie energy transformation. This simple activity allows students to “see” real life examples of energy transformation they observe in every day life.