



Energy Conversions and the Laws of Thermodynamics

There are two laws of thermodynamics that must be considered when discussing any type of **energy**. The **First Law of Thermodynamics** says that energy is conserved. In all physical changes, energy is neither created nor destroyed. Energy can be converted from one form to another. **Chemical energy** can be converted to heat (**thermal energy**) or to light; light can be converted to chemical energy; nuclear energy can be converted to light or to heat; chemical energy can be converted to **mechanical energy**, and so on. All forms of energy can be converted back and forth but energy cannot be created from nothing or destroyed forever.

The **Second Law of Thermodynamics** states when energy is changed from one form to another, some of the energy is degraded to a more dispersed, random form with increased **entropy**. Often energy is lost in the form of heat (thermal) or light (radiant). Energy is not 100% converted to work. In other words, no system is fully efficient in transforming energy. This includes the human body. Our food (chemical energy) can be transformed to provide energy for movement (mechanical energy), however a significant amount of the energy is lost in the form of heat. You can place your hand on your arm and feel the energy in the form of heat that you are losing from your last meal. Below are some examples of the efficiency of different energy sources.

- ⇒ Coal (chemical energy) to electricity (electrical energy)—only 33% efficiency
- ⇒ Gasoline (chemical energy) to movement (mechanical energy)—only 15% to 35% efficiency
- ⇒ Electricity (electrical energy) to an incandescent light bulb (radiant energy)—only 10% efficiency



Energy is lost as heat through steam during the process of converting nuclear energy to electrical energy.

Glossary of Terms

Chemical energy: The potential energy released by breaking the bonds in molecules

Energy: The ability to do work

Entropy: The tendency of the universe towards disordered systems

First Law of Thermodynamics: Energy is conserved. In all physical changes, energy is neither created nor destroyed. Energy can be converted from one form to another

Mechanical energy: The energy an object has from its motion or its potential for motion

Second Law of Thermodynamics: When energy is changed from one form to another, some of the energy is degraded to a more dispersed, random form with increased entropy

Thermal energy: Kinetic energy associated with the movement of molecules; commonly produced from combustion. Heat is the transfer of thermal energy from bodies of higher kinetic energy to lower kinetic energy

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