

Conservation of Energy Notes

Energy - The "something" that enables work to be done.

Kinetic energy - energy of motion.

$$KE = \frac{1}{2} mv^2$$

Potential energy - stored energy or energy of position. A common form of potential energy we deal with is **gravitational potential energy (PE)**. PE is the potential energy of an object due to its position relative to another object, the earth is often "the other" object. As a result the usual equation in physics for PE is

$$PE = mgh$$

Law of conservation of energy - energy cannot be created nor destroyed; it can only change form.

We usually define **mechanical energy** as the sum of all the kinetic and potential energy. Since the energy of an object must be conserved, the kinetic energy used to place a book on a shelf is stored in the book as potential energy, all the while the mechanical energy staying constant.

Work is the amount of energy required to move an object, or released by the motion of an object, a certain distance; motion must be in the same direction of the applied force. If work is done on an object by its surroundings, the work is positive. When work is done by an object on its surroundings, the work is negative. The sign of the work indicates the direction of motion of energy.

The **Work-energy theorem** states that work equals the change in kinetic energy. This idea can also be manipulated to include potential energy as well. When an object is placed a certain height above the ground it has gravitational potential energy. When allowed to fall gravity does work on the object, causing it to fall. As the object speeds up it gains kinetic energy as it loses an equal amount of potential energy. So:

$$W = \Delta KE \quad \Delta KE = -\Delta PE \quad (\text{the negative indicating loss of energy})$$

From this we can determine that **work** is the applied force multiplied by the distance traveled, both in the same direction:

$$W = \vec{F} \cdot \Delta \vec{x}$$

UNITS of energy and work

USCS --> ft·lb; calorie; Calorie

SI --> N·m or Joule (J)