

Energy is the ability to do work (Energy is measured in Joules (J) = $\text{kg}\cdot\text{m}^2/\text{s}^2$)

Energy comes in two basic forms – potential and kinetic

1. Potential energy is energy stored within an object that can be used later.

For mechanics we use mainly

a. gravitation potential energy ($U_g = mgh$)

b. Spring potential energy ($U_s = \frac{1}{2} k_s x^2$)

2. Kinetic energy is the energy an object has due to its motion ($K = \frac{1}{2} mv^2$)

Work is the ability to apply a force over a distance, which thereby changes the energy of an object (work is also measured in Joules)

$$W = F \cdot d \cos\theta$$

$$W = \Delta K$$

Power is the rate at which work is done.

$$P = W/t \text{ (power is measured in Watts (W))}$$

Mechanical Advantage

Work in = Work out

On either side of a machine, the input or output side, the total change in energy is equal (when friction is neglected).

In a given system energy can be describe by the following

$$E = U + K \text{ (potential energy + kinetic energy)}$$

Since energy is always conserved it is just changed between one form and another, therefore

Energy before an interaction = energy after the interaction

$$U(\text{before}) + K(\text{before}) + W(\text{friction}) = U(\text{after}) + K(\text{after})$$

For example, when a rock is dropped from a high location it originally has only potential energy due to gravity. When it is half way down it has half its energy as potential and half as kinetic, but the total is still the same (neglecting friction as usual). When the object is about to hit the ground it

has zero potential energy and all kinetic energy. This final kinetic energy is the same as the starting potential energy.