



Work and Energy

Work

- Work is said to be done when force is applied on an object and it gets displaced due to the application of force.
- It is a scalar quantity.
- Mathematically, work done is a product of force and displacement.
- Work done = Force \times Displacement
- S.I Unit of Work = Joules (J)
- $1\text{J} = 1\text{N} \times 1\text{m}$

Types of Work Done

- ① **Positive Work done:** Work done is said to be positive if force and displacement are in the same direction.
- ② **Negative Work done:** Work done is said to be negative if force and displacement are in opposite direction.
- ③ **Zero Work done:** Work done is said to be zero if force and displacement are perpendicular to each other.

Energy

- The ability or capacity of an object to do work is called energy.
- It is a scalar quantity.
- S.I Unit of energy - Joules.
- The object which does work loses energy and the object on which work is done gains energy.

Kinetic Energy

- The energy possessed by an object due to its motion is called kinetic energy.
- $K.E = \frac{1}{2}mv^2$



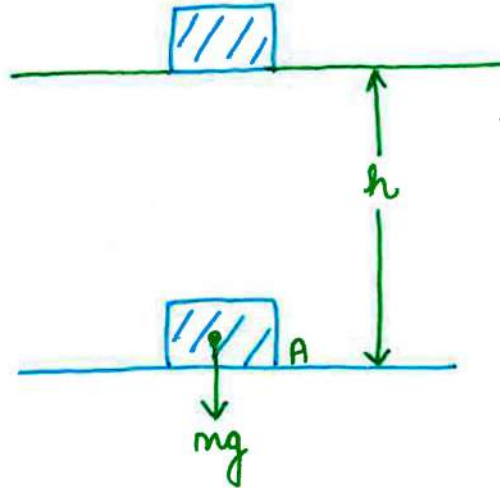
- Work done = Change in Kinetic Energy
$$= K.E_f - K.E_i$$
$$= \frac{1}{2}mv^2 - \frac{1}{2}mu^2$$

Potential Energy

- The energy possessed by an object due to its position or configuration is called potential energy.

Gravitational Potential Energy

- The gravitational potential energy of an object at a point above the ground is defined as the work done in raising it from the ground to that point against gravity.
- $P.E = \text{Work done} = m \times g \times h$



Law of conservation of energy of a freely falling body

- At maximum height
 $P.E = \text{maximum}, K.E = 0$
- At mid point
 $P.E = K.E$
- Just before touching the ground
 $P.E = 0, K.E = \text{max}$



Law of conservation of energy

- According to the law of conservation of energy, energy can neither be created nor destroyed. It can only be converted from one form to another.
- The total energy before and after the transformation remains the same.

Power

- The rate of doing work is called power or the work done per unit time is called power.
- Mathematically, $\text{Power} = \frac{\text{Work}}{\text{time}}$
- S.I unit of power is Watt (W) or Joule per second (J/s)

Commercial Unit of Energy

- It is defined as energy consumed by an appliance of 1kW when it is used for one hour.
- 1 kilowatt hour = $1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$
- 1 kWh = 1 Unit of energy