Class 9th

PHYSICS

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 = Force × Displacement
- S.I Unit of Work = Joules (J)
- 1 J = 1 N × 1 m

Types of Work Done

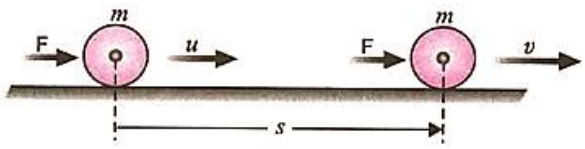
1. **Positive Work done** - Work done is said to be positive if force and displacement are in the same direction.
2. **Negative Work done** - Work done is said to be negative if force and displacement are in opposite directions.
3. **Zero Work done** - Work done is said to be zero if force and displacement 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 = ½ mv^2



- Work done = Change in Kinetic Energy

  = $K.E_f - K.E_i$

  = ½ mv^2 – ½ mu^2

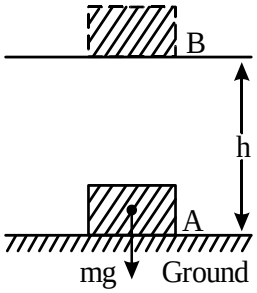
Potential Energy

- 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 = Work done = m × g × h



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.

Conservation of energy for a freely falling body

At maximum height

P.E = Maximum, K.E = 0

At Mid Point

P.E = K.E

At just before touching the ground

P.E = 0

K.E = max

Power

- The rate of doing work is called Power or the work done per unit time is called power.
- Mathematically, Power = (Work / Time)
- S.I unit of power is Watt (W) or (Joule / sec)

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 = **$1\ kWh = 3.6 \times 10^{-6}\ J$**
- 1 kWh = 1 Unit of energy