# Talent & Olympiad

# Work, Energy and Power

## **Synopsis**

• Work

Work is said to be done only when a force displaces an object. The amount of work done by a body is measured as the product of magnitude of the force applied and the distance moved by the body in the direction of the force. Work is a scalar quantity.

Work = force  $\times$  displacement of the body, W = F  $\times$  S

W = FS Cos  $\theta$  Where 'S' is the displacement of the object and  $\theta$  is the angle between the force and displacement.

W = FS if the displacement is along the force then

 $\theta = 0$  and  $\cos \theta = 1$ 

W = -FS if the displacement is opposite to the force then  $\theta = 180^{\circ}$  and  $\cos \theta = -1$ .

If the displacement is perpendicular to the force, then the work done is zero

 $(9 = 90^\circ, \cos 9 = 0).$ 

Energy: The capacity to do work is called energy. It is a scalar quantity and its units are the same as that of work.

#### Types of energy:

**Kinetic energy**: The energy possessed by a body by virtue of its motion is called kinetic energy. If a body of mass m is moving with a velocity v, then its kinetic energy is given as

K.E.=-mv2

Potential energy: The energy possessed by a body by virtue of its position is called potential energy. If a body of mass W is lifted to a height 'h' against gravity 'g; then its potential energy is given as P.E. = mgh

### Potential energy is of two types:

(i) **Gravitational potential energy:** The potential energy of an object due to its height above the earth's surface is called its gravitational potential energy.

(ii) Elastic potential energy: A stretched or compressed object such as a spring or a rubber band has elastic potential energy.

- **Relation between work and energy:** Work done by external forces on a system is equal to the increase in the energy of the system.
  - **Principle of conservation of energy:** According to the law of conservation of energy, one form of energy can be changed into another form of energy. Amount of energy lost in one form should be equal to the amount of energy gained in another form.
- **Power:** Work done per unit time is called power. Watt is the unit of power. Horse Power = 746 W

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