

Motion

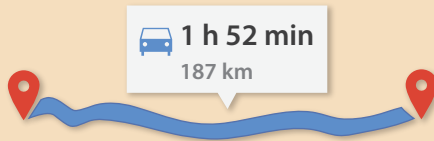
Motion

- Change in position of an object with respect to time.
- Change in position is based on the reference point of an individual.



Distance

- Length of the total path travelled by a body.
- SI Unit: metre(m)



Speed

- Distance travelled by a body per unit time.
- SI Unit: metre/second (m/s)

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Scalar quantity

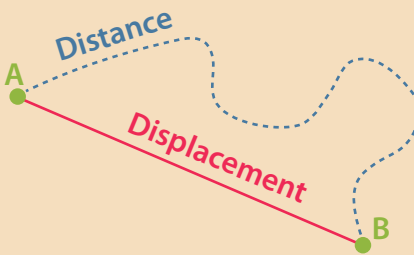
- Quantities having only magnitude and no direction.
- Examples: Speed, mass, distance, volume, etc.

Vector quantity

- Quantities having both magnitude and direction.
- Change in either magnitude or the direction, changes the value of the vector quantity.
- Examples: Velocity, acceleration, force, displacement, etc.

Displacement

- Length of the shortest path travelled by a body.
- SI Unit: metre(m)



Acceleration

- Rate of change of velocity with time.
- SI Unit: metre/second squared (m/s^2)

Equations of Motion

- $v = u + at$
- $v^2 = u^2 + 2as$
- $s = ut + \frac{1}{2}at^2$

Where,

s = displacement
 u = initial velocity
 v = final velocity
 a = acceleration
 t = time of motion

Distance –Time Graph

- Determines the change in the position of the object.
- Slope gives the speed of the object.
- Line graph of uniform motion is always a straight line.
- Time lies on the x-axis while the distance on the y-axis.

Velocity –Time Graph

- Slope gives the acceleration of the object.
- Line graph of uniform velocity is a straight line.
- Time lies on the x-axis while the velocity on the y-axis.
- Distance travelled is the area under the graph.

Uniform Speed

- Body travelling equal distance at equal intervals of time.
- Average speed = Speed

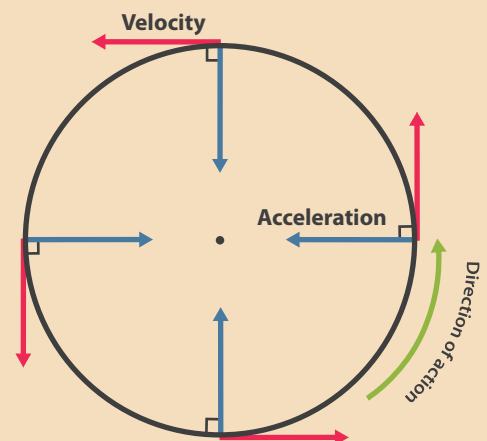
Non-uniform Speed

- Body travelling unequal distance at equal intervals of time.
- Average speed

$$= \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

Uniform Circular Motion

- Body undergoing circular motion at a constant speed.



- Body traces a circle with a fixed centre.
- At every point, the body changes its direction.

Terminologies of Uniform Circular motion

Time Period (T)

Time taken by the body to complete one revolution.

Frequency (f)

The number of revolutions the body completes in one second

$$f = \frac{1}{T} \quad \text{Unit: Hertz (Hz)}$$

Angular Speed

Speed of the object in rotational motion. It is the rate at which the angle subtended at the centre changes.

$$\text{Angular speed, } \omega = \frac{2\pi}{T}$$

Centripetal Force

Centripetal force is the force acting on a body in a circular path. It points towards the centre around which the body is moving.

$$\text{Centripetal Force, } F = \frac{mv^2}{r}$$