

MYP 4 - Motion

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An object is said to be in motion when its position changes with time.

The total path covered by the object is said to be its **distance traveled**.

The shortest path / distance measured from the initial position to final position of the object is called its **displacement** .

When an object covers equal distance in equal interval of time, it is said to be in **uniform motion**.

When an object covers unequal distance in equal interval of time, it is said to be in **non-uniform motion**

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The distance traveled by an object in unit time is referred to as its **speed**. Its unit is m/s or km/hr.

Average speed is defined as total distance traveled by total time. Mathematically it is represented as below

$$\text{Average speed } (v) = \frac{\text{Total distance travelled}(s)}{\text{Total time taken } (t)}$$

Conversion Factor

- Change from km/hr to m/s = $1000\text{m}/(60 \times 60)\text{s} = 5/18 \text{ m/s}$

Velocity is the speed of an object moving in a definite direction. Its unit is m/s or km/hr .

Average velocity is final velocity minus initial velocity divided by time. Mathematically it is represented as below

$$\text{Average velocity} = \frac{v + u}{2}$$

Where v is final velocity , u is initial velocity

Magnitude

Magnitude is the size or extent of a physical quantity. In physics, we have scalar and vector quantities.

Scalar quantities are only expressed as magnitude. E.g: time, distance, mass, temperature, area, volume

Vector quantities are expressed in magnitude as well as the direction of the object. E.g: Velocity, displacement, weight, momentum, force, acceleration, etc.

Acceleration is the change in velocity of an object per unit time. Its unit is m/s^2

Mathematically it is represented as below :

Where v = final velocity , u = initial velocity

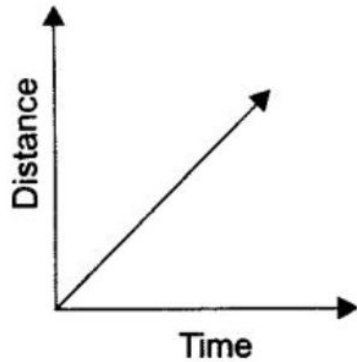
$$\text{Acceleration} = \frac{v - u}{t}$$

Graphical representation of motions

(i) Distance-time graph

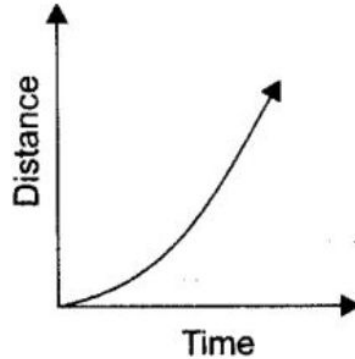
For a distance-time graph, time is taken on x-axis and distance is taken on the y-axis.

[**Note:** All independent quantities are taken along the x-axis and dependent quantities are taken along the y-axis.]

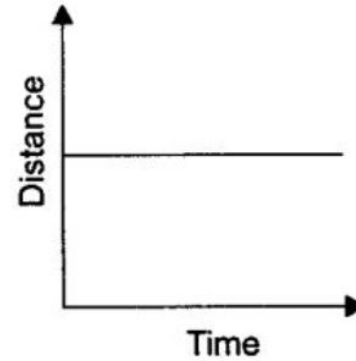


Uniform speed

$$\left(\text{speed} = \frac{\text{distance}}{\text{time}} \right)$$

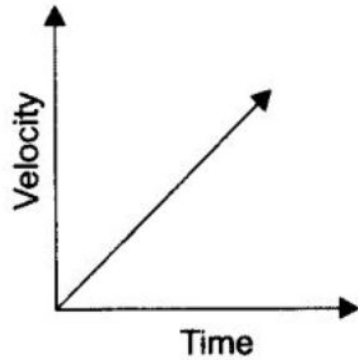


Non-uniform speed

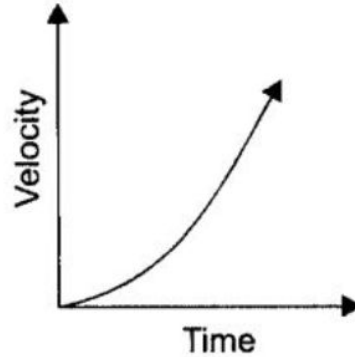


Stationary

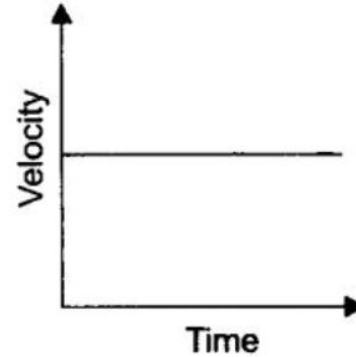
(ii) Velocity-time graph



Uniform acceleration
 $\left(a = \frac{v}{t}\right)$



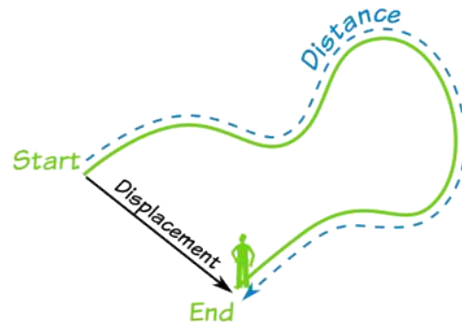
Non-uniform
acceleration



Uniform motion
or no acceleration

Distance v/s displacement

Distance	Displacement
1. It is the length of the actual path covered by an object, irrespective of its direction of motion. 2. Distance is a scalar quantity. 3. Distance covered can never be negative. It is always positive or zero. 4. Distance between two given points may be same or different for different path chosen.	1. Displacement is the shortest distance between the initial and final positions of an object in a given direction. 2. Displacement is a vector quantity. 3. Displacement may be positive, negative or zero. 4. Displacement between two given points is always the same.



Uniform Circular Motion

Uniform circular motion

- If an object moves in a circular path with uniform speed, its motion is called uniform circular motion.
- Velocity is changing as direction keeps changing.
- Acceleration is constant