Motion

Definitions and Formulae

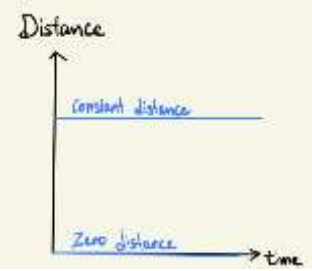
Variables	Type of quantity	SI units	Definition
Distance	Scalar	m	The total length of space travelled between two points.
Displacement	Vector	m	The shortest distance from initial point to final point in a given direction.
Time taken	Scalar	s	The time interval during a motion.
Speed	Scalar	m/s	Rate of change of distance travelled.
Velocity	Vector	m/s	Rate of change of displacement.
Acceleration	Vector	m/s^2	Rate of change of speed or velocity.

Remain at rest

Distance or displacement = constant

Speed or velocity = 0

Acceleration = 0

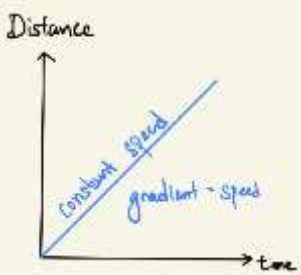


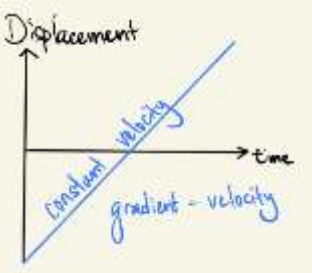
For constant motion

Distance or displacement changing

Speed or velocity = constant

Acceleration = 0



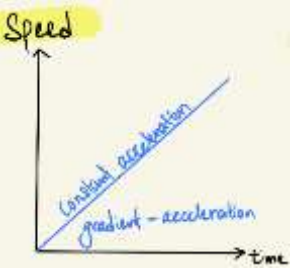


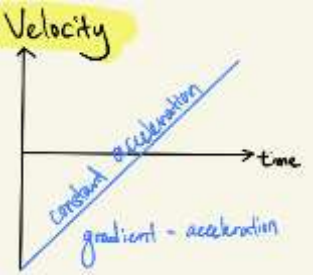
For constant acceleration

Distance or displacement changing

Speed or velocity changing

Acceleration = constant



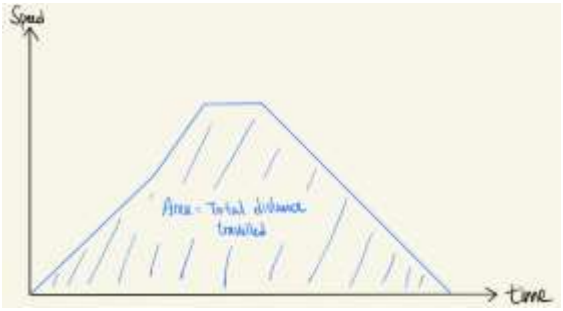


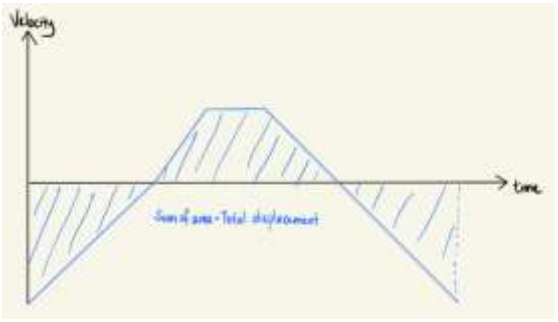
$$speed = \frac{distance}{time\ taken},\ average\ speed = \frac{total\ distance\ travelled}{total\ time\ taken}$$

$$velocity = \frac{displacement}{time\ taken},\ average\ velocity = \frac{total\ dispalcement}{total\ time\ taken}$$

$$acceleration = \frac{change\ in\ speed\ or\ velocity}{time\ taken},\ change = final - initial$$

- **Total distance travelled = area under the speed-time graph**
- **Total displacement = area under the velocity-time graph**





Equations of motions, s, u, v, a, t

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = \frac{(u+v)}{2}t$$

$$s = ut + \frac{1}{2}at^2$$

$$s = vt - \frac{1}{2}at^2$$

Where

$$s = distance\ or\ displacement, m$$

$$u = initial\ speed\ or\ velocity, m/s$$

$$v = final\ speed\ or\ velocity, m/s$$

$$a = acceleration, m/s^2$$

$$t = time\ taken, s$$