

One-Dimensional Motion

Essential information

- Over a period of time:

$$\text{average velocity} = \frac{\text{change in displacement}}{\text{change in time}}$$

- If $s(t)$ is the displacement of a particle, then its velocity is defined by $v = \frac{ds}{dt}$
- If $v(t)$ is the velocity of a particle at time t , then the acceleration of the particle is defined by $a = \frac{dv}{dt}$
- Acceleration is found by calculating the gradient of the graph
- Displacement can be found by calculating the area under the graph
- The equations for motion under constant acceleration are given by:

$$v = u + at$$

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

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

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

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

where u is the initial velocity, v is the final velocity, a the acceleration, s is the distance and t the time.

- The constant acceleration on the Earth's surface is approximately given by

$$a \approx 9.81 \text{ ms}^{-2}$$
- Newton's First Law states that "A body remains in a state of rest or moves with uniform motion, unless acted on by a force."
- Newton's Second Law states that "The force of an object is equal to its mass multiplied by acceleration: $F = ma$ where m is in kilograms (kg), a is in metres per second (ms^{-2}) and F is in Newtons (N).