

# Acceleration

Acceleration occurs when an object speeds up, slows down, OR changes directions.

Acceleration is positive when the object speeds up.

Acceleration is negative when the object slows down.

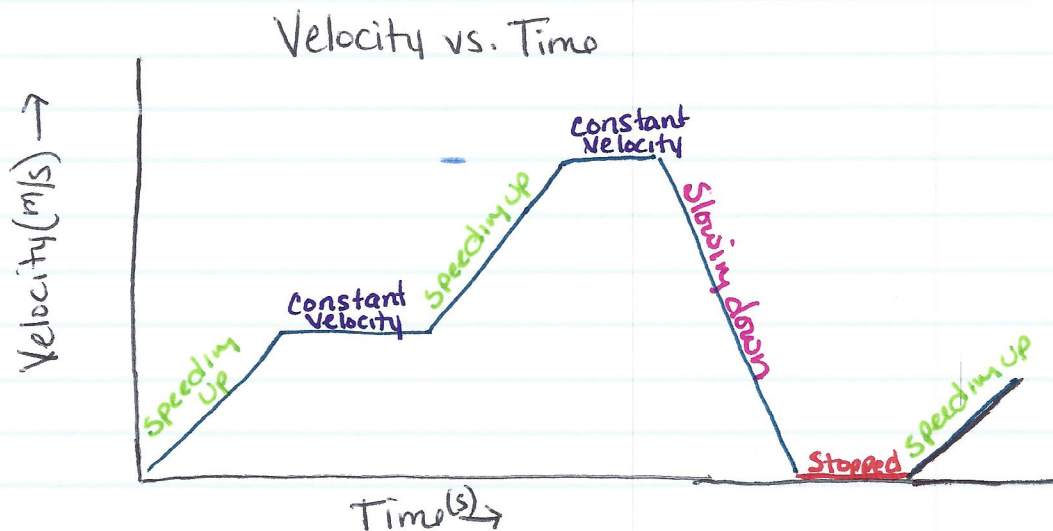
Acceleration can thus be defined as the change in velocity over time.

$$\text{Acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

$$a = \frac{v_f - v_i}{t}$$

$a$  = acceleration ( $\text{m/s}^2$ )  
 $v_f$  = final velocity ( $\text{m/s}$ )  
 $v_i$  = initial velocity ( $\text{m/s}$ )  
 $t$  = time (s)

Acceleration can be graphed on a velocity vs time graph



We can derive additional formulas by rearranging

$$a = \frac{v_f - v_i}{t}$$

Derived equation to solve for  $v_f$

$$v_f = (t)(a) + v_i$$

$$t(a) = \left( \frac{v_f - v_i}{t} \right) t$$

$$(t)(a) = v_f - v_i$$

$+ v_i \qquad + v_i$

$$v_f = (t)(a) + v_i$$

Derived equation to solve for  $t$

$$t = \frac{v_f - v_i}{a}$$

$$t(a) = \left( \frac{v_f - v_i}{t} \right) t$$

$$\frac{(t)(a)}{a} = \frac{v_f - v_i}{a}$$

$$t = \frac{v_f - v_i}{a}$$