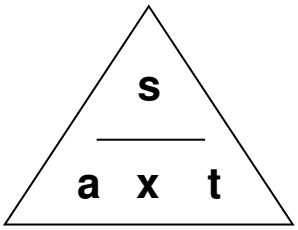
Acceleration

The acceleration of an object can be calculated using the equation:

$$\text{acceleration } (m/s^2) = \frac{\text{change in speed (m)}}{\text{time taken for change (s)}}$$



Copy and answer these questions. Remember to include your working out and units.

1. Calculate the acceleration of a bike, if its speed changes from 0m/*s* to 30m/s in 6 seconds?

2. A boy carries out an experiment by dropping a marble from a window. His friend uses a datalogger to measure the speed of the ball as it hits the ground, and find it to be 30m/s. Calculate the acceleration due to gravity.

3. A boat increases its speed from 15m/s to 25m/s in 12 seconds. Calculate the boat's acceleration?

4. A cyclist freewheels down a hill. Her speed increases from 12 km/hr to 23 km/hr in 6 seconds. Calculate her acceleration in m/s^2.

5. A vehicle is moving at 10m/s. If it accelerates at $3m/s^2$, how long is it before it is moving at 31m/s?

6. The speed of a car between two sets of traffic lights changes as shown:

Time (s)	0	20	40	60	80	100	120
Speed (m/s)	0.0	2.5	5.0	7.5	10.0	5.0	0.0

   a. Plot a graph of speed versus time for the car's motion.
   b. Calculate the acceleration and distance travelled in:
      i) the first 80 seconds.
      ii) the last 40 seconds.
   c. Work out the average speed of the car between the 2 sets of lights.

Acceleration - Answers

1. *Acceleration = Change of Speed ÷ Time*
   = 30m/s ÷ 6s
   = 5m/s²

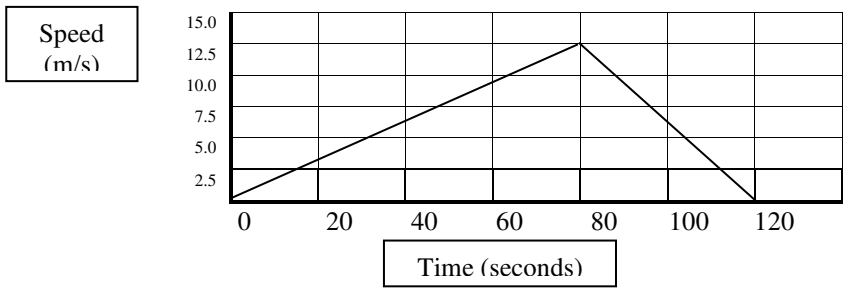
2. *Acceleration = Change of Speed ÷ Time*
   = 30m/s ÷ 3s
   = 10m/s²

3. *Acceleration = Change of Speed ÷ Time*
   = 10m/s ÷ 12s
   = 0.83m/s²

4. *Change of speed = 11km/h*
   = 11km/h x 1000m ÷ 3600s = 3.06m/s

   Acceleration = Change of Speed ÷ Time
   = 3.06m/s ÷ 6s
   = 0.51m/s²

5. *Time = Change of Speed ÷ Acceleration*
   = 21m/s ÷ m/s²
   = 7.0s

6. 

   b. i) the first 80 seconds.

   Acceleration = Change of Speed ÷ Time
   = 10m/s ÷ 80s
   = 0.125m/s²

   Distance travelled = area under first section of graph
   = ½ x 80s x 10m/s
   = 400m

   ii) the last 40 seconds.

   Acceleration = Change of Speed ÷ Time
   = -10m/s ÷ 40s
   = -0.25m/s² (A deceleration)

   Distance travelled = area under second section of graph
   = ½ x 40s x 10m/s
   = 200m

   c. *Average speed = Total distance travelled ÷ Time*
   = 600m ÷ 120s
   = 5m/s