

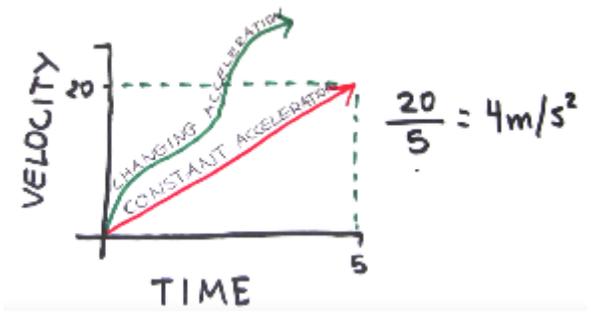
Keyword	Definition
speed	How fast something is moving. Often measured in metres per second (m/s), miles per hour (mph) or kilometres per hour (km/h).
velocity	The speed of an object in a particular direction. Usually measured in metres per second (m/s).
acceleration	A measure of how quickly the velocity of something is changing. It can be positive if the object is speeding up or negative if it is slowing down.
scalar quantity	A quantity that has a magnitude (size) but not a direction. Examples include mass, distance, energy and speed.
vector quantity	A quantity that has both a size and a direction. Examples include force, velocity, displacement, momentum and acceleration.
instantaneous speed	The speed at a particular point in time
average speed	The average speed across a whole journey

Motion equations
To memorise:
distance travelled = average speed × time
acceleration = change in velocity ÷ time taken $a = \frac{v-u}{t}$
To be able to use:
final velocity ² -initial velocity ² = 2 x acceleration x distance $v^2 - u^2 = 2ax$

'suvat' and units

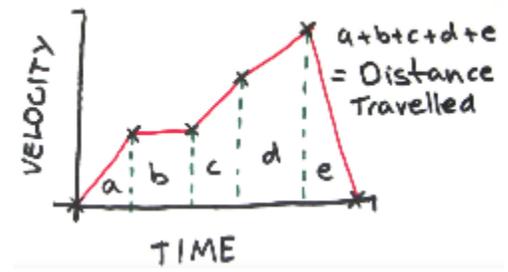
s – displacement (m)
(x – distance (m))
u- initial velocity (m/s)
v- final velocity (m/s)
a – acceleration (m/s²)
t – time (s)

Velocity - time graphs



The gradient tells you the acceleration

Downward slope - slowing down
Flat line - constant velocity
Below 0 - different direction



The area under the line tells you the distance travelled

Area of a rectangle = base x height
Area of a triangle = $\frac{1}{2}$ x base x height

GCSE POD
Motion



Prior learning - check you know about speed-time graphs from Year 8 'What happens on a Rollercoaster'

Vector and Scalar			
Vector	Example	Scalar	Example
displacement	10 metres north	distance	10 metres
velocity	25 m/s west	speed	25 m/s
weight	30N	mass	3kg
acceleration	200m/s ²	energy	360 joules
force	30N		
momentum	550kgm/s		

These three are pairs

Units for **acceleration** are m/s² because we're measuring the change in velocity over a certain time

Speeds of some everyday things:
 Walking – 1-2 m/s
 Running – 3-8 m/s
 Cycling – 5-20 m/s
 Driving – 10-40 m/s
 Flying – 250 m/s

g Acceleration in free fall (g) is 10m/s² on Earth

Method to determine acceleration

Two different ways to do this:
 1) Measure final speed *and* initial speed *and* time
 acceleration = change in velocity ÷ time taken
 OR

2) Measure final *and* initial speed and use the following equation:
 $v^2 - u^2 = 2ax$ rearranged to give:

$$a = \frac{v^2 - u^2}{2x}$$

Remember that to measure any speed you need to measure distance and time

Method to determine speed

- 1) Measure distance using appropriate equipment e.g. metre rule
- 2) Measure time taken using appropriate equipment e.g. stopwatch or light gate. (light gates eliminate human reaction time when exact time is important)
 - If using light gates, attach a measured piece of card to the moving object which will break the light beam. A data logger uses the length of the card (distance) and the time that the beam is broken for to calculate speed.
- 3) Use distance travelled = average speed × time rearranged to give speed = distance ÷ time

