Velocity and Acceleration

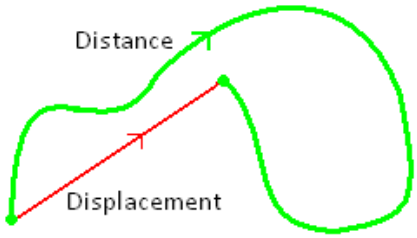
To be able to calculate distance and displacement and explain what they are
To be able to calculate speed and velocity and explain what they are
To be able to calculate acceleration and explain uniform and non-uniform cases

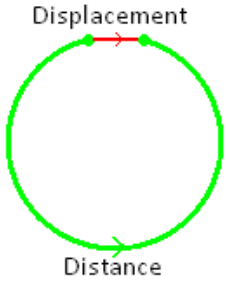
Distance

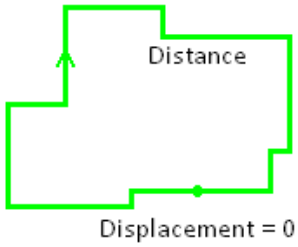
Distance is a scalar quantity. It is a measure of the total length you have moved.

Displacement

Displacement is a vector quantity. It is a measure of how far you are from the starting position.







If you complete a lap of an athletics track: distance travelled = 400m
displacement = 0

Distance and Displacement are measured in metres, m

Speed

Speed is a measure of how the distance changes with time. Since it is dependent on speed it too is a scalar.

$$speed = \frac{\Delta d}{\Delta t}$$

Velocity

Velocity is measure of how the displacement changes with time. Since it depends on displacement it is a vector too.

$$v = \frac{\Delta s}{\Delta t}$$

Speed and Velocity are is measured in metres per second, m/s
Time is measured in seconds, s

Acceleration

Acceleration is the rate at which the velocity changes. Since velocity is a vector quantity, so is acceleration. With all vectors, the direction is important. In questions we decide which direction is positive (e.g. → +ve)

If a moving object has a positive velocity:
* a positive acceleration means an increase in the velocity
* a negative acceleration means a decrease in the velocity (it begins the 'speed up' in the other direction)

If a moving object has a negative velocity:
* a positive acceleration means an increase in the velocity (it begins the 'speed up' in the other direction)
* a negative acceleration means a increase in the velocity

If an object accelerates from a velocity of u to a velocity of v, and it takes t seconds to do it then we can write the equations as $a = \frac{(v-u)}{t}$ it may also look like this $a = \frac{\Delta v}{\Delta t}$ where Δ means the 'change in'

Acceleration is measured in metres per second squared, m/s^2

Uniform Acceleration

In this situation the acceleration is constant – the velocity changes by the same amount each unit of time.
For example: If acceleration is 2m/s^2, this means the velocity increases by 2m/s every second.

Time (s)	0	1	2	3	4	5	6	7
Velocity (m/s)	0	2	4	6	8	10	12	14
Acceleration (m/s^2)		2	2	2	2	2	2	2

Non-Uniform Acceleration

In this situation the acceleration is changing – the velocity changes by a different amount each unit of time. For example:

Time (s)	0	1	2	3	4	5	6	7
Velocity (m/s)	0	2	6	10	18	28	30	44
Acceleration (m/s^2)		2	4	6	8	10	12	14