**SPEED and VELOCITY** – Simple motion

**SPEED** is the general term used to describe how fast something moves. Instantaneous speed is the exact speed of an object at a particular time while average speed is the speed over a certain length of time.

To be scientific about it, speed is a measure of the distance travelled divided by the time taken: Speed = distance ÷ time. This is commonly shown as the formula

$Speed= \frac{distance }{time}$ or $s= \frac{d }{t}$

In this formula, there are three unknowns (letters). If you know two of these values, you can use this formula to calculate the only one you do not know. So you can use this formula to calculate speed, or distance, or time.

The triangle on the left shows how you can remember this formula and easily use it to write a formula for each of the unknowns. Your teacher can show you this technique.

If you plan to do physics in the future however, you should however learn how to transpose formulas

$s= \frac{d }{t}$ or $t= \frac{d }{s}$ or $d=s×t$

The scientific units for speed are metres/second, and speed is usually calculated in science using these units.

* To calculate speed correctly, distance has to be in metres and time has to be in seconds.
* To calculate distance correctly, speed has to be in metres/sec and time has to be in seconds.
* To calculate time correctly, distance has to be in metres and speed has to be in metres/sec.

Sample question : Miranda travelled the 20 kilometres from Caloundra to Buderim in 25 minutes. What was her average speed? Show three steps!

TASK: Do the worksheet “Simple questions on Speed, Time and Distance”.

**VELOCITY** is a different, but similar idea to speed. Velocity is calculated from the displacement (s) of an object and the time (t) taken. Velocity is therefore different from speed because displacement is not the same as distance (d).

$Velocity= \frac{displacement }{time}$ or $v= \frac{s }{t}$

HOW are displacement and distance different?

Distance is how far you have travelled. It does not depend on the direction of travel. So if you walk 200m to a shop and then 200m back, the distance would be 400 m.

Displacement is how far you are from your initial position. In the above example, your displacement is zero

The difference between distance and displacement may not seem much, but it does have consequences in science. Speed uses distance and is therefore a scalar quantity, meaning it has a numerical value only. Velocity uses displacement and is therefore a vector quantity, meaning it has a numerical value and a directional value. This means a velocity can be negative.

An example of this would be say a car traveling away from you at a velocity of 20 m/s, and a car traveling towards you at a velocity of -20m/s. The cars are travelling at the same speed but opposite velocities because they are travelling in opposite directions. Velocities are much more common in science because different velocities can be added and subtracted, while speeds cannot.

In everyday use, speed is more commonly used. This course will generally work with straight-line motion (not curved paths), so you can calculate speed and velocity in the same way and consider them similar. However when calculating velocity always add a direction to your answer. We will use the general term speed (with distance), unless there is a specific reason.

TASK - Do the worksheet “Simple questions on Speed, Time and Distance”