Speed & Velocity

$$\text{speed (metre per second, m/s)} = \frac{\text{distance travelled (metre, m)}}{\text{time taken (second, s)}}$$

The **velocity** of an object is its **speed** in a particular **direction**.

This means that two cars travelling at the same speed, but in opposite directions, have different velocities. One velocity will be **positive**, and the velocity in the other direction will be **negative**.

Distance time graphs

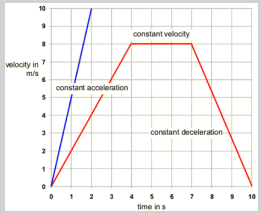
The vertical axis of a distance-time graph is the distance travelled from the start, and the horizontal axis is the time taken from the start.

When an object is stationary, the line on the graph is horizontal.

When an object is moving at a steady speed, the line on the graph is straight, but sloped.

The **steeper** the line, the greater the **speed** of the object.

Velocity time graphs



The vertical axis of a velocity-time graph is the velocity of the object and the horizontal axis is the time taken from the start.

When an object is moving with a constant velocity, the line on the graph is horizontal.

When an object is moving with a steadily increasing velocity, or a steadily decreasing velocity, the line on the graph is straight, but sloped.

The steeper the line, the more rapidly the velocity of the object is changing.

Forces

A force can be a **push** or a **pull**

Forces can change the speed of something, the direction it is moving in or its shape.

Forces can be measured using a **force meter**.

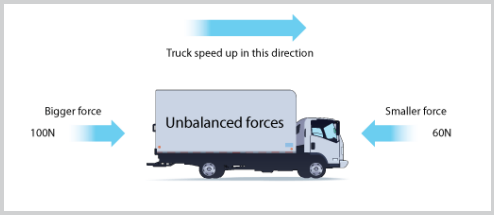
The unit of force is called the **newton**, and it has the symbol **N**

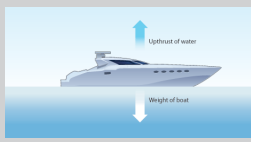
Force Diagrams

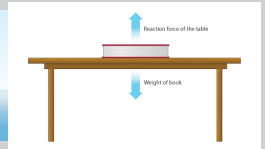
If the forces on an object are unbalanced this is what happens:

an object that is not moving starts to move

an object that is moving changes speed or direction







Mass

People often confuse mass and weight. Weight is a force, and is measured in newtons. Mass is measured in kilograms (kg).

The mass of an object is the **amount of matter** or "stuff" it contains. The more matter an object contains, the greater its mass. An elephant contains more matter than a mouse, so it has a greater mass.

Mass is measured in **kilograms**, **kg**, or **grams**, **g**.

All objects have a force that attracts them towards each other. This is called **gravity**. Even you attract other objects to you because of gravity, but you have too little mass for the force to be very strong.

Weight is a force caused by gravity. The weight of an object is the **gravitational force** between the object and the Earth.

Weight is a force, so it's measured in **newtons**. On the surface of the Earth an object with a mass of 1 kg has a weight of about 10 N.

Density

$$Density = \frac{mass}{volume}$$

It is important to know the difference between density and weight.
If we have 10 kg of a substance,
its mass is 10 kg and its weight is 100 Newtons.

The mass is the amount of stuff you have (the number of atoms).
The weight is the force of gravity pulling on that mass.

Imagine that the 10 kg of substance takes up a volume of 1 m^3.
If the same 10 kg of substance is squashed into a volume of 0·5 m^3, then we still have the same mass
and it still has the same weight but it now only

Springs

Force	Velocity time graphs	Distance time graphs	Speed & Velocity
Force Diagrams	Mass	Density	Springs