WOW sheet

What is force?

Here is what ‘force’ means in physical science:

Force is a push or a pull exerted on one object by another object.

A force can be an **external force** meaning that the force comes from outside the object rather than inside of it. There are also **internal forces** where the force comes from inside the object itself. External forces can cause a change in an object’s motion, but internal forces cannot.

You may also see the term **net force**. The net force on an object is the total force on that object. If many forces act on an object, then the net force is the sum of all the forces. Some of those forces might cancel each other out too!

Here’s an example

When you throw a ball up into the air, there are several forces at work on the ball all at the same time, and in different directions. There’s the force you gave it by throwing it up. There’s also the gravity of the Earth, pulling it back down. And there’s the air resistance from the air too! You would need to add all of these together to get the net force on the ball.

You can see that direction matters when you talk about force. That’s because force is a **vector**.

A **vector** is a quantity that has both a direction and a magnitude (a size).

Here's an example

Speed is a measurement that tells you how fast something is going, but not what direction it is going. Velocity is a different measurement that tells you both how fast something is going AND what direction it is going. Velocity has both direction and magnitude (in this case, speed) so it's a vector.

In equations, force is often written with a bold **F**. This shows that force is a vector. An example of this is Newton's second law:

$$\mathbf{F}=m\boldsymbol{a}$$

Unit of measure

The unit that force (**F**) is measured in is newtons (N).

A **newton** (N) is the international unit of measure for force.

Like all units of measurement, understanding what a newton is can be a little confusing. This is because a unit of measure is just a way for people to talk about the size of something.

Here's an example

Defining units of measure can sometimes feel like talking in a big circle! Here's the definition of a centimetre and a metre:

- A **centimetre** is a unit of length, equal to one hundredth (1/100) of a **metre**.
- A **metre** is a unit of length, equal to one hundred (100) **centimetres**.

Keep in mind a unit of measure is just a way to talk about the size of something. Don't worry too much about understanding 'exactly' what that size 'looks like'.

One newton is equal to 1-kilogram meter per second squared. In other words, 1 newton of force is the amount of force required to accelerate an object with a mass of 1 kilogram so that it travels 1 meter per second every second.

Formulaically, it can be written as:

$$1\,\mathrm{N} = 1\frac{\mathrm{kg}\cdot\mathrm{m}}{\mathrm{s}^2}$$