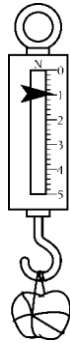


## Section 1- What is a force?

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

You cannot see a force but often you can see what it does. Forces can change :

- the **speed** of an object
- the **direction** that an object is moving in
- the **shape** of an object



Forces are measured with a newtonmeter. Forces are measured in Newtons with the symbol N .

**Contact forces** need to touch the thing that they are affecting. Examples of contact forces are:

- friction
  - air resistance
  - water resistance
  - upthrust
- } drag

## Section 3 - Friction & Drag

Friction is a force caused by two things rubbing together. Air resistance and water resistance are kinds of friction. They are sometimes called drag. Friction acts in the direction opposite to the direction of movement. Friction can slow things down or make things stay still. Friction between solid surfaces is caused by rough surfaces. The grooves of each surface make it difficult for the surfaces to slide each other.



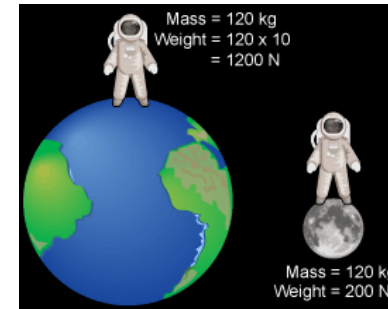
Friction can be reduced by lubrication e.g. oil  
 Drag is caused by the particles in the air or water bouncing off an object. Each collision causes a push force against the object .

## Section 4 - Weight and mass

Some forces do not need to touch the thing that they are affecting. They are called **non-contact** forces. There are three non-contact forces:

- **magnetism**
- **gravity**
- **static electricity**

The area where you experience a force is called a field.



Your **mass** is the amount of substance in your body. Your mass is measured in **kilograms (kg)**.

Your weight is a force (N) caused by gravity pulling on your body.

Wherever you take an object, its mass will not change but its weight depends on the force of gravity.

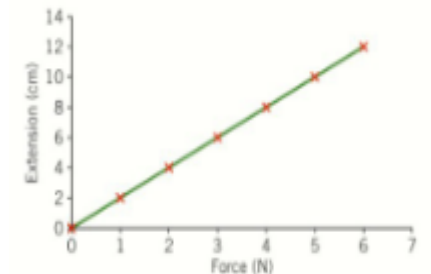
On Earth, gravity accelerates (pulls on) every kilogram of mass with a force of 10 N.

You would weigh less on the moon because the force of gravity is less than on Earth. The force of gravity is less because the moon is smaller in size than Earth.

Gravity on Earth is 10 N/kg  
 Gravity on the moon is 1.6 N/kg

## Section 5 - Hooke's Law

A spring will extend (stretch) if a Force (N) is applied to it. If the force is doubled then the extension will be doubled. In this case the spring obeys **Hooke's Law**. The spring has extended in a **linear** (proportional) fashion as shown by a **straight line** on a graph. When the Force is removed it will return to its **original length**.

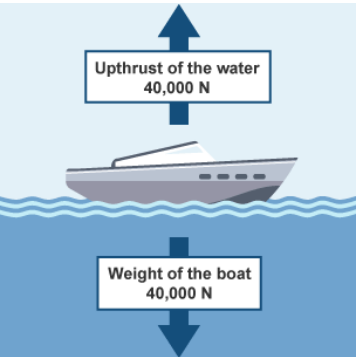


A spring can be extended and not return to its original shape. The force value that causes this is called the **elastic limit**. The graph would not be a straight line it would be curved at the end.

## Section 2- Force diagrams

We can show the forces acting on an object using a **force diagram**. In a force diagram, each force is shown as a force arrow. An arrow shows:

- the size of the force (the longer the arrow, the bigger the force)
- the direction in which the force acts



When two forces acting on an object are equal in size but act in opposite directions, we say that they are **balanced** forces.

When two forces acting on an object are not equal in size, we say that they are **unbalanced** forces.

