Summary Sheets

Forces and their effects

Forces are pushes or pulls.

Forces can:

- change the shape or size of an object
- change the speed things are moving (make them move faster or slower)
- change the direction of a moving object.

The units for measuring force are **newtons** (**N**).

Friction is a force caused by two things rubbing together. **Air resistance** and **water resistance** are kinds of friction. They are sometimes called **drag**.

Upthrust pushes things up. Solid things, like your chair, give you upthrust. Things float in water because of upthrust.

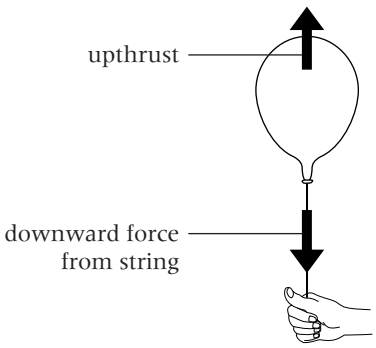
Contact forces need to touch the thing that they are affecting. Examples of contact forces are:

- friction
- air resistance
- water resistance
- upthrust.

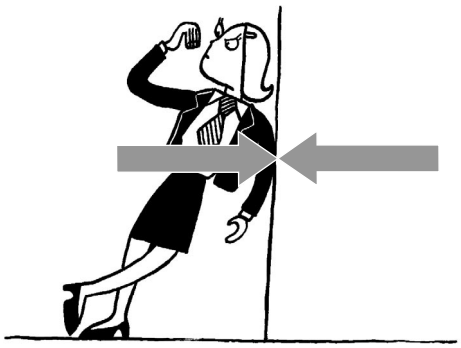
Some forces do not need to touch the thing that they are affecting. They are called **non-contact** forces. There are three non-contact forces:

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

Balanced forces



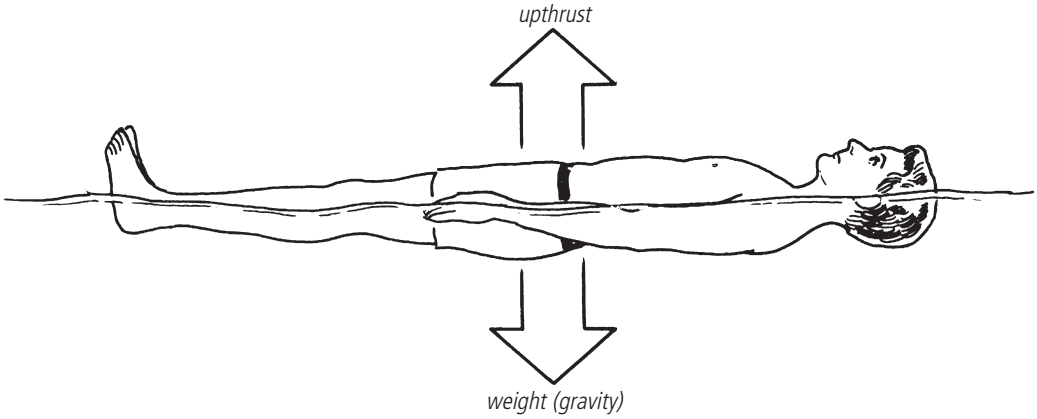
*The upwards and downwards forces on this balloon are **balanced**. The balloon will not move.*



The forces here are balanced. The girl will not move, and neither will the wall!

A rocket in space does not need to use its engine to keep moving. There is no air in space, so there is no air resistance to slow it down.

If you are floating in a swimming pool, your weight and the upthrust are balanced.



Density and floating

You can decide if something will float by working out its **density**. Density is the mass of a certain volume of something, and it can be calculated using this formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

The units for density are g/cm^3.

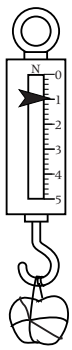
The density of water is $1\ g/cm^3$. If an object has a density less than $1\ g/cm^3$ it will float. If its density is greater it will sink.

Measuring forces

Elastic materials will stretch with a force and then return to their original shape when the force is taken away.

Materials like Plasticine will stretch with a force but they will not return to their original shape afterwards. Plasticine is not elastic.

Springs are used to measure the size of a force because they are elastic. A big force stretches a spring further than a small force. **Force meters** have springs inside them.



This force meter is measuring a force of 1 N.

Weight and mass

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

Your weight is a force caused by gravity pulling on your body. The **newton** (**N**) is the scientific unit used to measure forces, and so it is also used as the unit for weight.

Wherever you take an object, its mass will not change but its weight depends on the force of gravity. An object on the Moon would have a smaller weight than on Earth, because the Moon's gravity is not as strong as Earth's.

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

Friction

Friction is a contact force. Friction can:

- slow things down
- wear things away
- produce heat
- make a noise.

Friction is sometimes helpful, for instance:

- your shoes grip the floor because of friction
- tyres and brakes use friction
- pencils write because of friction.

Friction is not always helpful:

- parts of engines wear away because of friction
- friction makes bicycles harder to pedal.

Friction can be increased by using rough surfaces, or by using materials like rubber that have a lot of friction.

Friction can be reduced by using smooth surfaces, or by **lubrication**. Things like oil or grease are **lubricants**, and help things to move past each other easily.

Speed

To measure how fast something is travelling you need to measure the distance it travels and the time taken. Units of speed are km/h or m/s or mph. The units for speed depend on the units you have used to measure the distance and the time.

Stopping distances

A moving car takes some time to stop. The distance it travels while the driver is deciding whether to stop is called the **thinking distance**, and the distance it travels while it is slowing down is called the **braking distance**. If you add the two distances together you get the **stopping distance**.

Stopping distances are longer if the road is wet or icy, if the car has worn tyres, or if the driver is tired or has been drinking alcohol.

Distance/time graphs

A journey can be shown on a distance/time graph. This graph shows a person running, then stopping for a rest, then walking slowly. The steeper the line on the graph, the faster they are moving.