

Forces

Balanced forces are forces that are the same size but work in opposite directions. If forces are balanced:

- a stationary object stays stationary;
- a moving object continues to move at the same speed.

A car or motorbike uses the energy stored in fuel to move at a steady speed because it needs a force from the engine to balance the forces of **air resistance** and **friction**.

The amount of air resistance on something can be reduced by giving it a smooth, **streamlined** shape. The air resistance increases as the speed increases, so cars use up more fuel per mile when

they are travelling fast. Air resistance is caused by air particles hitting the moving object. The particles transfer energy to the object, which is why objects moving through air can get hot.

Magnets

Magnetism is a **non-contact force**. A magnet does not have to be touching something to attract it. Magnets attract **magnetic materials**. Iron, nickel and cobalt are magnetic materials. Mixtures, like steel, that include a magnetic material will also be attracted to a magnet. Other metals, such as aluminium or copper, are not magnetic and will not be attracted to a magnet.

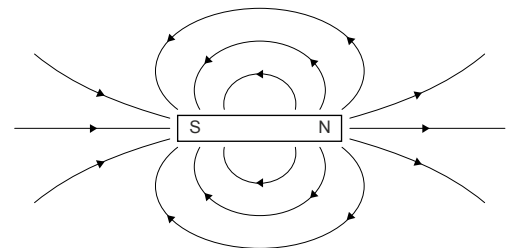
- The two ends of a bar magnet are called the **north-seeking pole** and the **south-seeking pole**, or **north pole** and **south pole** for short.
- A north pole and a south pole **attract** each other.
- Two north poles or two south poles **repel** each other.

Magnetic fields

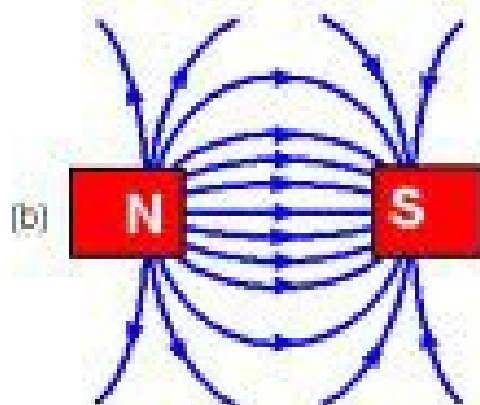
The space around a magnet where it has an effect is called its **magnetic field**.

You can find the shape of the magnetic field using iron filings or using a **plotting compass**.

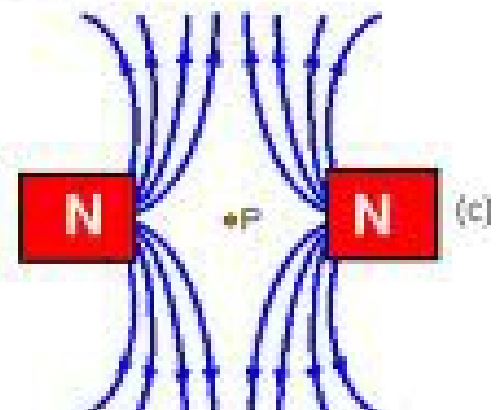
The Earth has a magnetic field. A **compass** is a small magnet that will point towards the Earth's North pole. But magnetic materials placed near a compass can change the direction that the compass points towards.



This is the shape of the magnetic field of a bar magnet. The magnetic field of an electro magnet is a



unlike pole attraction



like pole repulsion

Forces

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 unit for measuring force is the **newton (N)**.

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

Solid things, like your chair, push up on you. Upwards forces from water or air are called **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**.

Friction

Friction is a contact force. Friction can:

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

Friction can be increased by using rough surfaces, or by using materials such as 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.

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.

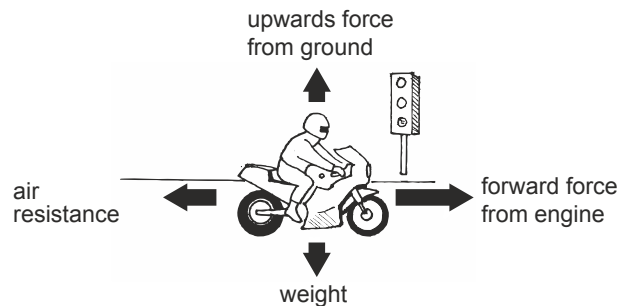
Balanced forces are forces which are the same size but work in opposite directions. **Unbalanced forces** make things change speed, change shape or change direction.

If forces are balanced:

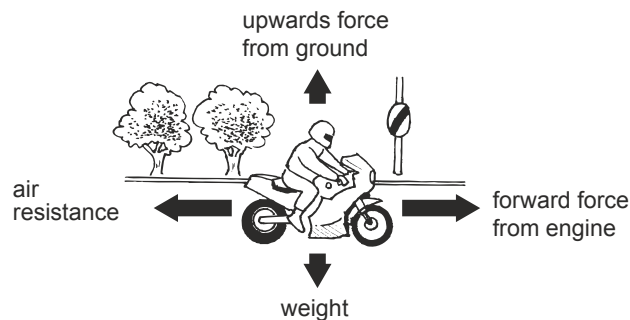
- a stationary object stays stationary
- a moving object continues to move at the same speed and in the same direction.

If forces are unbalanced:

- a stationary object will start to move
- a moving object will change its speed or direction.



The motorbike is going at a steady speed. The forces are balanced. The resultant force is



Speed

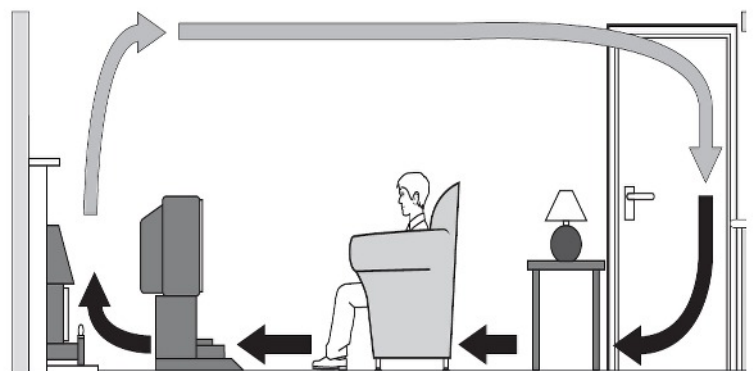
To measure how fast something is travelling, you need to measure

the distance it travels and the time taken. Units for speed are **km/h** or **m/s** or **mph**. The unit for speed depends on the units you have used to measure the distance and the time.

$$\text{Speed} = \text{distance divided by time}$$

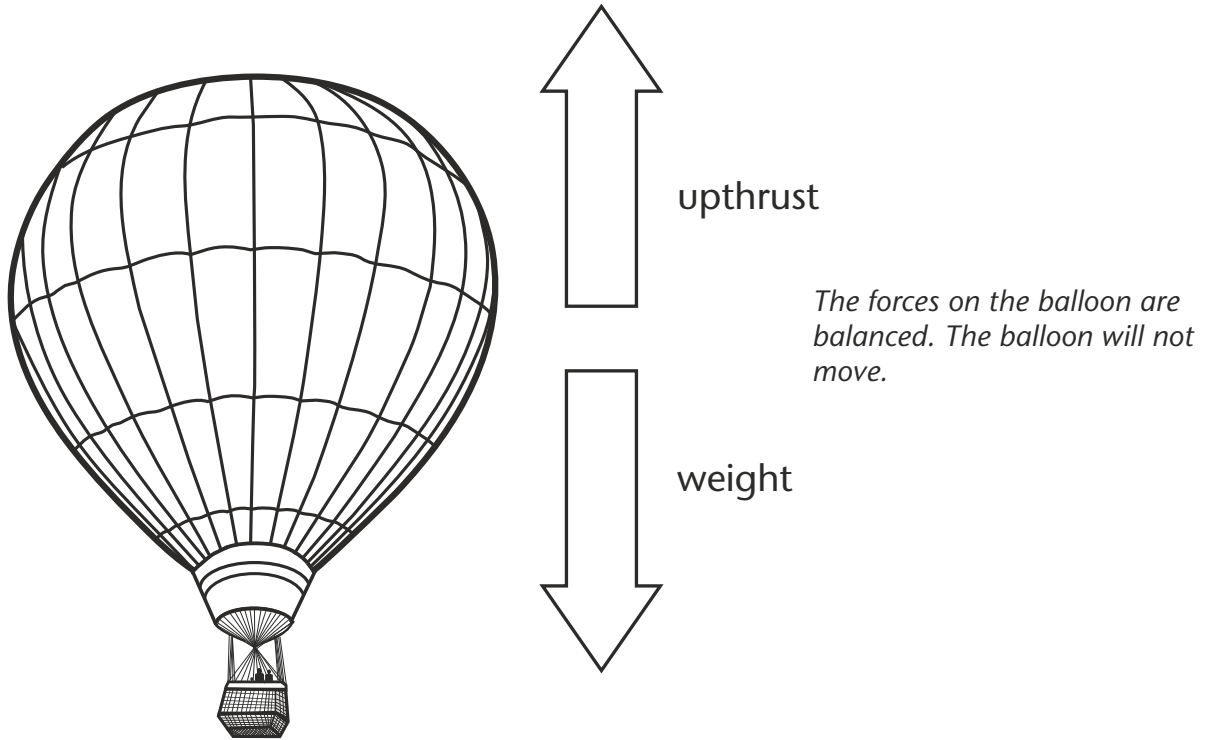
Thermals i.e. hot air rises

When the air near the fire is heated, the particles gain more energy and start moving faster. Because of this the particles spread further apart and the air becomes less dense and rises. As it rises it meets cooler air and passes the energy on. Having passed on the energy, it cools and becomes denser. The denser air sinks, setting up a cycle or convection current.



Balanced forces

Balanced forces are forces that cancel each other out. Balanced forces do not change the speed that something is moving.



Newton's Third Law

If object A exerts a force on object B, then object B exerts an equal and opposite force on object A. (Exerts just means puts in physics language.)

If a bird pushes its wings downwards it pushes down on the air. Because of Newton's Third Law the air pushes back on the bird which means that it moves upwards.

