

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.

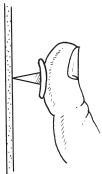
A car or motorbike uses the energy stored in fuel to move at a steady speed because it needs a force from the engine to balance the forces of **air resistance** and **friction**.

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.

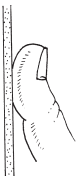
Pressure on solids

Pressure is the amount of force pushing on a certain area.

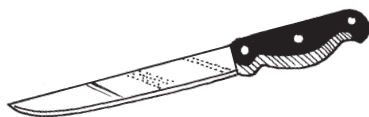
For a certain area, the bigger the force, the bigger the pressure. For a certain force, the bigger the area, the smaller the pressure.



In this picture, the thumb is putting a force onto the head of the pin. The force is transferred to the point of the pin. The point has a very small area, so there is a very large pressure on the board, and the pin goes in.



In this picture, the thumb is putting a force directly on the board. The area of the thumb is much larger than the area of the pin point, so there is only a small pressure on the board. The thumb does not go into the board.



Sharp knife – a small area giving a large pressure.



Snow shoes – a large area giving a small pressure.

Magnets and electromagnets

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.

A bar magnet is a **permanent magnet**, because it is always magnetic. A wire with electricity flowing through it has a magnetic field around it. An electromagnet is a coil of wire with an electric current flowing through it. It is only magnetic while the current is flowing.

You can make an electromagnet stronger by:

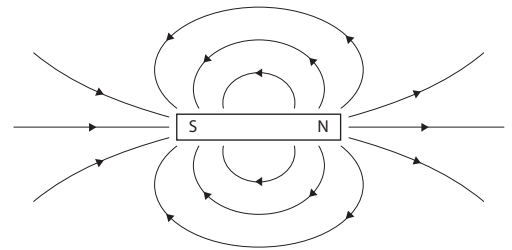
- increasing the number of coils of wire
- increasing the size of the current (by increasing the voltage)
- using an iron core.

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 similar shape.

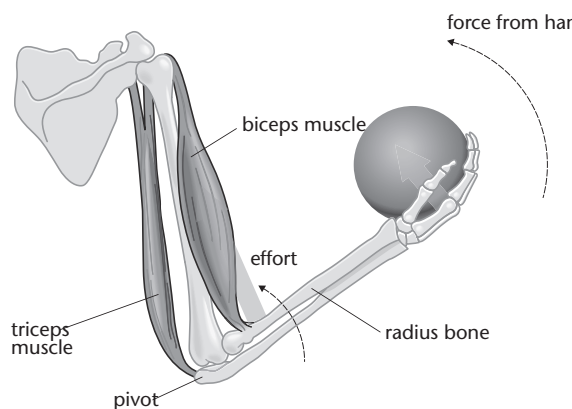
Levers

Forces can be used to turn objects around **pivots**. A pivot is also known as a **fulcrum**.

Levers work by magnifying the force that is put in (the **effort**) or they can make the load move further than the effort. The amount the force or distance is multiplied depends on the distances between the load and the pivot and the effort and the pivot.



The hammer is acting as a force multiplier.



The arm is acting as a distance multiplier.