How to make an electromagnet – transcript

When an electric current flows through a wire it creates a magnetic field. By winding the wire into a coil around a central core made from a magnetic material, the magnetic field can be strengthened.

In this experiment an electromagnet will be made using an iron rod and copper wire. The strength of the magnet will then be investigated.

A typical electromagnet is made from a coil of copper wire (the coil is sometimes called a solenoid).

Copper is used because of its low resistance. When a current flows through the wire, a magnetic field is generated and will attract other metal objects made from magnetic materials such as iron filings or paperclips.

This can be seen when the solenoid is connected to the battery.

When the current is removed, the paperclips fall off.

Iron is a magnetic material, but the iron rod on its own does not attract any iron filings or paperclips.

This shows that despite being magnetic, iron does not always act as a magnet.

To increase the magnetic force of the solenoid, an iron core, in this case, an iron nail, can be inserted.

The copper wire is wrapped tightly around the nail a number of times. The amount of times the wire is wrapped is known as the number of turns.

It still will not pick up any paperclips, so we know it is not yet magnetised.

To make the electromagnet work a current must be passed through the coil.

When the current passes through the wire it induces a magnetic field which also magnetises the nail.

The strength of the electromagnet can be judged by counting the number of paperclips picked up.

Now the electromagnet works, its strength can be investigated. The variables that are going to be changed are the current and the number of turns of wire.

So that there is a control measurement, the current electromagnet strength with 50 turns of wire is tested.

The number of paperclips collected in the control is recorded in a table for comparison.

The first variable being changed is the current. It has now been increased.

The number of paperclips collected using the increased current is counted and recorded.

Now the current has been increased again.

The final number of paper clips collected by the magnet is counted and recorded.

It is clear that as the current increases, the strength of the electromagnet has increased.

The current has been returned to its original setting. The next variable being altered is the number of turns of the wire.

The original number of turns of wire was 50 and the control showed that this picked up 1 paperclip.

50 more turns of the wire have been added.

The electromagnet is turned on and the number of paperclips collected is counted.

50 more turns of wire are added to the rod. The effect of this is measured by picking up and then counting the number of paperclips collected.

The last 50 turns of wire are added and the effect of this is once more measured.

The results are recorded in the table.

It is clear that as the number of turns of wire increases, the strength of the magnet increases.

Electromagnets have many applications from electric bells, electromagnetic cranes, loudspeakers, electric motors, relays and transformers.