Investigation 15 Pulling paper clips

Here's how you can harness the energy from a battery and turn it into a magnetic force.

YOU WILL NEED **Thin wire approx one metre long • A long nail • Two 1.5 volt D-cell batteries • Wire cutters • Masking tape • A "knife" switch – you should be able to find this in a hobby shop, electronic supply store or a hardware store. Get a DC (direct current) switch • Electrical tape or cellotape • Some paper clips •**

1 Strip the wire bare with the wire cutters, so that the copper is showing or use copper wire without insulation.

2 Wrap the long piece of wire tightly around the nail (about 50 times); leave a few inches of wire free at either end.

3 Use the remaining inches of wire to connect the knife switch and the two batteries to the nail.

4 You will have to cut small sections of the wire to join the knife switch to the batteries and the batteries to each other. Attach the wire to the batteries using electrical tape or cellotape. The knife switch will have two raised points for attaching the wire.

6 Close the circuit by closing the knife switch. This creates a circuit of electricity that passes through the wire and around the nail.

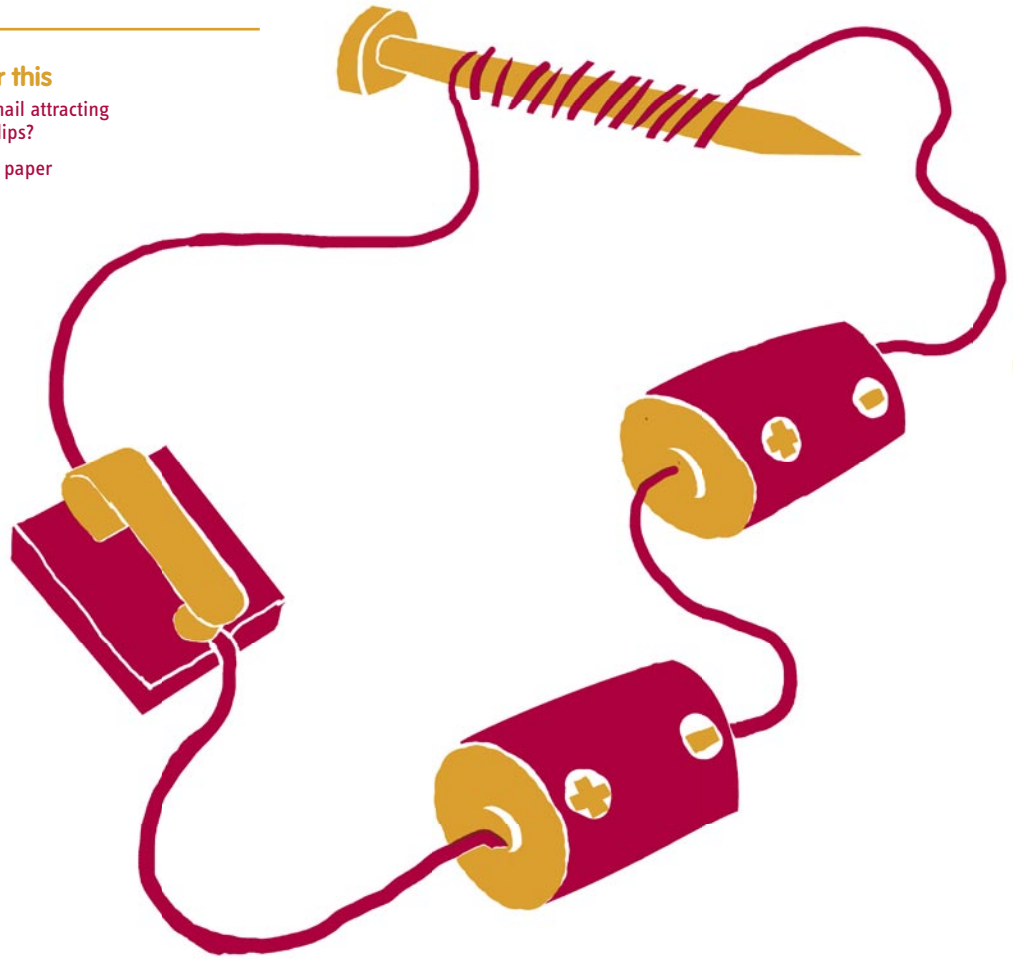
7 Place some paper clips near to the nail and close the knife switch.

8 What happens to the paper clips?

Consider this

Why is the nail attracting the paper clips?

Will it draw paper or material towards it? Why not?



Tell Me More!

When an electric current passes through a wire, it creates a magnetic field that reaches out in expanding circles. When a wire carrying a current is twisted into a coil, it is called solenoid. The magnetic field twists with the coiled wire, causing the magnetic field lines to concentrate inside the coil. Placing a metal nail into these coils causes the nail to become magnetic. The nail is called an electromagnet.

The nail becomes magnetised because the coil's magnetic field causes the tiny magnetic fields in the nail to point in the same direction - towards the North Pole. This makes the nail's magnetic force strong enough to pick up objects such as paper clips.

Energy can be neither created nor destroyed, just changed from one form to another. The electrical energy in the wire is changing into magnetic energy in the nail causing work to be done by pulling the paper clips towards it. Electromagnets are very useful. They are used in door bells and relay switches.