

Electricity and electromagnetism :

A **magnet** attracts **iron, cobalt** and **nickel**. (Magnets attract steel because the main component of steel is iron).

Magnets have two poles: the **north pole** and the **south pole**. The opposite poles of two magnets **attract**. The like poles of two magnets **repel**.

Electricity is a flow of **electrons**. Electrons flow easily through most metals.

Electrons traveling through a wire create a **magnetic field** around the wire. Electrons traveling through a wire coiled around an iron nail convert the nail into an **electromagnet**.

Workshop Project: Build an electromagnet



The elastic band holds each end of the wire against the battery terminals.

Only use a 1.5 volt AA battery with this electromagnet.

Only remove the insulating enamel from the last 1 cm of the wire.

Removing too much insulation could cause a short circuit.

A short circuit would cause the wire to get very hot.

Your electromagnet will get warm; this is normal.

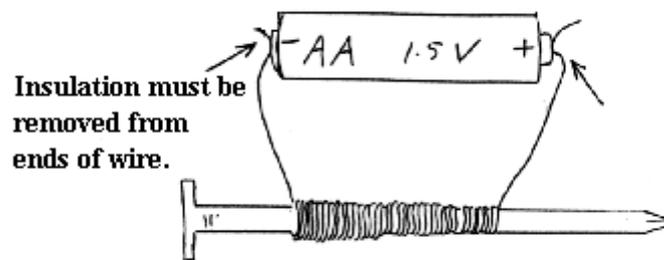
Materials:

- 5 meters of magnet wire.
- thick nail.
- AA battery
- Small piece of sandpaper.

Assembly:

Wrap all of the wire onto the iron nail leaving about 10 cm of both ends of the wire exposed. Be careful to wrap in the same direction from beginning to end. Magnet wire is coated with a special **enamel** coating. This **insulation** must be removed from both ends of the wire to allow a metal to metal connection with the battery. Fold a small (2 cm square) piece of sandpaper over the end of the wire and sand, by pulling the paper, about one cm at each end. The colour of the wire changes as you expose the **copper** metal under the insulation.

Before connecting your electromagnet to a battery, test it to see if it attracts iron. Bring the tip of the nail close to some paper clips (metal paper clips usually contain iron).



Now connect your electromagnet to a battery, one wire touching the minus end the other touching the plus end. Use an elastic band pulled over your battery to hold the wires in place. Your electromagnet should now strongly attract metal paper clips.

My electromagnet doesn't work!

- The most common problem is poor sanding - make sure that both ends of the wire have all of the enamel insulation removed.
- Make sure you are using a good battery. Rechargeable batteries are excellent.
- Do the metal objects you are testing your battery on contain iron? Test them with a permanent magnet.

Safety:

- Use only a 1.2 to 1.5 volt battery (such as an AA) with this electromagnet. Higher voltage batteries will cause the electromagnet to overheat. An AA battery will cause your electromagnet to get warm, this is normal.
- If you have sanded too much of the wire they could twist together creating a **short circuit**, causing the wire to get very hot, even with an AA battery.

Going Further: Use a compass to determine which end of your electromagnet is the **north pole**. Reverse your battery connections. Has this changed the north pole?