

Build Your Own Electromagnet!

In this worksheet, you will learn how to build your own electromagnet, as well as experiments to try, and how electromagnets work!

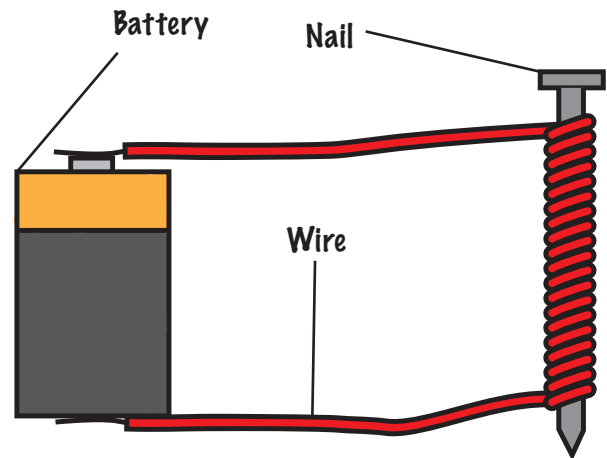
Materials:

- One D battery
- About 3-4 feet of thinly coated copper wire
- A large iron nail, about 3-4 inches long
- Electrical tape
- Some paper clips or other metal objects that are attracted to magnets.

Directions:

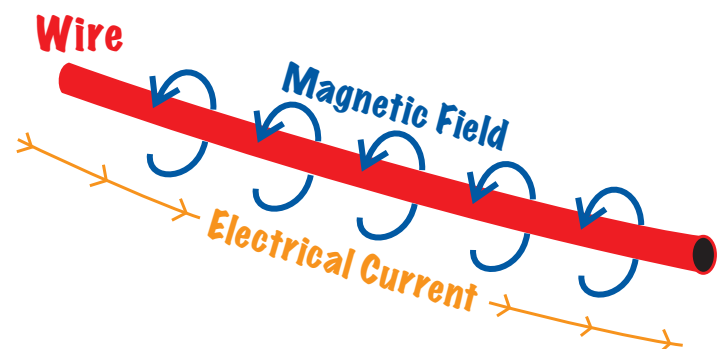
- 1) Leaving about 8-10 inches of loose wire, tightly wrap the wire around the nail, trying not to overlap any of the loops.
- 2) Trim the wire if needed so that there is another 8-10 inches of loose wire hanging from the other end of the nail.
- 3) Now carefully remove about an inch of the insulation from both ends of the wire, and tape one end of the wire to the top of the battery, and the other end to the bottom of the battery. Be careful, because the wire can get hot once it is connected to the battery!
- 4) Now current is flowing from the battery through the wire, and has turned the nail into an electromagnet! Test your new electromagnet by putting the point of the nail close to some paperclips.

Note: The electromagnet can use up the power in the battery fairly quickly. When you are done, be sure to disconnect the wires from the battery to keep the wires from getting too hot! Never put your electromagnet near a household outlet!



Interesting things to try:

- See if the number of times you wrap the wire around the nail will affect the strength of the electromagnet.
- Does the thickness of the core (the nail) affect the strength of the electromagnet?
- Does the thickness of the wire affect the strength of the electromagnet?



How does it work?

When electricity passes through a wire, a very small magnetic field is generated. By looping the wire around a core, the lines of the magnetic field are concentrated inside the coil, and this is an electromagnet. When the electrical current stops, the magnetic field disappears.

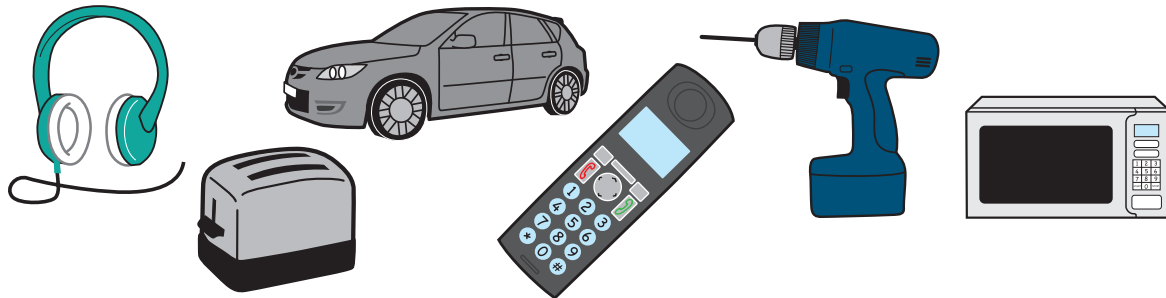
All About Electromagnets!

Did You Know:

- The type of core used today (the nail) would be called a ferromagnetic core, because it is made of material that reacts to magnets. Ferromagnetic cores make much more powerful electromagnets than cores that are not ferromagnetic.
- When you disconnect the electromagnet from the battery, it will no longer be magnetic.
- If you were to wrap some of the wire in one direction, and some of the wire in the opposite direction, the forces created by the electricity would cancel each other out and reduce or eliminate the power of your electromagnet.
- If you switch which end of the wire is connected to what end of the battery, your electromagnet will reverse poles. What used to be the north pole would become the south pole, and vice versa!
- The coil of wire you used to make your electromagnet is called a "solenoid". A solenoid that is bent so that the ends meet, forming a doughnut shape, is called a "toroid".

What uses electromagnets?

Electromagnets aren't just used for picking up scrap metal at the dump! All kinds of things in our daily lives use electromagnets. Anything with a motor, that produces sound, that uses magnetic recording (such as the hard drives in computers) all contain electromagnets! Our lives would certainly be very different without electromagnets.



Can you think of other items that would use electromagnets?

Draw them below!