



## DIY Electromagnet

### Description

Create an electromagnet by running an electrical current through a wire coil with a metal core. Experiment with the number of coils around your magnet to increase/decrease its strength.

### Background

You are probably already familiar with magnets! The magnets on your refrigerator at home always attract (or repel) to the fridge, depending on which side you introduce to the surface.

But, did you know that you can create magnets?! By simply running an electric current through a piece of metal, a magnetic field can be produced. By wrapping the wire around an object multiple times (these are called solenoid coils), you can increase the strength of this magnetic field. Notice the wire wrapped around each nail. Each coil of wire produces its own magnetic field when attached to the battery. The number of coils can make the field stronger, as those individual field align.

Ferromagnetic materials (like the iron nail in this activity) have do not overall magnetic field. The magnetic fields of their atoms point in random directions and ultimately cancel one another out. This is why you cannot pick up any paperclips with just an ordinary nail. (Try it!) However, if we place the nail in the center of the wire coil, we can magnetize it and use it to attract or repel other magnets or magnetic objects (like the paperclips).

Follow the procedure to create your own electromagnets with varying numbers of coils. Which number of coils produced the strongest electromagnet: 10? 20? 40?

<https://www.youtube.com/watch?v=cxELqN7wjS0>

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[http://theory.uwinnipeg.ca/mod\\_tech/node101.html](http://theory.uwinnipeg.ca/mod_tech/node101.html)

### Materials

- 3 iron nails
- 20-gauge copper wire (uncoated)
- 9V battery with terminal cover
- 2, 2-sided alligator clip lead wires

- About 50 paperclips

## **Procedure**

1. Hook up the alligator leads to the terminals of the battery.
2. Wrap the copper wire around a zinc nail about 10 times. Ensure about 3-4 inches of copper stick off either side of the solenoid.
3. Connect the open end of the alligator clips to the wire sticking off either end of the solenoid/nail set-up.
4. Carefully, pick up the nail and try to collect as many paper clips as possible. (The head of the nail works best.)
5. Repeat steps 2-4 using 20, 30, and 40 coils.
6. Note the number of paperclips you collect each trial and compare your results.

## **Questions**

- What effect did increase the number of coils on the nail have on the strength of the electromagnet?
- Can you think of a practical use for electromagnets?