



Curiosity Guide #509

Electromagnetism

Accompanies Curious Crew, Season 5, Episode 9 (#509)

Temporary Magnet

Investigation #5

Description

Aren't magnets fun? Here's how to make a temporary magnet.

Materials

- Insulated copper wire, 22-gauge or higher, cut to two feet in length
- Wire stripper
- Paper clips
- Paper plate
- 6-volt lamp battery
- 2 alligator clips
- Large iron nail

Procedure

- 1) Wrap the insulated wire as tightly as possible around the nail in repeating loops traveling down the shank of the nail.
- 2) Leave a two-inch long loose end on each end of the wire. Then strip the insulation off the final inch of each lead.
- 3) Clip an alligator clip to the lead on one end of the nail. Attach the lead to one pole of the lamp battery.
- 4) Cover the paper plate with a pile of loose paper clips.
- 5) Place the nail into the plate of clips. Is there any reaction?
- 6) Connect the second alligator clip to the final lead and battery.
- 7) Place the nail in the clips again. What do you notice?
- 8) How might you be able to pick up even more clips?

My Results

Explanation

When electrons flow through a coiled wire (called a solenoid), a magnetic field is created inside and around that loop. Increasing the number of coils of wire in the loop creates a stronger magnetic field. Wrapping the coil around an iron core like a nail significantly increases the strength of the magnetic field when it is electrified.

Before the nail was connected to the battery, the paper clips were not attracted. Atoms in the nail behave like little electromagnets because the charged atoms are constantly repelling one another while spinning around the nucleus. Those atoms generally spin in random directions. However, when the solenoid was electrified, the atoms in the nail lined up with one another! The nail became a strong temporary magnet able to attract the paper clips.

Turning off the flow of electricity makes the nail gradually lose its magnetic properties. The atoms of the iron nail randomly change their spinning direction and cause the paper clips to fall off the nail. To increase the strength of the electromagnet, you could increase the number of coils or try a battery with more power. Change one variable at a time to see how many paper clips the electromagnet can lift.

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