



## Curiosity Guide #509

### Electromagnetism

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

#### Design a Homemade Speaker

STEM Challenge

#### Description

I've got the music in me!

#### Materials

- 2 ceramic magnets
- C battery
- 8 feet of 24-gauge or thinner magnet wire made of enameled copper or aluminum
- Tape measure
- Sandpaper
- Clear tape
- 3.5-millimeter mono plug
- 2 alligator clips
- Paper cup
- Foam cup
- Paper bowl
- Foam bowl
- Radio or phone with 3.5-milliliter headphone jack
- Scissors
- Disassembled old speakers

## Procedures

- 1) Examine the parts of a disassembled speaker.
- 2) Measure and cut 8 feet of magnet wire with scissors.
- 3) Sand off the enamel from the last two inches of each end of the wire to expose the bare metal.
- 4) At four inches in from one end, begin to wrap the wire in a tight coil around the side of the battery. Make sure that the coil is tightly overlapped.
- 5) Leave the last four inches of the wire free as well.
- 6) Slide the loop off the battery and use the free ends to form a couple of holding twists around the coil, being sure to leave the sanded ends straight out from the coil.
- 7) Secure the coil to the bottom of the cup or bowl.
- 8) Attach each coil lead to a different alligator clip.
- 9) Insert the 3.5-milliliter mono jack into the radio.
- 10) Clip one alligator clip to one of the jack's poles and the second clip to the other.
- 11) Turn on the radio.
- 12) Place one magnet inside the cup and the second on the outside on top of the coil so that the two magnets attract and hold the coil in place.
- 13) Carefully hold the cup or bowl to your ear.
- 14) What do you notice?

## My Results

## Explanation

On top of the coil will be one magnetic pole, which attracts to the opposite pole of the ceramic magnet. The same is true with the other pole of the coil. The bottom pole attracts to the ceramic magnet inside the cup. When the current begins to flow through the coil, it creates a magnetic field. The flowing current causes a vibration that transfers against the air and the cup. Because the cup is such a lightweight material, it too transfers that vibration over a larger area, moving the air particles inside. That vibration travels in our ears, and we can hear the radio. Your homemade speaker may not be as loud as the speakers we normally listen to, which are made from powerful rare earth magnets that require much less electricity to work well. All speakers, however, generally include a magnet, a coil, and material to amplify the sound vibrations. Besides a paper cup, what else can you think of using for your speaker?

**Ponder this!** It's fun to think that electromagnets are in speakers, but did you know you can also find them in levitating trains? It's true! These trains use electromagnets to get the trains to repel and float above the tracks. At the same time, the electromagnets send a moving magnetic field through the tracks that pushes the train forward. Imagine traveling over 250 miles an hour and not being able to hear the clickety clack of the wheels! Electromagnetic levitation and propulsion! What a ride!

**Parents and Educators: use #CuriousCrew #CuriosityGuide to share what your Curious Crew learned!**



*Curious Crew is a production of Michigan State University.*

*Learn more at [WKAR.org](http://WKAR.org).*

*© MSU Board of Trustees. All rights reserved.*