

## Inquiry Question

**Can you build a basic speaker using only magnets and a bit of wire? Can you modify it and "tweak" it to make it sound better? What are the principles involved?**

**Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

A basic speaker is simply an electromagnet (a coil of wire) wrapped around a magnet that is free to move. When the electric signal from your music device travels through the coils it creates an electromagnet whose strength and direction will fluctuate with the electrical signal created by the music. As a result, the permanent magnet will bounce as it reacts to the changing magnetic field of the electromagnet. If this magnet can move some sort of speaker cone (a cup will vibrate in this case), we will hear the music.



### General Instructions

Using a few permanent magnets, some "magnet wire" and some cups or bottles, you can make a surprisingly decent speaker. Experiment with different designs and keep track of what sounds better as you go.

#### Materials you'll need:

- Your course notes
- The internet
- Between 1 and 2 metres of coated copper magnet wire (at least 24 gauge or thinner)
- One or two small, strong magnets (the rare earth, or Neodymium magnets can be purchased at hobby or science shops or specialty shops like Lee Valley - 1 inch in diameter or smaller.)
- Two plastic cups
- Tape
- Glue (or hot glue gun)
- one mini mono-phone plug that will fit into an iPod. These are easily bought from hobby or electrical supply shops.
- scissors
- alligator clips to connect magnet wire to the mono-phone plug (or "jack")

**Procedure:**

The final design is up to you. There are lots of ways to build such a speaker. Use the video(s) below to give you an idea as to how to get started.



### **Ideas and Hints**

- Be as careful as you can when wrapping the wire. A tight, symmetrical coil will be much better than a sloppy one.
- Thinner wire will allow for more windings but is difficult to work with.
- The position of the magnets is important. Try to get them as close as possible to the centre of the coil you made.
- Get some assistance with attaching to the mono-phone jack. It is easy to create a short at this point. The two wires must NOT touch each other, even at the plug ("jack").

### **Project submission:**

- Upload your completed work to the Physics project drop box if you chose to submit online.
- You can either submit photos/video of your project (along with an explanation and/or steps of construction) or, if you can drop-in to the school, you can present it to your teacher in-person.
- Be sure to carefully organize any data collected so that any other student or teacher could reproduce your experiment and achieve the same results.

### **Project Timing:**

- In its most basic form, this project will take the average student 2 hours. Locating all of the materials needed may vary.

### **Inquiry Questions and Experimental Design:**

1. Experiment with different cups or bottles. Which cup/bottle sounds the best? Why?
2. Try different arrangements of the magnets (inside the cup, outside, sandwiched between two cups, two magnets on either side of the cup. What arrangement sounded the best? Why do you think this is so?
3. Are some magnets better than others? What factors seem to matter for a magnet to work well with your design?
4. Do you think that more or less windings on your coil would be better? Why?
5. Research: How is sound produced? What must happen to the air in front of a speaker to make the sound louder? See if you can use this concept to improve the volume of your speaker.