



# Speakers: Another Tool Using Magnetism And Electricity

## Overview

In this activity, students will be designing their very own speakers out of basic materials that they can plug into any audio device that allows external speaker plug in (for amplification purposes, i.e. does not work with iPods, MP3 players, etcetera). This is a very important lesson in understanding the interaction of electromagnetic fields, magnets and coils of wire. This could be incorporated into a lesson on electricity, or sound. This lesson is recommended for grades 6<sup>th</sup> through high school.

## Objectives

Students should be able to:

- Define sound as a vibration of air
- Explain how speakers work with a coil of wire and a magnet

## Oregon State Science Standards 2009

### Interaction and Change

6.2P.2 Describe the relationships between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits.

### Engineering Design

6.4D.3 Describe examples of how engineers have created inventions that address human needs and aspirations.

## Pre-requisite knowledge

Students should have a basic understanding of sound waves, and very basic understanding of fundamental electricity and electromagnetism.

## Materials

For one speaker:

- 1, 4"x4" card square
- 2, 2.5"x1.5" card stock pieces (for springs)

- 1, 4"x1" strip of paper
- 1 Dixie cup
- 1, 4 meter length of 30 gauge wire, ends stripped of coating, wrapped around a chunk of cardboard so that students can easily wrap it around something else
- 1, 1' or longer of thick speaker wire, ends stripped
- 2-3, cylindrical magnets 1" or less in diameter
- Tape
- Hot glue with gun

### **Teacher Preparation**

Be sure to read through the Speaker PowerPoint. Make sure you can define and describe sound well. You may want to assemble a speaker to use as a demonstration and understand any difficulties for students. Strip the speaker wire for the students and also take off the enamel coating on the ends of the copper wire. This can easily be done using sand paper. There is a You Tube video of the speaker assembly here: <http://www.youtube.com/watch?v=c-0dPIQKwfg>.

### **Procedure**

1. **Anticipatory Activity** - Show a model of the speaker they are going to be building, and run through an interactive demonstration on how the speaker works step by step. Use the Speaker PowerPoint Presentation to aid with describing how speakers work. Make sure they understand the principles behind the vibration and how it is vibrating, then finally plug in the speaker and show them that it works.
2. **Activity** – Group students into pairs or groups of three. Have the students make the speaker. Walk around the class and assist the students as needed. You may want to assist them while using the hot glue gun depending on their ability.
  - a. Have students wrap the strip of paper around the magnets and tape it to make a cylinder that the magnets will easily fit through. Remove the magnets. The magnets need to slide a little in the paper.
  - b. Glue the paper cylinder to the middle of the bottom on the Dixie cup using hot glue. Depending on your student's ability, you may want to hot glue it for them.
  - c. Students will then wrap their wire around the paper cylinder, making sure to leave 2" of each end hanging out. Glue the coiled wire to the paper so that it is held firmly in place.
  - d. Glue magnets to middle of cardboard square.
  - e. Fold card stock pieces in half, and symmetrically glue one end on either side of the Dixie cup. These will act as the springs.
  - f. Place the wire coil around the magnets, then glue the two "springs" down to the cardboard.
  - g. Attach each end of speaker wire to each end of the coil hanging out. Cover the exposed wire with electrical tape.

- h. The speaker wires are now ready to be plugged in. They can be plugged into any stereo that has speaker wire inputs.
3. **Closure** - Allow each student to test his/her speaker out and troubleshoot any problems. The coil should be able to move up and down easily over the magnets. Go through the electromagnetic process again with the students while they are testing their speakers out. Relay the message to students that this is the basics of how all speakers work in the world today, even their small headphones contain tiny coils of wire that are wrapped around magnets that produce sound vibrations.

**Picture of a built speaker**

