

COURSE: Middle School

UNIT: Introduction to Problem Solving

EXERCISE: Build your own Speaker

TIME FRAME: 3 Hours



PREPARATION: *Summary of “to do’s” that the teacher should understand and prepare before bringing this lesson to the classroom.*

Information:

Before starting this exercise, students and teachers should have an understanding of material covered in:

- Video: Speakers - Magnetism & Sound

Teachers will need to ensure that the proper supplies are available for students to build their solutions.

Materials:

Build your ow Speaker kit includes:

- Neodymium magnet
- Enameled magnet wire
- Cardboard
- Pre wound coil
- Construction paper template
- 3D printed cone base
- Sandpaper
- Wire nuts

Tools:

- Audio Amplifier with
- RCA to 3mm adapter cord
- Hot glue gun

Additional Materials:

- Bring in your Laptop, Chromebook, Cell phone or any MP# player with music on it and a 3MM headphone jack

Adapted from: GK-12 Program, Center for Engineering and Computing Education, College of Engineering and Information Technology, University of South Carolina



SAFETY: *Summary of safety strategies in the lesson.*

CAREFUL! Neodymium magnets are powerful and they snap together quickly. These magnets have a tendency to chip if they snap together. **MAGNETS SHOULD NEVER BE SWALLOWED!**

51 DESIRED RESULTS:

ESTABLISHED GOALS:

Problem Solving Techniques and Applications Standards:

TRANSFER:

Students will be able to independently use their learning to...

- Understand and appreciate the various parts of speakers and their functions.

MEANING:

UNDERSTANDINGS

Students will understand that...

- When current travels through a conductor, a magnetic field is created

ESSENTIAL QUESTIONS

Students will keep considering...

- How speaker technology differs from speaker to speaker
- Different types of speakers and how their parts are different



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- When a magnetic field passes by a conductor, voltage is induced in the conductor
- electric currents produce magnetic fields. The stronger the current, the more intense the magnetic field.
- Magnets can be permanent or temporary
- Magnets and electromagnets attract or repel each other; similar poles repel, while dissimilar poles attract.

ACQUISITION OF KNOWLEDGE AND SKILL:

Students will know...

- The various parts to a speaker
- How a speaker works
- The principles on how the speaker operates

Students will be skilled at...

- Constructing speakers and other speaker technology
- Identifying different parts of a speaker

S2 EVIDENCE:

EVALUATIVE CRITERIA:

- Functions as expected
- Constructed well

ASSESSMENT EVIDENCE:

Performance Task(s):

Build your own Speaker

Students will construct a simple audio speaker using simple electrical device and tools in this exercise.

Other Evidence:

- Completed

- End of unit assessment

S3 LEARNING PLAN: *Summary of Key Learning Events and Instruction*

Adapted from: GK-12 Program, Center for Engineering and Computing Education, College of Engineering and Information Technology, University of South Carolina

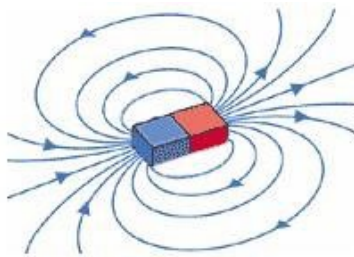
Pre-Assessment

Understand a series circuit.

Identify the north and south poles of a magnet

Discussion Questions: Solicit, integrate and summarize student responses:

- 1) Can we make a non-magnetic object magnetic? (Answer: Yes, this is known as magnetic induction. This phenomenon can be demonstrated with two nails. We can magnetize one nail by touching it to a magnet. Then, both nails will hang together. The magnetized nail is a temporary magnet. Temporary magnets retain their magnetism for a short time. They are similar to electromagnets that magnetize where the electric current is on and demagnetize when it is off.)
- 2) What is a magnetic field and where do magnetic fields come from? (Answer: Magnetic fields are caused by the movement of electrons. The magnetic field lines give the direction in which the magnetic force acts. They converge where the magnetic force is strong and spread out where it is weak. For instance, in a compact bar magnet, they spread out from one pole and converge towards the other. The magnetic force is strongest near the poles where these field lines come together. A space modified by the presence of magnetic field lines is a magnetic field.



The field lines around a bar magnet.
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Does magnetism ever wear off? (Answer: Most permanent magnets retain their magnetism for a very long period. This is because they are composed of electrons divided naturally into "magnetic domains"—tiny regions where all the magnetic fields of the atoms are all pointing in the same direction. These electrons are charged and spin, acting like little electromagnets, and their magnetism never wears off. It is the lining up of many, many electron spins that creates permanent magnets. Therefore, the underlying magnetism never wears off; only the ordering of all the spins together may become more disordered.)

Outline:

1. Introduction

- Have students watch and listen to the video "Speakers - Magnetism & Sound."
- Pass out student activity sheets "Building a Coffee Cup Speaker" to each student.
- Have students listen and read along as you review electromagnetics with the Engage section of the Learning Activity, the problem, and the constraints.
- Have students write down any extra constraints or special instructions you wish to add.

2. Construct

- Have students read the procedures and construct the speaker.

3. Test

- Students test the speaker
- Students discuss and write down observations into the chart provided.

4. Brainstorm

- Students discuss and write down possible modifications they can make to their speakers.

5. Test

- Students test their speakers again and write down observations.

6. Communicate Results

- Students discuss their results with their group and write a short presentation communicating their results.
- Students share their results by speaking in front of the class or recording a short video.

Suggested Strategies

1. Before the activity

- Briefly review magnets and their polarities.
- (Optional) Bring out a speaker radio and have it playing some music.

2. Demonstrate

- Follow along in the activity with the students going over each step and demonstrating how that step is done.

3. Tips and tricks

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- a. Watch step by step videos prior to introducing the activity
- b. Practice wrapping the coil around the dowel ahead of time

4. Student Time

- a. Give students time to construct their speakers. Once they are done, connect and test the student-made speaker.

Student Procedure:

Step 1: Form Cone Housing Frame

Form the Cone Housing Frame into a cone shape by pressing or squeezing it together to break down the structure of it to make it easier to form. You should easily be able to bring the two open edges together. Apply a large bead of glue along one edge. Align the edges. Hold in this position for approximately 30 seconds to allow the glue to cool.

Step 2: Prepare and Place Magnet

Lightly sand one face of the magnet. Clean the surface. Glue to the base of the inner circle of the Cone Base. Place and center magnet in the Cone Base. Attach the Cone Base to the Cone Housing.

Step 3: Prepare paper Cone Housing

Pick the color you want the Cone Housing to be. You will cut out the big circle first and then cut out the shaded area inside. DO NOT cut on the dashed line! This is for alignment. Fold over the paper to line up the cut edge to the dashed line and tape. Line up and tape both sides to hold in place. Place in the Cone Housing Frame to check fit.

Step 4: Attach coil to Cone Housing

When gluing the coil to the Cone Housing you want to be sure the end of the wire that has the two 12-inch unwrapped ends is facing the Cone Housing. Place glue around the edge and position on the Cone Housing.

Step 5: Gluing Cone Ring to Cone Housing Frame

Place the Cone Housing into the Cone Housing Frame. The wires should go through one of the openings in the frame. Be sure the wire moves freely around the magnet. Place the frame on the Cone Ring and glue together.

Step 6: Attach Cone Button

Cut out the Cone Button from one of your templates. Cut along the solid line. Then bring the cut edge to the dashed line and tape both sides. Glue the outer edge and place it on the Cone Housing. Align so it is centered.

Step 7: Connect to speaker wire.

Take one of the speaker wires that is in the package that came with the Amp. You will connect the speaker wire and magnet wire using gray wire connectors. Twist the magnet wire around the speaker wire. Use the gray wire connector to keep them connected. Repeat for the second wire.

Step 8: Connect amp and Test.

Insert the speaker wire connector to the white port on the amp. The USB cord, which is what will power your amp, must be connected to the red port on the amp. Connect the USB end to a block and plug into a wall outlet. It can also be plugged into a computer. Connect the 3.5mm Auxiliary Cord to the Amp and to your electronic device. Turn on your Amp by turning the larger knob clockwise. You should hear music coming from your speaker!!! Congratulations!!!

1. Discussion

A follow-up discussion of this activity should include having a student explain in detail how the speaker works. Have them trace the path of electrons from the wires coming out of the tuner through the speaker.

Progress Monitoring:

- The instructor will need to monitor the classroom, check students' work, and ensure students are on task and following directions.

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- Ensure students store their projects at the end of class and leave all materials in the room.
- At the end of the activity, post student projects in the room and provide appropriate feedback.



DIFFERENTIATION: *Summary of Key Differentiation Techniques*

Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom, therefore use the information below and experts in the area needed to design your plan for differentiation.

The ASCD Study Guide for Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe

Integrating Differentiated Instruction and Understanding by Design: Connecting Content and Kids.
by Carol Ann Tomlinson, Jay McTighe
ISBN-13: 978-1416602842
ISBN-10: 1416602844

Differentiating Reading Instruction
by Laura Robb.
ISBN13: 9780545022989

A Teacher's Guide to Differentiating Instruction
The Center for Comprehensive School Reform and Improvement



CAREER CONNECTIONS: *Summary of Career Opportunities Associated with this Lesson*

Please use this space to insert careers that might be connected to this lesson. This section will need continuous updating as new careers and emerging technologies change the opportunities available in the workforce.

Electrical Engineer

Electrical engineers can design systems that oscillate electricity for products such as speakers.

Sound Engineer

Sound engineers manipulate speakers and electricity to produce desired sounds and effects.

System Engineer

System engineers utilize speakers for systems such as sound systems.



KEYWORDS: *Please Insert Keywords from this Lesson with their Definitions*

Please use this space to insert keywords and their definitions

Current: A flow of electrical charge carriers. The common symbol for current is the uppercase letter I. The standard unit is the ampere symbolized by A.

Electromagnet: A magnet consisting of a coil of insulated wire wrapped around a soft iron core that is magnetized only when current flows through the wire.

Magnet: An object that is surrounded by a magnetic field and has the property of attracting iron, steel, or other magnets.

Magnetic field: A region in which magnetic forces can be observed.

Magnetic force: The force exerted between magnetic poles or between two electrically charged moving particles (protons and electrons).