

Expert Electric Circuits

Grade Level: 8, 9, 10

Duration: 30-45 minutes

Classification: Classroom

Subject(s): Electrical Engineering, Physics

Categories (STEM): Technology, Engineering, Science

Keywords: Electromagnet, Polarity, Induction

Introduction

- Summary: Students will be challenged to create an electric motor using a simple circuit and a magnetic field

Online Resource: <https://www.instructables.com/id/How-to-Make-a-Simple-Motor/>

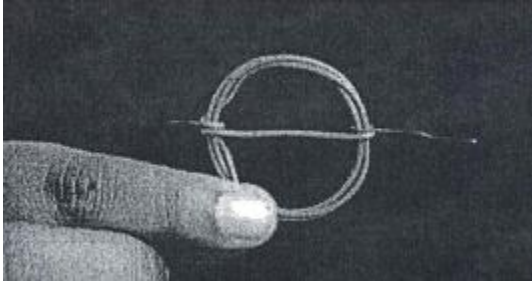
Materials

Materials	Quantity	Reusable?
Wire cutter or needle-nose pliers	1 per class	Yes
Insulated copper wire	3.5 feet per group	Yes
Masking tape	2 rolls per class	No
D-cell batteries	2 per group	Yes
Aluminum foil	2 strips per student (5-6 in)	Yes
Large paper clips	2 per group	Yes
Ring magnets	3 per group	Yes
Meter stick	1 per class	Yes
Ruler	1 per class	Yes

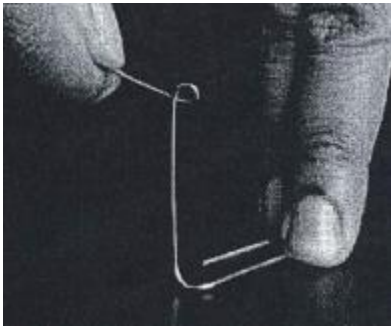
Directions

- Divide students into groups of 3-4
- Cut the wire into 3 pieces, two 12 inch pieces and one 18 inch.
- Using the masking tape, connect two batteries vertically. Make sure they are lined up positive to negative.
- Coil the longest wire into a circle roughly the size of a quarter. Leave space on both sides of the wire, creating a long (2in) and short (1in) end.

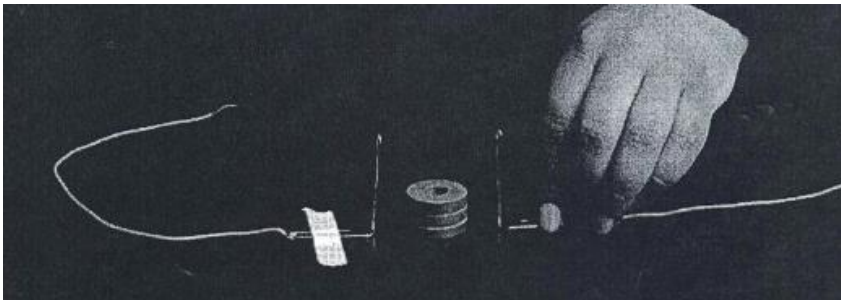
- Wrap the longer end of the wire to bisect the circle as shown below. There should be remaining straight wire on both sides of the coil.



- Bend the large paper clips to create a small stand.



- Attach one short wire to the base of each paper clip.
- Assemble the following setup. Tape the paper clips down to the table and place the three magnets between them.



- Using the paper clip bases, insert the wire coil so that it sits roughly 1 cm over the stack of magnets.
- Connect the free ends of the wires to the battery tower. It may be easiest to tape them in place.
- Gently spin the coil and watch what happens. If the coil gets hot, disconnect.
- Troubleshooting Tips
 - Make sure the circuit is on a level surface and the coil spins without wobbling
 - Try spinning the coil in the other direction
 - Check that the connections of the wires to the battery

Activity Extension

- Change the size of the coil, what happens?
- Change the number of magnets, what happens?

Discussion Questions

- What could you change to make your motor more powerful?
- Did your electric motor work on the first try? If not, what problem-solving techniques did you use to help?

What is happening?

- The coil creates an electromagnet as the current runs through it.
- Magnets have polarity, positive and negative sides.
- Each time the coil spins it temporarily stops the electric current, this causes the magnets to attract and repel, spinning the coil again.

Applications:

- Majors
 - Electrical Engineering
 - Computer Engineering
 - Physics
- Jobs
 - Electrical Engineer
 - Computer Engineer
 - Electrician
- Hobbies
 - Building with Little Bits or Snap Circuits
 - Building a Computer
- Real world applications
 - Electricity is used all around us to power houses or charge devices
 - Rubber wheels on cars do not conduct electricity, protecting them from lightning strikes
 - Tesla makes electric cars



**PROGRAM FOR WOMEN
IN SCIENCE AND ENGINEERING**

This activity was last updated in fall 2020 by Student Role Models.