ELECTROMAGNET ACTIVITY

Introduction

Although you may not see them at first, batteries are everywhere! You can find them in remotes for TV, phones, cars, and more. They are the most essential part of electronics, without them none of the wiring or code would work.

Learning Objectives

1. Be able to understand how to create an electromagnet.
2. Understand that the electric current creates a magnetic field.

Group Materials

1. 3 inch Nail
2. 2 feet of insulated copper wire (AWG 22 or higher)
3. D-cell battery
4. Paper lips, tacks, or pins
5. Wide rubber band

Electromagnetic Field Materials

1. Toilet paper tube
2. Insulated copper wire (AWG 22 or higher), several feet
3. Cardboard (5x5 inches)
4. Masking tape
5. Rubber band
6. 3 D-cell batteries
7. 9-volt Battery
8. Many metal paper clips

9. Extra batteries, if available: 6-V, 12-V, lantern batteries
10. 2 orienteering compasses
11. Optional: electrical tape
12. Optional: clothespins/clamps

Class-shared Materials

1. Wire Cutters
2. Wire strippers

Step-by-Step- Electromagnetic Field Stations

1. Wrap wire around the toilet paper tube 12-15 times to make a wire loop. Leave two long tails of wire hanging from the coil.
2. Poke four holes in the cardboard and weave the wire ends through the cardboard holes so that the tube and coil are attached to the cardboard
3. Use clothespins, clamps or tape to secure the cardboard to a table or desk.
4. Using masking tape or rubber band, connect one end of the coil wire to any battery, leaving the other end of the wire not connected.
5. Place some pins, paperclips or tacks at the station. Also, place any other available extra batteries (6V, 12V, etc.) and two, small orienteering compasses at this station.

Preparation- Teacher

1. Set aside batteries for students to test their own electromagnets such as 9-V batteries. (For example: you can make a 3-V battery setup by connecting 2 D-cells in series or a 4.5-V battery setup by connecting 3 D-cells in series.)

2. Cut one 2-ft piece of wire for each team. Using wire strippers, remove about ½ inch from both ends of each piece of wire.

Step by Step- Making the Electromagnet

1. The toilet paper tube-metal coil from the first part of the lab should have one end of the coiled wire attached to one end of the battery. Students connect the other end of the wire to the other end of the battery using tape or rubber band.
1. Move the compass in a circle around the electromagnet, pay attention to the direction that the compass points (locate magnetic field of the magnet).
2. Direct students to draw the battery, coil and magnetic field under questions below. Use arrows to show the magnetic field. Label the positive and negative ends of the battery and the poles of the magnetic field (Question 1).
4. Change both ends of the wire to the opposite ends of the battery. Use the compass to check the direction of the magnetic field.
5. Make a second drawing (Question 1). Dangle the paperclip near the coil again.
6. Remove one end of the wire from the battery to conserve battery power.

Step-by-Step- Continued

1. Materials: 1 nail, 2 feet of insulated wire, 1 D-cell battery, several paper clips and a rubber band.
2. Wrap the wire around a nail at least 20 times- tightly! (No gaps between the wires and no overlapping wraps.)
3. Connect the ends of the coiled wire to each end of the battery using the

rubber band to hold the wires in place.

5. See how many paperclips you can pick up!
6. Note down below by questions (Question 3).
7. Disconnect the wire from the battery after testing the electromagnet. (Question 4).

Conclusion Qs

1. Drawings of your electromagnetic field:

   Drawing 1: Drawing 2:

2. What happens if you dangle a paperclip from another paperclip near the coil?

3. How many paperclips could you pick up? _ _ _ _ _ _

4. Can the electromagnet pick up paperclips when the current is disconnected?