

# IV...Electricity and Magnetism

## Introduction:

Moving magnets can induce electric currents, and electric currents can cause magnetism. Based on this statement, there is obviously a close relationship between electricity and magnetism. Electric current flowing in a wire creates a magnetic field around it. This magnetic force is evidence of the phenomena known as electromagnetism.

## Purpose:

The following activities (Part 1 and Part 2) will show the relationship between electricity and magnetism. They will show how the changes in Earth's magnetic field can affect the flow, and sometimes interrupt the flow, of electricity from power company to consumer.

## Part 1.

## Procedure:

Carefully wrap the nail with the insulated wire making 20 loops. Connect the bare ends of the wire to the battery (for short periods of time only)

Determine the number of paper clips your magnet is able to hold. Now increase the number of loops to 40, and determine how many paper clips your magnet can hold.

## Questions:

- 1.How many paper clips did the magnet hold with 20 loops? How many with 40 loops?
- 2.What does this show about the strength of magnetic fields?
- 3.When you disconnect the battery, does the magnet still work? Why?
- 4.Can you describe a relationship between the flow of electricity and magnetic fields?

## Materials:

1. Dry cell battery. Use a 6-volt lantern battery for best results
2. Large nail or metal rod (about 10 cm long)
3. Two meters of bell wire (insulated)
4. Paper clips or small metal washers
5. Galvanometer
6. Bar magnet

## Teacher Notes:

1.The use of 10 loops vs 20 loops will work if your metal rod is too short to fit the full, 40 loops in the second part of the activity..

2.Remind the students to put the loops close together when they do their wrapping.

3.For best results, a 6-12 volt battery is recommended.

4.Have students take an average of the number of clips magnets can hold at 20 and 40 loops.

## CAUTION

Connect the battery to the wire for short periods of time only. The wire will get hot.

Do NOT use a car battery or a motorcycle battery to produce a stronger magnetic field. These batteries will explode if shorted, or cause the wire to spark and melt.

## **Part 2**

In the last activity you were able to create a magnet using the flow of electricity through a wire. This is called an electromagnet. In this activity you will induce the flow of electricity in a wire using a permanent 'bar' magnet. The flow of electricity will be small so you will need to use the galvanometer to measure the flow. Using the same wire, make a coil big enough to allow the bar magnet to pass through. Hook the bare ends of the wire to the galvanometer. Pass the bar magnet through the coils in a back and forth motion, slowly then quickly. The movement of the needle on the galvanometer is caused by the induced flow of electricity.

### **Teacher Notes:**

1. A stronger bar magnet will yield better results.
2. Students may need to vary the number of coils to get good results, they may also need to alter the speed at which they pass the bar magnet between the wire coils.

### **Questions:**

1. Does the speed at which you move the magnet through the wire coils have any effect on the needle's movement? What happens?
2. What do you think would happen if the power company was operating at 'full' capacity (such as during a heat wave or extreme cold spell) and a magnetic storm happened? Magnetic storms cause rapid changes in the magnetic field of the earth near ground level.