

Magnetism II – Lesson 5

Source of Magnetism and Magnetic Force

Summer 2004

Cal Poly Pomona

Objective:

To investigate the connection between electricity and magnetism with two examples: an electromagnet and an electric motor.

Experiment 1

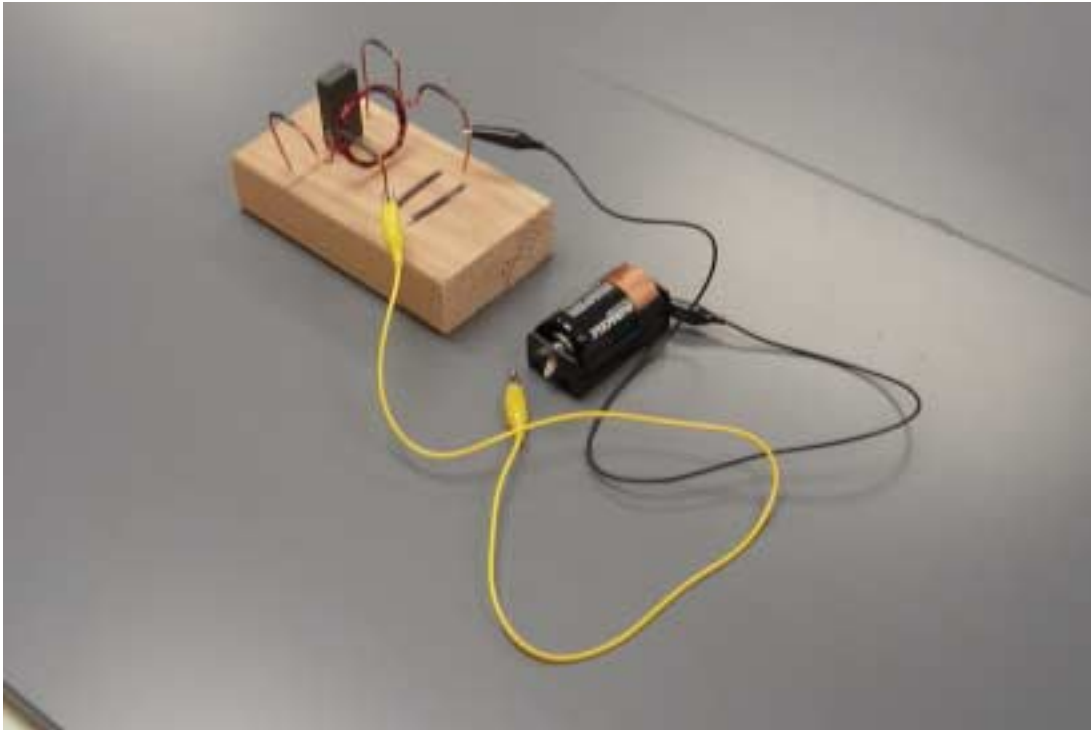
- a) Place the paper clips on the table top.
- b) You and your partner will be given two pieces of “transformer wire” , the copper wire with an enamel coating. One piece is 50 cm, and the other piece is 100 cm. Wind the 50 cm piece around the nail..
- c) Try to pick up the paper clips with the nail. What happens?

Note: in the following experiments you will connect the free ends of the transformer wire to your battery(s). The wire might get hot and the battery drained quickly (why?). Be careful not to burn yourself and/or drain the battery too fast.

- d) Use your sandpaper to sand off the plastic coating on the free ends of the transformer wire. Connect a battery to the bare ends of the transformer wire causing current to flow in the wire. Now, try to pick up the paper clips with the nail (do this quickly). Write in your journal what happened.
- e) Why do we call the nail with the wire wrapped around it an electromagnet?
- f) Let’s see if the electromagnet has a north and a south pole. Place a string through one hole of your permanent magnet and hang it from the lab stand. Connect the electromagnet to the D battery. Describe in your journal what happens when you bring it near the hanging magnet. How do you know it has a north and a south pole?
- g) Repeat part f) with the battery reversed. What happens?
- h) Paper Clip Contest: Try to pick up as many paper clips as you can using 1) the 50 cm wire provided, and 2) the 100 cm wire provided. How many paper clips did you pick up in each case? Write down any conclusions that you can draw from these experiments.

Experiment 2

Using the electric motor stand provided, you will finish construction the motor. The only part missing is the armature (coil of wire that will spin). Using the transformer wire, make four to six loops with the ends of the wire sticking out. Test that your armature is balanced and will easily spin in the cradle that holds it. See the picture below:



- a) Lie your armature on the cardboard that is provided. Using your sandpaper, sand off the enamel coating on the top half of the wire from each of the ends. Note: this is critical for making the motor work. Why is this critical in order that the armature keeps spinning?
- b) Place the armature in the holder with the magnet and battery in the correct position and test if the armature will spin. If you have difficulty, call over one of the instructors.

Once your motor is working, you can experiment with it:

- c) What happens if you turn the magnet around? Why?
- d) What happens if you switch the battery leads? Why?
- e) What happens if you use two magnets? Why?
- f) What happens if you use two batteries in series? Why?
- g) If there is time, we will see whose motor spins the fastest and the longest.