Electromagnets'R'Us

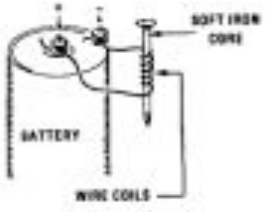
Name: _____

- Wherever there is electricity (overhead power lines, home appliances, computers, etc.) there is an **electromagnetic field** surrounding it.
- When electrons flow through a wire (making an electric current) a magnetic field is created around the wire.
- When you wind a wire around a nail and connect the wire to a battery, the electric current creates a magnetic field around the nail.
- Since the nail is made of iron, it will become magnetized.
    - The **domains** in the nail all line up to face north and south, and there you have it…an **electromagnet**!!

Electromagnets have 2 key advantages over permanent magnets:

1. They can be made very strong, by a) increasing the number of times the wire is wound around the nail, or b) increasing the strength of the current running through the wire
2. They can be turned on or off by stopping or starting the flow of electrons.

- Electromagnets are very useful in real life; they are used to pick up huge loads of scrap metal in junkyards.
    - They are also used in loudspeakers, clocks, telephones, doorbells, and generators.



Activity

Objective: to create and test an electromagnet to learn about how it works

Materials: 1 iron nail, 2 feet of insulated copper wire, 1 dry cell, several paper clips or pins.

Method:

1. Strip approximately 3 cm off of each end of your copper wire
2. Wind the wire tightly around the nail, leaving about 15-20 cm of extra wire at each end
3. Connect one end of the wire to the negative pole of the dry cell, then connect the other end of the wire to the positive pole of the dry cell.
4. Use the nail to pick up your paper clips.
5. Record how many times your wire is wound around the nail, as well as how many paper clips the nail was able to pick up
6. Disconnect the dry cell and observe/record what happens
7. Try wrapping more or less coils of wire around the nail and observe how this affects the magnet's ability to pick up the paper clips.

Observations:

1. 1st attempt: my electromagnet had _____ coils, and was able to pick up _____ out of _____ total paper clips

2. What happened when you disconnected the battery? Why?

3. 2nd attempt: my electromagnet had _____ coils, and was able to pick up _____ paper clips. This was _____ more / less than on my first attempt.

4. 3rd attempt: my electromagnet had _____ coils, and was able to pick up _____ paper clips. This was _____ more / less than my 1st attempt, and _____ more / less than my 2nd attempt.

5. Explain why you had different results for each of your 3 attempts.