Electrical Circuits

1. There are different successful arrangements of bulb, battery and wire that will result in the bulb lighting. Find at least two. Draw each successful configuration of wire, battery, and bulb. Be sure to label these "successful". As part of some of your arrangements, you may touch the bulb directly to the battery if you wish.

2. Equally as important, draw and label each unsuccessful arrangement as well. Find at least two different unsuccessful ones. As part of some of your arrangements, you may touch the bulb directly to the battery if you wish.

3. Now that you have made a successful circuit, use the different materials in your kit (wood, cloth, plastic, metal, etc.) and insert each of these items in your circuit. Make a data table to record the results. Record whether or not the bulb lights up and whether the material is a conductor or insulator.

Material	**Bulb Lights** (Yes / No)	**Conductor / Insulator**

4. Each individual part (or component) of a conducting circuit must also provide through itself a pathway; do you recall from experiment 1 that we concluded that all successful circuits and their parts have two "ends"? Examine one of your bulbs, using a magnifying glass. Can you identify the electrical pathway and its ends in the bulb? Make a careful sketch of the bulb and trace over the pathway with a colored pencil.

Concluding Questions to Answer:

Look at your sketches of successful and unsuccessful configurations and answer the following questions.

- What do the successful configurations ç?

- What do the unsuccessful arrangements have in common with one another?

- What are the differences between successful and unsuccessful configurations?

Magnetism

Materials:

- 1 transparency sheet
- 2 bar magnets
- 1 mini compass
- 1 jar of iron filings

1. Take a bar magnet and use the different materials in your kit (wood, cloth, plastic, metal, etc.) and test each one to see if it is attracted to the magnet. Make a data table to record the results.

Item	Attracted to Magnet (Y / N)

Concluding Questions:

- What kinds of materials are attracted to the magnet?

- What do the materials attracted to a magnet have in common?

- For those that are attracted to a magnet, is this attraction stronger or weaker than the force of gravity?

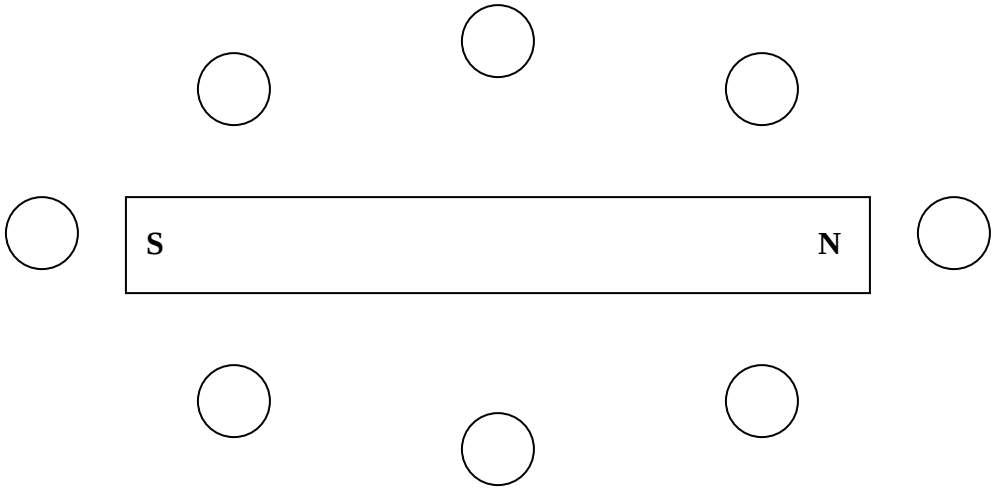
- What kinds of materials are not attracted to the magnet?

- What do the materials attracted to a magnet have in common?

2. All 'things' that exert a force on other 'things' establish an invisible force field around themselves. For example, we have seen that all objects with mass establish a gravitational force field around themselves, and electrically charged objects also establish an electrical force field. Magnets establish a magnetic force field, and these are the easiest kind of force fields to visualize.

Procedure: *Caution: during this activity leave the magnets in the plastic bags.*

- To 'see' this normally invisible force field, place one of your bar magnets on your table and then place your transparency over the magnet.
- Now, from a couple of inches above the transparency and centered above the magnet, sprinkle a fairly large amount of iron filings onto the transparency over and around the area of the magnets. Very gently tap the transparency so that the filings will move around and align themselves with the magnetic force field lines.
- Pick up a "mini-compass" from your kit. Set it down on some areas of the aligned iron filings where the alignment pattern is well defined. What relationship do you see between the needle alignment and the pattern of the filings? Try this at several other locations where the filings are differently oriented.
- Draw an arrow in each circle showing the orientation of the compass needle in each location.



Concluding Questions:

- What inference might you make as to what it is that causes the compass needle to line up the way it does? What causes this?

- From these observations, what do you infer might be the reason that a compass needle anywhere on earth lines up the way that it does?

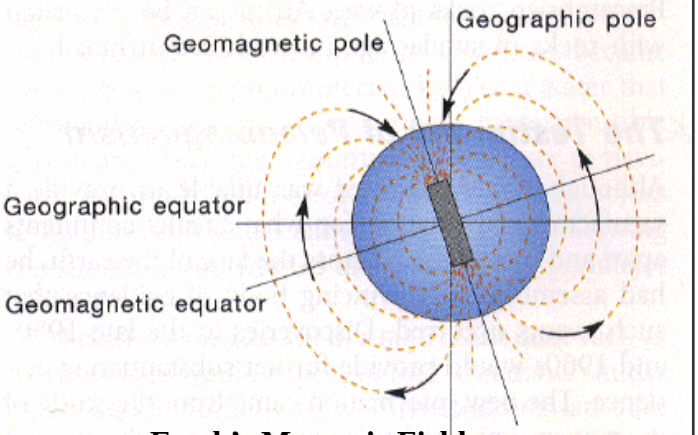
Procedure:

3. Take both of your bar magnets. Position them so they are just attracted to each other; 1-2 inches apart. Place the transparency over the magnets.
   - Now, from a couple of inches above the transparency and centered above the magnet, sprinkle a fairly large amount of iron filings onto the transparency over and around the area of the magnets. Very gently tap the transparency so that the filings can overcome whatever small friction or static electric charge attraction they have with the table and align themselves with the magnetic force field lines.
   - Sketch the pattern the iron filings make around the magnet. This is the shape of the magnetic field.
   - Return the iron filings to their container.

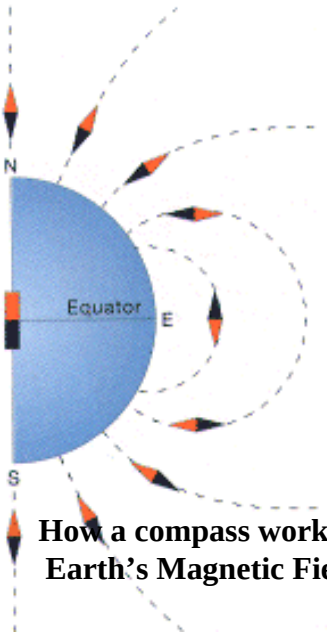
Procedure:

4. You can also the magnetic fields created by two magnets that are repelling each other.
   - Take both of your plastic covered magnets, place them parallel onto their long edge on your table. Position them so they are just repelling each other; about 4 inches apart. Place your clear plastic table with the transparency over the magnets.
   - Now, from a couple of inches above the table top and centered above the magnet sprinkle a fairly large amount of iron filings onto the table over and around the area of the magnets. Very gently tap the table so that the filings can overcome whatever small friction or static electric charge attraction they have with the table and align themselves with the magnetic force field lines.
   - Sketch the pattern the iron filings make around the magnet. This is the shape of the magnetic field.
   - Return the iron filings to their container.

Class Discussion: Earth as a giant magnet



Earth's Magnetic Field



How a compass works in Earth's Magnetic Field.