Electricity and Magnets; Friends for Life

SKILLS/OBJECTIVES

- To understand the concept of magnets (positive and negative ends, like ends repel)
- Begin (attempt) to explain that magnetic fields come in waves (similar to the ocean)
- Make the connection between electricity and magnets and see how one can induce/influence the other.

MATERIALS

- Materials List

One small spool of magnet wire per group
One very small, low power light bulb per group
1 Neodymium magnet per group
1 large magnet per group
2 bar magnets per group
Sandpaper
1 AA battery per group
1 foot of electrical wire per group
1 sheet of paper per group
1 piece of steel wool cut up / iron filings per group
Tape (preferably electrical)
1 rubberband

BACKGROUND

- As we previously saw, one can use a battery to power a circuit which turns on a light-bulb, but we can use a battery to create a temporary magnet as well.
- The students will also see that magnets and electricity are closely related by using a magnet to power a light bulb.
- Magnets have two poles, a northward facing one and one facing towards the south. We name them after directions because of the Earth's magnetic properties. The Earth functions as a very large, powerful magnet.
- Magnets are everywhere! They are in hairdryers, telephones, vacuum cleaners, electric appliances to name a few.

Activity #1	**Initial test of Magnetism**
Materials	One magnet per group
Worksheet	Y (just a recorder)

- **Give one group of children a magnet and a sheet of paper. Allow them to search about the room for different substances that the magnet will stick to and certain surfaces it will not adhere to. Have one member of the group record the findings.**
- Instructors should follow/watch the children because, while most of the magnets are not powerful enough to harm electronics, it is probably a good idea to keep children away from computers, projectors, etc.
- **Ask the children if they can see any connection between what works and what doesn't.**

Activity #2	**Visualizing the Magnetic Field**
Materials	One bar magnet per group Iron fillings (or steel wool cut up) Paper
Worksheet	N

- **Give each group two bar magnets and have them assemble in any fashion they choose (+/+ -/+ -/-) and place the piece of paper on top of the magnets**

Instructors need to ensure that the paper is properly covering the magnets because getting the iron filings off of them is a hassle. Tell the children that the iron filings are going to be affected by the magnets, ask them to make a prediction about what will happen when sprinkled on top.

- **Allow the children to SLOWLY sprinkle the filings on top of the paper over the magnets. This probably best done from a paper cup or a like vessel.**

What do they observe? What patterns arise?

- **Funnel the magnets back into the cup and change the orientation of the magnets. Repeat the above experiment**

Ask children to predict what differences they will see. Afterwards, talk to them about the difference between positive/negative, attraction/repulsion and how this is shown by the filings.

Activity #3	**Creating a temporary magnet**

Materials	One magnet per group A handful of paperclips One AA battery per group One large nail per group Copper wire >1 foot Sandpaper Rubber band
Worksheet	N

Talk to the children about the connection between electricity and magnetism. Both have a positive end and a negative end. Do they think that this is at all related? Do they think we can create a magnet from a battery?

- **Pick up the paperclips with the magnet. Try and pick up the paperclips with the nail.**
- **Use the sandpaper to carefully remove casing from each end of the wire (about ½ an inch per side). Wrap the wire around the nail (coiled) many times, yet leaving enough room that the ends can be connected to the battery.**

Let the children think about this part. Should they connect both ends to the positive side? What will happen if they do this based on their knowledge of electricity? Allow them to make this mistake if they happen to go that road

- **Connect an end of the wire to each node of the battery and ensure its place with a rubber band. Allow it to sit for a minute.**

The battery and the nail will both get hot, that is normal, yet they should not become too hot to handle.

- **Let the students use the nail to pick up the paperclips. Remove the nail from the wire and see if it continues to pick up paperclips. Drop the nail from a decent distance onto a hard surface (safely). Then check if it continues to pick up paperclips.**

Ask why does this happen? What changed in the nail to allow it to now pick up paperclips? What do we know about magnets and electricity that can explain this? Why would dropping the nail make it incapable of picking up paperclips?

Activity #2	**Visualizing the Magnetic Field**
Materials	One small spool of magnet (?) wire per group One very small, low power light bulb per group 1 Neodymium magnet per group 1 large magnet per group Sandpaper

	Tape (preferably electrical)
Worksheet	N

- **Remove wire from spool and coil it in a circle as flat as possible. Use the sandpaper to remove casing from ends. Tape the coiled wire (with the ends exposed) so that it does not come undone.**
- **Connect an end of the wire to each leg of the light bulb. Pre-coiling around a nail or paperclip might be a good idea.**

They may need help with these steps. That is okay because they are not necessary to the lesson plan. They are more of the "set-up stages."

- **Hold the coiled wire in your non-dominant hand and the magnet in the other. What motions can make the bulb light up? Can they make the bulb light up?**

What do they observe? What patterns arise? Why can we use magnets to create electricity? How does the bulb light up without a traditional power source? What do we know about direct currents and alternating currents that make this possible?