Hidden Attractions: A Program about Magnets and Magnetism
Presented by the Sciencenter in Ithaca, NY

Program Overview

Hidden Attractions introduces students to magnets and magnetism. The program is designed for classes or home-school groups of up to 24 students in grades 1-4. Each program runs approximately 50 minutes, and is held in the Sciencenter classroom.

Students begin by sharing and activating prior knowledge of magnetism. They view several demonstrations and in pairs or small groups, they participate in hands-on exploration of the properties of magnets. The number and complexity of the activities depends on the group and their level of background knowledge. *(For background information and magnetism basics, see page 3).*

Although there are a number of learning objectives, students not grasp them all during the program. Pre-program and post-program activities will reinforce their learning and help broaden their understanding.

Learning Objectives:

Students will be able to:

- Make and test predictions regarding magnetism Explain that air exerts approximately 15 pounds of pressure per square inch.
- Demonstrate an understanding of the following properties of magnets
    - Magnetism is a force that attracts some (but not all) metals.
    - A magnetic field extends beyond the physical object of the magnet and can attract objects from a distance.
    - A magnetic field can work through other materials but may be weakened or blocked by the thickness of those materials
    - All magnets have a north and south pole; opposite poles attract each other and like poles repel.
    - A magnetic field is not the same throughout a magnet, it is strongest near the poles.
    - Some magnets work for a long time, other magnets work for a short time and magnets can lose their magnetism.

Students will practice the following process skills:

- Scientific observation
- Interpreting data
- Drawing conclusions.

New York State Math, Science and Technology Curriculum Standards:

Standard 1 Analysis, Inquiry and Design

Scientific Inquiry

1. The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing creative process.
2. Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

<u>Standard 4 Science</u>

The Physical Setting

3. Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.
5. Energy and matter interact through forces that result in changes in motion.

Background Information

(Source: http://my.execpc.com/~rhoadley/magindex.htm)

Ancient people (either Greeks or Chinese) discovered that certain rare stones attracted iron and would always turn in the same direction when allowed to swing freely. These naturally occurring magnets, or *lodestones* (lode means to attract), were rocks which contained magnetite, named after a region in Greece where many lodestones were found.

A magnet is any object that creates a *magnetic field*. A magnetic field is a force exerted on objects around the magnet. The magnetic field of one magnet will interact with another magnet or a piece of magnetizable material.

Iron, cobalt, nickel and a few other elements and alloys of these metals are *magnetizable*. Magnetizable materials contain "magnetic pockets" which behave like many little magnets. Ordinarily their magnetic forces are disorganized. They pull in many different directions and the net effect is that they cancel each other out. When exposed to a magnet, the magnetic pockets align and the magnetizable material behaves like a magnet itself. Depending on the *retentivity* of the material, this temporary magnetism may last only while exposed to a magnet or it may be retained for a long time.

Magnets are dipoles, meaning that they have at least two poles, a north and a south pole. If you break a magnet, each of the new pieces will have both a north and south pole. The north pole of a magnet is actually a "north-seeking" pole, and will align itself to point toward magnetic north. Opposite poles will attract each other and like poles will repel.

Resources

Websites

Exhaustive site about magnets and magnetism, includes many great links:

http://my.execpc.com/~rhoadley/magindex.htm

Great general background on magnets:

http://www.newi.ac.uk/BUCKLEYC/magnet.htm

Ideas for fun demonstrations, experiments, and hands-on activities:

http://www.exploratorium.edu/snacks/iconmagnetism.html

Resources for buying magnets and other science supplies:

http://www.teachersource.com/
http://www.scientificsonline.com/
http://www.arborsci.com/

Books

Doherty, Paul. & John Cassidy. *Magnetic Magic: Tricks Done with Magnets*. Palo Alto, CA: Klutz, 1994.

Feiler, Jane, & Nancy Terry Hooten, *Magnets… A World to Discover!* Level 1. Sonoma, CA: Dowling Miner Magnetics Corporation, 1990.

Livingston, James D., *Driving Force: The Natural Magic of Magnets*. Cambridge, MA: Harvard University Press, 1996.

Vecchione, Glen. *Magnet Science*. New York: Sterling Publishing, 1996.

Classroom Activities

Get in Line!

This activity demonstrates the making of a temporary magnet.

Time to get in line for lunch? During your magnet study, try an innovative method for getting your students to line up. Remind students that each tiny particle of matter in a piece of iron is facing a different direction. When a magnet passes over, all the atoms line up. Now pass a magnet over your students to get them to line up!

Make a Compass

This activity demonstrates the making of temporary magnets and that magnets will orient themselves to the earth's poles.

Materials

- Non- metal bowl or other wide shallow container for water
- Water
- Steel sewing needle
- Small piece of cork or polystyrene
- Compass

Procedure

1. Stroke the need about 100 times from the eye to the point using the south end of a bar magnet. (Be sure to lift the needle clear of the magnet each time. Just rubbing it back and forth will not magnetize the needle.)
2. Partially fill the bowl with water.
3. Stick the needle through the cork or polystyrene and float it on the water.
4. Does the needle slowly swing around and point in a certain direction? Compare the needle with the compass.
5. Try these things and watch what happens:
    - Use your finger to move the needle so it points in a different direction, and then watch what happens after a few seconds.
    - Gently turn the bowl
    - Hold your bar magnet near your homemade compass.

Explanation: When a magnetizable material such as the needle is repeatedly passed over a magnet, the magnetic pockets within the needle align creating a piece of metal, which itself acts as a magnet until pockets become scattered by a sudden jarring force or another magnet.

Visualize Magnetic Fields

*Note: this activity is best for the overhead projector, so that students are not exposed to iron filings, which should be handled with caution.

This activity demonstrates the shape and orientation of magnetic fields around the poles of a magnet

Materials

- Safety Goggles
- Bar Magnet
- Sheet of glass or stiff acetate (an overhead projector sheet works well)
- Iron filings or steel wool cut into bits (BE VERY CAREFUL – DO NOT GET FILINGS IN EYES)

Procedure

1. Place the glass or acetate over the bar magnet.
2. Sprinkle filings over the magnet.
3. Notice the patterns that appear when you sprinkle the filings.

Bobbling Butterfly

This activity demonstrates that the magnetic field extends outside of a magnet.

Materials

- Jar with a steel lid or paperboard box
- Magnet
- String
- Tape
- Paperclip
- Paper, scissors, and markers

Procedure

1. Make a small paper cutout of a butterfly or dragonfly.
2. If using a box, cut out a viewing hole in the side of the box. (A tissue box on its side works well.)
3. Tape a paperclip or other magnetic material to the butterfly.
4. Tie one end of a string to the paperclip and tape the other on the bottom of the jar or box so that the paperclip is near, but not touching the top.
5. Put the magnet inside the jar lid and screw lid onto the jar or tape a magnet into the top of the box.
6. Now turn the jar over and watch as the butterfly bounces in the magnetic field of the magnet on the jar's lid.

Adapted from: Playing With Magnets by Gary Gibson

How Strong is Your Magnet?

This activity demonstrates that magnetic fields are weakened by nonmagnetic materials

Materials

- Several magnets
- Paperclips, brads or other magnetizable objects
- 3X5 cards or scrap papers

Procedure

1. Hold a magnet against the card or paper and touch the pile of paperclips.
2. Count how many paperclips the magnet can hold.

3. Add one sheet of paper, or card and repeat steps one and two.
4. Continue adding one sheet at a time until the magnet will no longer hold a paperclip.
5. Repeat the test with different magnets.

Nail Pull Experiment

This experiment allows students to see that some magnets are stronger than others, and discover how to determine which magnet is stronger.

Materials

- Several strong magnets
- Several magnetic object such as nails

Procedure

6. Put a nail or other object between two magnets.
7. Ask students how they can tell which magnet is stronger.
8. Try pulling apart the two magnets.
9. Repeat the test:
    - try it several times to confirm results.
    - try it with different objects to see if the result is the same.
    - try adding additional magnets to one side or the other.

Adapted from: Magnets… A World to Discover Level I by Jane Feiler and Nancy Terry Hooten.