CLASSROOM VISIT
ELECTROMAGNETS

NATIONAL HIGH MAGNETIC FIELD LABORATORY

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Pre-Outreach Activity: What Do We Already Know?

Teacher Background: A simple, yet effective learning strategy, a K-W-L chart, is used to help students clarify their ideas. The chart itself is divided into three columns:

K	W	L
WHAT WE KNOW	WHAT WE WANT TO KNOW	WHAT WE LEARNED

MATERIALS: > Chart Paper > Markers

ACTIVITY INSTRUCTIONS

1. Copy the K-W-L chart and pass out so that each student has their own sheet. Explain how the chart is to be filled out, then brainstorm with the class and have the students list everything that they know about magnets and magnetism. There are no right or wrong answers.

2. Next have the students list everything that they want to know about magnets and magnetism. You may need to provide prompts such as:

   If magnet experts were here, what questions would you ask them?
   If you were a scientist, what would you like to discover about magnets?

3. Keep the chart accessible so that you and the students can enter ideas, new information, and new questions, at any time. The class can return to the K-W-L chart after completing the activities. As students learn the answers to their questions, list the answers in the L column of the chart.

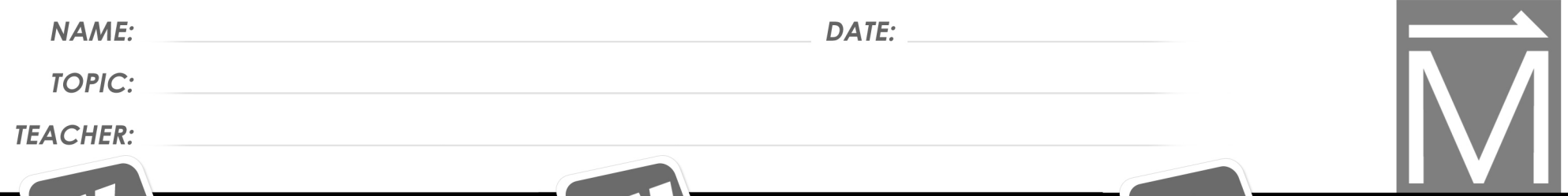
4. K-W-L charts are useful in identifying misconceptions that students have about magnets and magnetism. Once the misconceptions are identified, have students design a way to test their ideas, reflect on what they observe, and refine the original conclusion.

5. Periodically, return to the K-W-L chart during the activities to check off items from the W column and to add to the L column. Students may want to add items to the W column to further their explorations.

NAME: _____ DATE: _____

TOPIC: _____

TEACHER: _____



K — WHAT DO YOU KNOW

W — WHAT DO YOU WANT TO KNOW

L — WHAT HAVE YOU LEARNED

Pre-Outreach Activity: What is a Magnet?

Teacher Background:

We know essentially what magnets do. Magnets attract and repel. Materials with magnetic qualities have domains made up of billions of atoms that are configured in certain ways. Materials with strong magnetic characteristics have atoms with magnetic polarities mostly aligned. Each magnet has a north and a south pole, the regions where the magnetic force created by the magnet is strongest. Like poles repel and opposites attract. Magnetism is the force of attraction and repulsion of the magnets. This activity is designed to provide opportunities for your students to explore and discover through hands-on experiences the properties of magnets and magnetism:

Each magnet has a north and a south pole.	**Like poles repel.**	**Opposite poles attract.**	**Magnets attract some materials and not others.**

MATERIALS: > *Magnets* > *Compasses* > *A variety of classroom objects, not all metal.* > *K-W-L Chart*

ACTIVITY INSTRUCTIONS

1. Review the K-W-L chart with your students.
2. Distribute magnets, compasses, and the variety of objects to students. Each student should have at least two magnets. Students can share compasses and the other materials.
3. Give students ample time to explore and play with the materials freely.
4. Challenge the students to test what they previously listed in the K column of the K-W-L chart, reflect on what they observe, and refine the original preconceptions if needed.
5. Challenge the students to discover the types of materials that magnets attract. The students can prepare a chart listing the objects that are attracted to magnets and those that are not.
6. Challenge and guide the students to use the compass to discover the polarity of the magnets in terms of north and south poles.
7. Introduce the terms *attract, repel, like,* and *opposite* in a discussion of how magnets interact with each other.
8. Challenge your students to feel and describe the force of magnetism. Introduce the term *magnetic force* to describe the forces of repulsion and attraction.

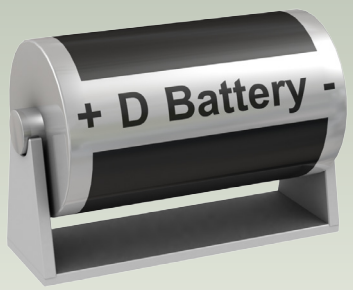
Post-Outreach Activity: Building a Stronger Electromagnet

Teacher Background:

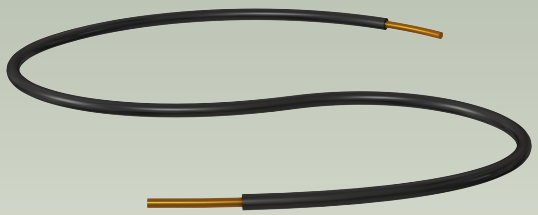
Variable refers to the one factor that is being tested or observed in an experiment. Most often, scientists work with only one variable at a time. There are many variables that can affect the strength of an electromagnet. For example, the number of winds, the size of the wire, the style of the winding, the core material, the coil diameter, or the amount of current. Students may add to the list length of the wire, size of the battery, or the core diameter. This activity, however, will deal only with number of winds, style of winding, and core material, though students are encouraged to come up with their own variable sand test them.

MATERIALS:

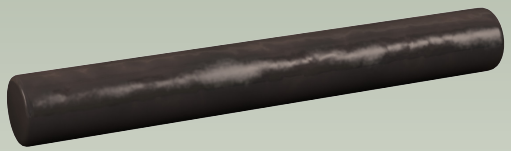
- 1 D-cell battery
- 1 battery holder



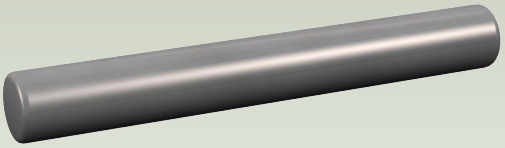
- Insulated wire



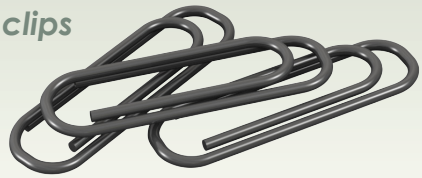
- an iron rod



- an aluminum rod



- paper clips



- a wooden dowel

ACTIVITY INSTRUCTIONS

1. By now your students should be familiar with what an electromagnet is, and how it works. Have the students build an electromagnet by completing only 20 winds of wire around the iron rod.

2. Invent a way to measure your magnet that does not involve the use of paper clips and test the strength of the magnet you have just created.

3. Do you think the strength of the magnet would be affected by adding more winds? Create a new magnet use a total of 40 winds. Test this magnet in the same way you tested your previous magnet. Record any changes.

4. At this point, what do you think adding more winds will do to the magnet's strength? What other factors could affect the strength of the electromagnet?

Next Generation Sunshine State Science Standards

4th Grade:
SC.4.N.1.1, SC.4.N.1.2, SC.4.N.1.3, SC.4.N.1.4, SC.4.N.1.5, SC.4.N.1.7, SC.4.N.1.8, SC.4.P.8.1, SC.4.P.8.4

5th Grade:
SC.5.N.1.1, SC.5.N.1.2, SC.5.N.1.3, SC.5.N.1.5, SC.5.N.1.6, SC.5.N.2.1, SC.5.N.2.2, SC.5.P.8.3, SC.5.P.8.4, SC.5.P.10.2, SC.5.P.10.3, SC.5.P.10.4, SC.5.P.11.1, SC.5.P.11.2, SC.5.P.13.1, SC.5.P.13.2, SC.5.P.13.4

6th Grade:
SC.6.N.1.1, SC.6.N.1.2, SC.6.N.1.3, SC.6.N.1.4, SC.6.N.1.5, SC.6.N.2.2, SC.6.N.2.3, SC.6.N.3.1, SC.6.N.3.2, SC.6.P.13.1

7th Grade:
SC.7.N.1.1, SC.7.N.1.2, SC.7.N.1.3, SC.7.N.1.6, SC.7.N.1.7

8th Grade:
SC.8.N.1.1, SC.8.N.1.2, SC.8.N.1.3, SC.8.N.1.4, SC.8.N.1.5, SC.8.N.1.6, SC.8.N.2.1, SC.8.N.4.1, SC.8.P.8.1, SC.8.P.8.4, SC.8.P.8.5, SC.8.P.8.7

High School:
SC.912.N.1.1, SC.912.N.1.2, SC.912.N.1.3, SC.912.N.1.5, SC.912.N.1.6, SC.912.N.1.7, SC.912.N.2.1, SC.912.N.2.4, SC.912.N.3.1, SC.912.P.8.4, SC.912.P.8.5, SC.912.P.10.10, SC.912.P.10.16, SC.912.P.10.17

Next Generation Science Standards

NGSS:
3-PS2-3, 3-PS2-4, 4-PS3-4, 3-5-ETS1-3, MS-PS2-3, MS-PS2-5, HS-PS2-5

VOCABULARY LIST

Magnet	*An object that is surrounded by a magnetic field and that has the property, either natural or induced, of attracting certain metals. magnets have a North and South pole.*
Magnetic field	*A region around a magnet in which objects are affected by the magnetic force.*
Attract	*To cause to draw near by a force.*
Repel	*To push back or away by a force.*
Permanent Magnets	*A piece of magnetic material that retains its magnetism after it is removed from a magnetic field.*
Temporary Magnets	*A piece of magnetic material that demonstrates the properties of a permanent magnet only while in a magnetic field.*
Electromagnet	*Created when a temporary magnet is placed into a coil (solenoid) that is carrying current.*