Activity: What Do We Already Know?

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 electricity?

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.

Teacher: 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**: What We Know
- **W**: What We Want To Know
- **L**: What We Learned

**Background:** Once the misconceptions are identified, have students design a way to test their ideas, reflect on what they observe, and refine the original conclusion.
**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 iron, nickel, and cobalt.

**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.
**Teacher Background:**

By coiling a current carrying wire, you can concentrate the magnetic field in the center of the coil. The DC current from a battery will create a flow of electrons in the same direction. So the wire carrying a DC current will have a small magnetic field around it. Coiling the wire concentrates the magnetic field inside the coil. Whatever is placed inside this coil will then be in a stronger magnetic field than if the wire was uncoiled.

**Materials:**
- 1 D-cell battery
- Insulated wire
- An iron rod
- An aluminum rod
- Compass
- Paper clips
- A wooden dowel

**Activity Instructions**

1. Explain to students that magnetism arises when the electrons in a material line up.

2. What is electricity? What is the difference between AC and DC? In DC circuits, electrons move together in one direction, and therefore have a constant magnetic field around them. What happens to the magnetic field if the wire is doubled over itself? What if the wire is coiled?

3. Coiling a current carrying wire concentrates the magnetic field in the center of the wire. Does the size of the coil make a difference? What about the number of turns in the coil?

4. Magnetic materials, such as iron, nickel, and cobalt, will become strong magnets if placed in a magnetic field. How can a compass help you determine what materials are magnetic? What part of the coil should the material placed near?

5. An electromagnet is created when a current carrying coil is wrapped around a magnet core. In this case, the iron rod is your core, and your copper wire makes your coil. How strong is your electromagnet? How can you make it stronger without adding any new pieces? Would adding more parts help?
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 variables and test them.

Activity: Building a Stronger Electromagnet

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?

MATERIALS:

- D Cell Battery
- Copper Wire
- Iron rod
- Paper Clips
- Assorted Magnetic Materials
- Compass
Next Generation Sunshine State Science Standards

4th Grade:

5th Grade:

6th Grade:

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:

High School:

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.