Unit: Static Electricity, Electricity, and Magnetism

Lesson: 2 What Does It Mean to Attract and Repel?

Enduring Value: Systems and System Models	**Essential Question(s):** How is life on Earth affected by forces that attract and repel?	**National Science Education Standards (NSES, 1996)** Content: Physical Science K-4 Light, heat, energy, and magnetism Position and motion of objects 5-8 Transfer of energy Properties and changes of properties in matter

Engage and Increase Background Knowledge:

1. Ask students if they think a blown up balloon will stick to a wall. Accept all answers. Try it. When you place the balloon on the wall and it falls down…ask what happened. *What else can we do? Students will probably say to rub it on your hair. Do that and have it stick to the wall. Ask students why rubbing it on hair makes it stick to a wall.* Ask students to write what they think is happening in their journals.
2. Create several hanging objects from the materials below. Demonstrate how objects can be moved without being touched, in both an attract and repel manner. (There are additional demonstrations such as bending water and lighting a light bulb with a balloon that can be found on the Internet: e.g., http://www.sciencemadesimple.com/static.html).
3. Give students the magnets and ask them to determine if the magnets will attract, repel, or do both. Does rubbing the magnets with some objects change their properties? *Do the properties of the magnets change when they are rubbed? What materials, if any, may cause them to change? Which materials will not change the magnets?*
4. Give student groups all of the materials (i.e., magnets, glass rod, nylon, wool, fur, silk, paper, cotton, hard rubber, polyester, saran wrap, and string), and have them create a classroom chart. Students can make a game by seeing what possible combinations are already on the board, and try to find new combinations that are not listed. Allow students to add them to the chart.

   NOTE: If you do not have these materials, there is a Project 1* experiment on the site above that uses only cereal, a wool sweater or long hair, a comb, and thread. The teacher may use this experiment as needed or add it. (See example on the next page.)
5. Create a chart with the students that allows them to see what is occurring and the differences among magnets and the other materials. When the chart is complete, ask students what is different about magnetism and static electricity. How did the materials used in these experiments behave the same, and how did they behave differently? Create a classroom Venn Diagram.

*** Sample Chart For Project 1** Experiment at http://www.sciencemadesimple.com/static.html:

Material Combinations	What happened when you moved them together?	Draw a labeled diagram
Comb without rubbing on wool and cereal		
Comb rubbed on wool and cereal		
Magnet without rubbing on wool and magnet (+ to +), (+ to -), and (- to -).		
Magnet rubbed on wool and magnet		
Magnet rubbed on wool and cereal		

NOTE: The teacher can try these ahead of time to prepare.

Materials:
cereal, comb, thread, magnets, glass rod, plastic knife, your hair, nylon, wool, fur, silk, paper, cotton, hard rubber, polyester, saran wrap, string, plus markers, whiteboard or poster paper

Explore (Investigate):

1. Students use the plastic knife, magnet, glass rod, and their hair to **explore what materials repel or attract** and if that property changes if they are rubbed with wool, silk, fur, paper, cotton, saran wrap, and polyester. Students can use their hands and string to suspend the plastic knife, magnet, and glass rod, while other students in their group can rub these suspended objects with the different materials. Students in small groups can take turns being the person who suspends the materials, the person who rubs the suspended materials, and the person who records the data on a chart that they create for their group. Support students as needed. NOTE: Initially allow students to use and test objects in any way they would like. You can suggest other ways if you see the students struggling.
2. Using the rubric to support success, students investigate with the teacher scaffolding learning as needed. The teacher uses questioning to move students forward.
3. Students will be guided as needed toward the Big Idea and the Evidence that supports this idea.

Get Ready to Present:
Using the rubric to support success, students work in collaborative groups to create reports to present to the class. The reports will be on whiteboards or poster paper and include a chart with results, the Big Idea, and the Evidence from their experiments that supports the Big Idea. Scaffold and support students as needed.

Present:
Students self-grade and hand in the rubric. Student groups present, and the audience asks questions while each student writes a response for each presentation. This *Audience Response Sheet* will be handed in as part of the project.

Build Class Consensus of the Big Idea to Post in the Classroom:
Facilitate discussion with students to determine a class consensus about the relationship between the size and strength of the magnets. See example ***Student Group Big Idea*** and ***Example Class Consensus*** below*. Does this consensus affect the earlier one or stand on its own*? Have students discuss and determine this.

STEM Vocabulary:
static electricity
forces
magnetic attraction and repulsion

Example Group Presentation:
1. Class Chart
2. Student **Big Idea**: *There are differences between magnets and other materials that attract and repel, as magnetic properties don't change, but the properties of the other materials do.*
3. Evidence: Specific Chart Results

Example Class Consensus:
There is a difference between static electricity and magnetic forces.

Connections:
electrons
electrically neutral
opposite charges attract
writing to present
presentation skills
magnets used in the health care industry
mechanical objects
computers