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BASIS Lesson Plan

Lesson Name: Exploring Magnets

Grade Level Connection(s)

NGSS Standards: Grade 3, Physical Science (3-PS2)
FOSS CA Edition: Grade 2, Physical Science (Magnetism/Electricity)

**Note to teachers: Detailed standards connections can be found at the end of this lesson plan.*

Teaser/Overview

This hands-on lesson guides students to explore the weird and wonderful world of magnets. Students will explore three different stations where they will investigate properties of magnets, such as attraction and repulsion. We'll also connect magnetism to some cool real-world examples!

Lesson Objectives

- Students will understand that magnetic forces can be described as pushes (repel) and pulls (attraction).
- Students will understand that magnets have two poles, north and south. When two like poles (N-N or S-S) come in contact, they will repel. When two unlike poles (N-S) come in contact, they will attract.
- Students will engage in scientific discussion to connect observations of magnets to the properties of magnets.

Vocabulary Words

Force: a push or a pull
Magnetism: an invisible force that pushes or pulls things towards a magnet without needing to touch. Magnetism cannot be seen, but the way it acts can be seen!
Properties: observable characteristics that help us understand how something works
Attract: a magnet's pull
Repel: a magnet's push
Iron: a metal that has magnetic properties

North pole: One end of a magnet where the magnetic force starts. North pole will be attracted to South pole, but repel another North pole.
South pole: One end of a magnet where the magnetic force ends. South pole will be attracted to North pole, but repel another South pole.

Materials

Scientist Volunteers will bring:

- Refrigerator magnets (1)
- Plastic baggies with magnetic & non-magnetic objects (10)
    - Paper clips
    - Pennies, Nickels
    - Packing Peanuts
    - Dry Pasta
    - Plastic Bottle Caps
    - Metal Bottle Caps
    - Corks
    - Etc
- Sorting sheets of "Magnetic vs Non-Magnetic" (10)
- Bar magnets (12)
- Pens (12)
- Donut magnets (26)
- North and South Pole worksheet (30)
- Paper clips (1 box)
- Cups (12)

Materials teachers should provide:

Classroom Set-Up

Students will start all together on the carpet for an introductory discussion and then should be in pairs that will work together through several activities. At the end of the lesson, we will come back to the carpet for a wrap-up discussion. We will need access to a whiteboard and markers.

Classroom Visit

1. Introduction (15 minutes)

Role Model Introduction:
Being a role model is an important part of being a BASIS volunteer! Begin your lesson by having each team member explain who they are and what they do as a scientist/engineer. Feel free to tell your story as if giving an elevator pitch to elementary school students: Why did you become a scientist? What questions are you trying to figure out? What do you do in your job? Why should students relate to you? Feel free to bring in photos, specimens, and other props. Let your personality shine through!

Topic Introduction:
After you introduce yourselves as role models, take some time to introduce the topic of this lesson: magnets. It may be helpful to keep the suggested take-away in the back of your mind throughout the lesson: **Magnetism can be used to push or pull objects even when those objects are not in contact with one another.**

Your topic introduction should cover, at a minimum, the following information. As much as possible, try to frame this information as questions posed to the class, rather than as a lecture. This helps activate students' prior knowledge and facilitate student-guided conversation.

- Today we brought with us a "magic" star. [Show kids a magnet being pulled and spun around on board using a magnet behind it.] Cool! How is it doing that? It's actually not magic – it's science! Today we're all going to be scientists and investigate how magnets work.
- Who here has used a magnet before? Where was it? On your refrigerator? What did you use the magnet for? What did you notice about the magnet? [Define **magnetism** and **force**]
- There are two types of forces we're going to explore today: pushes and pulls
- What are some examples of pulling that you are familiar with?
- What are some examples of pushing that you are familiar with?
- Do you think the magnet on your refrigerator is using a push or a pull to stay on there? [a pull] This pull is called attraction [define, write on board]. When magnets repel [define, write on board], the force they are using is a push.
- We're going to do some fun activities to explore magnets and understand their properties, and how you can use those properties of magnets to push and pull objects!

2. Learning Experience (35 minutes)

Students will work in pairs. Remember that all of these activities are designed to address the take-away in a particular way: **Magnets have specific properties that we can observe and we can use those observations to make predictions about how other magnets will behave.**

Activity 1: Magnetism: What Objects Are Attracted to Magnets?

1. Engage students in a conversation about what makes something magnetic.
    a. What kinds of things are magnetic? What kinds of things are not magnetic? You are going to sort through objects in the bag with a partner and place them in the appropriate category based on your hypothesis. If there are any objects that you are unsure about, set them aside and we will talk about them with the rest of the class.
2. Do the magnet sorting activity.
    a. Pass out bags of objects for testing and laminated sheets marked “Magnetic” and “Not Magnetic”. But DO NOT PASS OUT THE MAGNETS YET.
    b. Give the students five minutes to sort the objects. Were there any objects you were unsure about? What about in other pairs?
    c. Did you notice any patterns about the objects that are magnetic vs non-magnetic. For example, did you put all the metal objects in the Magnetic column, why or why not.
    d. Give each pair of students a magnet to test their hypotheses.
    e. Give students another minute to see which objects are attracted to magnets and which are not.
    f. Was anyone surprised? Why or why not?
3. Connect the activity to the big picture
    a. Invite students to reflect on why some objects were able to be picked up with magnets while others were not. Things that are magnetic generally have a metal called iron in them. There are lots of different kinds of metals and iron is just one kind.
    b. Emphasize the overall takeaway of the lesson: **Magnets have specific properties that we can observe and we can use those observations to make predictions about how other magnets will behave.**
    c. A nice real-world connection here are the magnets used to sort trash at waste management facilities.

Activity 2: Floating Magnets

1. Present students with a challenge. We will pass out one pen and two donut magnets to each pair. The challenge is to make one of the magnets “float” on top of the other magnet.
2. We want you to explore the properties of magnets before we tell you how to do it. So try it first, discuss with your partner, and see if you can figure it out. We’ll come around and help you if you’re not sure where to begin.

3. Pass out materials to each pair of students. Check in with students to see if they are on the right track. Attempt to guide them to the discover that the orientation of the donut magnets matters.
4. Once all the students have figured out how to make their magnets "float" engage the students in a discussion of how and why this happened.
5. Each magnet has two poles – a North Pole and a South Pole. When the North Pole and South Pole of two different magnets come into contact, they attract (define)
6. When two poles are the same (N-N or S-S), they repel (define).
7. Connect the activity to the big picture
    a. Invite students to reflect on why one side of the magnet will push against the certain side of another magnet (and why pulls on the other side). [North pole vs South pole]
    b. Emphasize the overall takeaway of the lesson: **Magnets have specific properties that we can observe and we can use those observations to make predictions about how other magnets will behave.**

Activity 3: Magnetic Pole Worksheet

1. Now that you all know about properties of donut magnets, we're going to hand out a worksheet and have you make a hypothesis about how you think bar magnets will behave.
2. Pass out the worksheets (one per student). Guide students to make their hypotheses before passing out the bar magnets. Prompt with questions – why do they think their hypothesis will be supported? What is their evidence.
3. Pass out the bar magnets to each pair (2 bar magnets per pair). Have students explore and see if their hypotheses are supported or not.
4. Connect the activity to the big picture
    a. Invite students to reflect on why their hypotheses were supported or not supported.
    b. Emphasize the overall takeaway of the lesson: **Magnets have specific properties that we can observe and we can use those observations to make predictions about how other magnets will behave.**

3. Wrap Up: Review and Discuss the Learning Experience (5 minutes)

It's important to leave time to **review** and **discuss** the learning experience at the end of the lesson. This might take the form of discussing conclusions from an experiment; or review of the take-away of the lesson

- Discuss attraction vs repulsion (did students observe this?)
- Discuss how the Earth is like a giant magnet (demo)

4. Connections & Close (5 minutes)

Connections to the real world around students:
Magnets are also used in elevators, credit cards, electric toothbrushes, refrigerators, and your television! There are magnets just about everywhere, so keep exploring to see what you can do with magnets!

Close:
Does anyone have any questions, about magnets or being a scientist? Thanks and goodbye!

Follow Up: After the Presentation

Teachers who wish to extend the impact of this lesson may find the following CRS web pages useful:

- http://www.crscience.org/educators/helpfulreports
- http://www.crscience.org/educators/treasuretrove

Standards Connections

NGSS:

- Connections by topic
  Physical Science: 3. Forces and Interactions
- Connections by disciplinary core ideas
  Physical Science: 3-PS2 Motion and Stability: Forces and Interactions
- Connections by scientific & engineering practices
  1. Asking questions and defining problems
- Connections by crosscutting concepts
  2. Cause and effect: Mechanism and explanation
  7. Stability and change
- Connections by performance expectation
  3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

FOSS CA Edition:
Grade 2 Physical Science: Balance and Motion, Investigations 6 (Magnets and Tools)