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BASIS Lesson Plan

Lesson Name: Magnet Mania!

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 (12)
- 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)
- Large pieces of poster paper, with pre-drawn mazes (6)
- Wand magnets (10)
- Bar magnets (8)
- Paper clips (1 box)
- Weight set with strings attached (different weights of 1g, 5g, 10g, 20g, 100g)
- Poster Diagram of Earth with Poles and Magnetic Field highlighted

Materials teachers should provide:

Classroom Set-Up

Students will start all together on the carpet for an introductory discussion and then should be split into three groups that will rotate through three stations. 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 be split into three groups. Each group will head to one of three stations set up around the room. At each station, they will interact with a new volunteer and explore a new way of exploring the pushes and pulls of magnets. One volunteer (or the teacher) will keep time; every ten minutes, the groups will rotate to a new station. Remember that all three of these stations are designed to address the take-away in a particular way: **Magnetism can be used to push or pull objects even when those objects are not in contact with one another.**

Station 1: Magnetic Repulsion Obstacle Course

1. Engage students in a conversation about the role of **repulsion** in magnetism.
    a. What kinds of things are magnetic? What kinds of things are not magnetic? Things that are magnetic have specific types of metals in them, commonly iron.
    b. Give each pair of students a pair of wand magnets. Have students explore. Can you pull one up off the table? Can you push one across the table? Does the side of the magnet matter?
2. Do the magnet obstacle course.
    a. Set up poster boards with pre-drawn mazes on them. Place a wand magnet on top of the obstacle course.
    b. Before having the students participate themselves, ask them how we could move this magnet through the obstacle course using only other magnets. [Could pull it across using attraction; could push it across using repulsion]
    c. The rules of the obstacle course are that (1) you cannot use your hands in any way to move the magnet and (2) you can only use the magnetic property of repulsion to move it through the course.
    d. Have one student try, to model for group. What did you notice about this activity? Was it easy? Difficult?
    e. Now have each student try it on their own.
3. 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: **Magnetism can be used to push or pull objects even when those objects are not in contact with one another: for example, by using one magnet to push another through an obstacle course!**

Station 2: Magnetism Attraction – How Much Can You Pull?

1. Engage students in a conversation about the role of **attraction** in magnetism.
    a. Has anyone seen magnets on their refrigerator before? Do you think it is pulling or pushing on the refrigerator? When you take a magnet off the refrigerator, why doesn't it move the whole refrigerator? [Strength of magnet usually depends on the size of the magnet]
2. Do the magnetic attraction activity.

   a. Set up paperclip chains and different weights with strings attached.
   b. Before having the students participate themselves, ask them how we can use the attraction of a magnet to pull the paperclip out of the water. Do you think it can lift one? Have one student try, to model for group.
   c. Let's try it with different weights 2g, 5g, 10g, 20g, 50g, 100g. For each weight, have a new student participate while other students observe. Will the magnet be able to pull them all up? Why? Why not? Have one student try it with you to show the whole group.
3. Connect the activity to the big picture
   a. Invite students to reflect on why a certain weight could or could not be pulled up by the magnet.
   b. Emphasize the overall takeaway of the lesson: **Magnetism can be used to push or pull objects even when those objects are not in contact with one another: for example, by using magnets to pull objects of different weights!**

Station 3: 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 res of our group.
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: **Magnetism can be used to push or pull objects even when those objects are not in contact with one another: for example, by using magnets we can sort magnetic and non-magnetic materials!**

c. A nice real-world connection here are the magnets used to sort trash at waste management facilities.

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?)
- What did students observe at each station?
- Discuss how the Earth is like a giant magnet (demo)
- Bring in magnetic silly putty for fun or to inspire further questions

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)