Utility Exploration Center Unit Lesson Plan

Powerful Forces: Fun with Magnets

Grade

3rd

NGSS standards

PS2-3

Time

4.5 hours total, spread over multiple days

There are many different ways we use magnets in our daily lives, from generating electricity to hanging art on the refrigerator. Exploring how magnets interact will help make connections to the magnets all around us!

Description

Students have seen magnets before and used them, but do they really know how they work? This lesson invites students to learn about magnets and explore how magnets are working for us in our everyday lives – even if we don't always see them.

Materials List

- Sewing needle
- Piece of paper
- Bowl
- Water
- Magnets of various shapes and strengths
- A book
- A shirt
- Compass
- Iron Filings
- Paper plate
- Large spoon
- Nails
- Empty metal soup can
- Small toys (will get dirty)
- Sand
- Large plastic tub
- Colander
- Paper clips and push pins
- Popsicle stick
- Glue
- A button (or similar sized object that will fit on a small magnet)

Performance Expectations

- Ask questions that can be investigated based on patterns such as cause and effect relationships.
- Cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Phenomena / Essential Questions

Phenomena: Students create their own compass.

Essential Questions: How do magnets interact and work together even though there is no contact? How do we use the power of magnetic interaction in everyday life?

Specific Learning Outcomes

- Students will understand the power of magnetic forces.
- Students will know where and how we use magnets every day.

NARRATIVE / BACKGROUND INFORMATION

Prior Student Knowledge

- No previous knowledge

Life Experience

- Students see magnets being used around them either on the refrigerator or in cabinets to keep them closed.
- Students, without knowing, benefit from the power of magnets every day, such as when they operate a microwave or computer.

Science & Engineering Practices (SEPs)

Asking Questions and Defining Problems

- Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.
- Ask questions that can be investigated based on patterns such as cause and effect relationships.

Disciplinary Core Ideas (DCIs)

PS2.B: Types of Interactions

- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

Crosscutting Concepts (CCCs)

Cause and Effect

- Cause and effect relationships are routinely identified, tested and used to explain change.

Teacher Background Information

- Magnetism is an unseen force that plays a big part in our everyday lives. We often think about the small magnets that we have on our refrigerator, but there are other magnets and magnetic forces at work all around us. Here is a clear explanation as to how magnets work and where they are at work.

Possible Preconceptions/Misconceptions

Misconception: All silver colored items are attracted to a magnet.

Truth: Only iron, nickel and cobalt and their alloys are attracted to a magnet.

Misconception: All metals are magnetic.

Truth: Only a few metals in the periodic table are magnetic. Most other common metals are non-magnetic metals.

Distance Learning Variations

- My Day as a Magnet could also be completed in an online storyboard (**Storyboardthat.com**) where students can choose visuals, text and captions to tell their story.
- All discussions can be completed via teacher's choice of videoconferencing tool.

LESSON PLAN – 5E MODEL

Estimated time: 20 minutes

Students observe phenomenon of a magnet transforming a needle into a compass.

Students complete Build Your Own Compass activity.

- Students create a compass out of everyday household items.
- Guiding questions: What did you notice? What happened? Why do you think the needle moved? What did we do to the needle? What did we rub on the needle? Why do you think we rubbed the magnet on the needle? How do you think magnets work? What affects how the needle moved? Do you think it would have worked if we had used something else instead of a needle, like a piece of spaghetti?
- Compile student questions to help guide further exploration. Examples: Why did the needle move? What caused the needle to move? What do magnets do? How do magnets work?

EXPLORE

Estimated time: 60 minutes

Students test cause and effect relationships of magnets, and explore how magnets are used in the world around us.

Test cause and effect relationships:

Students perform paperclip experiments and write down observations and predictions:

- Students attempt to pick up a paper clip using a magnet without touching the magnet to the paperclip.
- Students attempt to pick up one paperclip with another paperclip without touching it.
- Guiding questions: Were you successful? Why do you think you were or were not?
- Students hold a magnet in one hand and a paperclip in the other. Students begin to bring their hands together, and stop when they begin to feel an interaction between the paperclip and magnet. Repeat 2-3 times, and when students begin to feel the interaction between the two objects, students move paperclip from side to side.
- Guiding questions: Were they close together or far apart when you started to notice something happening? Did you notice a change as the objects came closer and closer? What happened when you moved the paperclip? Are you able to stop the interaction?
- Students test how many paper clips they can pick up using a single magnet and to record that number.
- Provide students with a stronger magnet. Have them repeat the experiment and record the result.
- Guiding question: Did the results change?

Students perform magnet on magnet experiments.

- Students bring two magnets together.
- Guiding questions: What happens? What happens when you flip one of the magnets? Do you get the same result?

Students complete Test Your Strength activity.

- Students test the power of different sized magnets and how objects can affect the power of a magnet.

Explore magnets around us:

Students complete Find Your Way activity.

- Students create their own directions using a compass. Using a worksheet, students navigate between locations at school, around the house or at the nearest park.

Students complete Does it Stick? activity.

- Students take a magnet around their house or classroom and try various objects to see if they can find a magnetic reaction. Students will use a hypothesis sheet to document the results.

Students write down any thoughts, questions or observations during the activities above to be used in the Explain section.

EXPLAIN

Estimated time: 60-90 minutes

Students discover explanations for observations they made in the Explore section.

Compile a list of students' observations about magnets.

- Students share observations, questions and conclusions they drew from the paperclip and magnet on magnet experiments, and from the Does it Stick? activity.

Watch Fun with Magnets! video (5 minutes).

- This video introduces students to the amazing force of magnetic power, and helps to specifically reinforce the discoveries students made in the Does it Stick? activity, and the paperclip experiments.

Students complete Iron Filings activity.

- Visualizing and understanding magnetic forces is really difficult. With a few really neat materials, students can see a magnetic force in action. Student can then explore the "direction" of poles and the strength of different magnets.

Watch Magnets and Magnetism video (3:46 minutes)

- This video helps to introduce vocabulary terms for interactions and phenomena that students have observed in the previous experiments and activities.

Discuss videos and activities to help students reach conclusions about magnetic relationships.

- Guiding questions: Did you see anything in the videos that helped to explain something you experienced in an experiment or activity? Based on your observations, is everything magnetic? How would you decide whether something is magnetic? Could you name some characteristics?
- What kind of magnetic interactions have we observed? How do you know? What do you think determines the strength of a magnetic interaction, whether it is attraction or repulsion? Using the vocabulary terms that were used in the Magnets and Magnetism video, what kind of magnets do you think we have observed so far together in our experiments and activities? How do you know?

Students complete My Day as a Magnet activity.

- Use this storyboard activity to allow students to demonstrate the depth of their understanding of magnetic relationships.
- Students create their own storyboard about what it would be like to be a magnet in an object that uses magnetism. For example, a student may write from the perspective of a magnet that keeps the refrigerator door closed and that helps save energy. Ask students to highlight or underline any vocabulary terms from the list below or from the article that they used in their storyboard.

Vocabulary

Magnet: an object that attracts some metals like iron

Magnetic Force: the attraction or repulsion between two magnets or between the poles of a magnet

Magnetic Field: the area around a magnet where one can feel the magnetic force

Estimated time: 2.5-3 hours

Ask students to brainstorm how they think magnets are used in our everyday lives and compile a list.

- Where have you seen magnets? How do you think they might be used? How do you think magnets might be useful? What are qualities you've discovered about magnets that might make them handy in accomplishing certain tasks?
- Potential ideas might include: easy observations of magnets keeping objects together, like helping to keep refrigerator doors closed, shutting the case of an iPad or attaching objects like pieces of paper without tape or glue.
- Magnets are found all around us. They're used in our homes, in our hospitals and even in our utilities. (See Article from Sciencing.com) Magnets are also used widely to operate Roseville's utilities. For example, they are used in generating electricity at the Roseville Energy Park and to help sort out magnetic recyclables at the Materials Recovery Facility. The Find the Magnets Interactive Map below helps to illustrate the different places and industries magnets are used in Roseville.

Students complete Magnetic Maze activity.

- As you learn about magnets and the pull they have with the metal community, why not put them to the test.

Students play Magnetic Hunt Online Game.

- This online game invites students to use their knowledge of magnets and magnetic fields as well as a toolbox filled with compasses, iron filings and magnetic film to a locate buried magnets. Through play, students explore and deepen their understanding of magnetism and electromagnetic conduction.

Students read Magnet & Magnetism - Kids Britannica article.

- Students read a short article describing magnets and showing examples of the different ways magnets are used every day around us. After students read this article, consider this Kahoot Quiz: Magnets.

Present Magnets Around Me PowerPoint.

- Present this PowerPoint including prompts for instruction and discussion during the presentation. With the use of visuals showcasing a variety of ways magnets are used in our daily lives, students will gain an understanding of how many magnets surround them every day.

Students complete Find the Magnets of Roseville activity.

- Explore this Interactive Google Map with your students and discover real world applications of magnets in Roseville found in places outside of normal daily interactions (our refrigerators). Without magnets in these places, our lives would be very different.

Students complete Sort and Separate activity.

- Students collect sand, rocks, paperclips, toys, and other household materials and mix them together in a large bin. This exploration gives an example of how our trash can be sorted using magnets! Students test the best way to separate trash into different types (size, weight, magnetic, etc.).

EVALUATE

Estimated time: 1-1.5 hours

Formative Monitoring (Guiding Questions / Discussion):

- How do magnets work together?
- What are some examples of magnetic use we see every day?
- Are all metals magnetic?

Summative Assessment (Quiz / Project / Report):

- Students complete Magnetic Design activity! Students draw a design for a device they think could solve a problem using magnets using the conclusions drawn about magnets and their relationships, and new knowledge about how magnets are currently used. This project should demonstrate that the students understand the power and capability of magnets and can recognize where magnets are used in everyday items.
- Guiding Questions: What problem does your device solve, or what process does it streamline? How do magnets help it to work? What characteristics of magnets are important in your design? (For example, if your invention helps to keep two objects together, it would be important that magnets are able to attract certain metals without touching.)
- Students complete Kahoot Quiz: Mighty Magnets! Finish this Unit with a Kahoot quiz to assess students' understanding of the magnets all around them and how magnets interact with our Earth.

Standardized Testing (CAST) Connection

- Page 19 (page 17 in a printed version) states an example of a question that may be on the 5th grade test related to magnetism.

Resource Links:

In case hyperlinks above get broken, here is a detailed list of links.

- **3-PS2-3**: www.nextgenscience.org/pe/3-ps2-3-motion-and-stability-forces-and-interactions
- **Teachers Background information**: www.roseville.ca.us/grade3
- **Build your Own Compass**: www.roseville.ca.us/grade3
- **Test your Strength**: www.roseville.ca.us/grade3
- **Find Your Way** : www.roseville.ca.us/grade3
- **Does It Stick?**: www.roseville.ca.us/grade3
- **Fun with Magnets Video**: www.youtube.com/watch?v=s236Q1nuWXg&feature=emb_title
- **Iron Filings**: www.roseville.ca.us/grade3
- **Magnets & Magnetism Video**: www.youtube.com/watch?v=-aNpmCSZHbk&feature=emb_title
- **My Day as a Magnet**: www.roseville.ca.us/grade3
- **Sciencing.com Article**: sciencing.com/uses-magnets-daily-life-8056272.html
- **Magnetic Maze**: www.roseville.ca.us/grade3
- **Magnet Hunt Online Game**: www.brainpop.com/games/magnethunt/?topic_id=ae2917eb0aa0a3a3
- **Magnets & Magnetism Britannica Article**: kids.britannica.com/kids/article/Magnet-and-Magnetism/353411
- **Kahoot Quiz**: Magnets: hcreate.kahoot.it/share/magnets/3dd8712e-7d87-4c70-a949-1527f4cccc8b
- **Magnets Around Me PowerPoint**: www.roseville.ca.us/grade3
- **Find the Magnets in Roseville**: www.roseville.ca.us/grade3
- **Interactive Google Map**: www.google.com/maps/d/u/0/viewer?ll=38.87015429336556%2C-121.40853580371093&z=11&mid=1-_eUFNUGK2OEleK-DXnint_dimr5b73p
- **Sort and Separate**: www.roseville.ca.us/grade3
- **Magnetic Design**: www.roseville.ca.us/grade3
- **Kahoot Quiz**: Mighty Magnets!: create.kahoot.it/share/mighty-magnets/2f1f879a-b34c-47fe-8394-d4f70f3ae392
- **CAST Test**: www.caaspp.org/rsc/pdfs/CAST.Practice-Scoring-Guide-Gr5.2020-21.pdf

COMMON CORE STATE STANDARDS CONNECTIONS ELA

ELA

- RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-3)
- RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-PS2-3)
- RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence). (3-PS2-3)
- SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3)