

Planet Magnet

http://eo.ucar.edu/educators/ClimateDiscovery/SEC_lesson2_10.14.05.pdf

Focus on Inquiry

The student will make observations to understand Earth’s magnetic field.

Lesson Overview



The Earth acts like a dipole magnet. In this lesson, students will use iron filings to observe the magnetic field around a bar magnet. They will then describe how this magnetic field is similar to the Earth’s magnetosphere.

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|--------------------------------|-----------------------------|---|---|
| Duration 1-1/2 Hours | Setting classroom | Grouping 3-4 students per group | PTI Inquiry Subskills 3.6, 3.7, 4.1, 4.2, 5.2, 5.8, 5.9, 7.2, 7.3 |
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| Lesson Components | Estimated Time | Inquiry Subskills Used | Technology Used | Level of Student Engagement | Brief Description |
|-------------------|----------------|------------------------|---|-----------------------------|--|
| <i>Engage</i> | 10 min. | 3.6, 4.2 | Computer with internet access or overhead | 2 | Provide images of the Earth’s magnetic field. Create a discussion from the images of the Earth’s magnetic field. |
| <i>Explore</i> | 20-25 min. | 3.6, 3.7, 5.8 | | 3 | Using magnets and iron filings/chips, the students will observe the pattern of the magnetic field. |
| <i>Explain</i> | 20-25 min. | 3.6, 4.1, 5.2, 5.9 | | 3 | Students describe how their observed magnetic field is similar to the Earth’s magnetosphere and complete the Student Page. |
| <i>Expand</i> | 30-40 min. | 3.6, 4.1 | Computer with internet access | 3 | Students explore an online 3-D model on the nature of a magnetic field |
| <i>Evaluate</i> | 30-40 min. | 7.2, 7.3 | | 3 | Students will create a poster to explain what they did, what the results were and explanation for their findings. |

Level of Student Engagement

| | | |
|---|----------|--|
| 1 | Low | Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction |
| 2 | Moderate | Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance |
| 3 | High | Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered |

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|---|---|
| <p>National Science Education Standards – Inquiry</p> <p>Use appropriate tools and techniques to gather, analyze, and interpret data. Develop descriptions, explanations, predictions, and models using evidence. Think critically and logically to make the relationships between evidence and explanation.</p> |  |
| <p>National Science Education Standards – Earth Science</p> <p>none</p> | |
| <p>Louisiana Grade Level Expectations – Inquiry</p> <p>Gr. 8, Inquiry GLE#7 – Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)</p> <p>Gr. 8, Inquiry GLE#10 – Identify the difference between description and explanation (SI-M-A4)</p> <p>Gr. 8, Inquiry GLE#15 – Identify and explain the limitations of models used to represent the natural world (SI-M-A5)</p> <p>Gr. 8, Inquiry GLE#19 – Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)</p> <p>Gr. 8, Inquiry GLE#22 – Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)</p> |  |
| <p>Louisiana Grade Level Expectations Earth Science</p> <p>Gr. 8, GLE#4 Demonstrate that Earth has a magnetic field by using magnets and compasses (PS-M-B2)</p> | |

Materials List (per student group)

- shallow box or cafeteria tray
- bar magnet
- tape
- plastic bag
- white paper
- small salt shaker (to contain the iron filings)
- iron filings or iron chips from Arbor Scientific (they are less messy). *See resources listing on the original lesson.*
- construction paper circle, one per student
- compass

Materials List (per class)

- overhead projector
- bowl to collect iron filings

Advance Preparation

1. Make copies of Student Page (pg. 4 of original lesson) – one per student.
2. Images of the Earth’s magnetosphere (see Page 2 of original lesson under Advance Preparation for websites containing images).
3. Cut circles the diameter of the length of the magnet that you will be using for the activity. You can have students do this for you.

Other Information

Learning Objectives

The learner will...

- ... use iron filings to explore the magnetic field around a magnet and record their observations.
- ... describe how their observed magnetic field is similar to the magnetic field around the Earth.

Prior Knowledge Needed by the Students

- None

Procedure

Engage

1. Divide students into groups. Begin by showing students artists’ conceptions of what the Earth’s magnetic field looks like. Ask students to describe what the magnetic field looks like in their own words. Ask the students how scientists might have figured this out. Introduce the term “magnetosphere” while students view and discuss the images.
2. Hold up a bar magnet. Ask students how they might discover what the magnetic field looks like for this magnet. Explain that they will be making and recording their observation of the magnetic field for the magnet using iron filings.

Explore

1. Distribute copies of Student Page – one per student. Go over the directions for the exploration with the students. Have each group of students get their materials (NOTE: do not distribute the compasses to the groups at this point). Allow 15 minutes for students to make and record observations on their Student Page.

Explain

1. Once again, review the images you began the lesson with of the Earth’s magnetic field. Ask students to describe their observations. Ask them if they can develop an explanation of the Earth’s magnetic field that is based on their description. Ask students if they can identify how their model is similar to the Earth’s magnetic field and if there is any difference between their model and the Earth’s magnetic field.
2. Ask students if they can distinguish between the North and South end of their magnet (if it has the N and S removed... how would it be possible? Can they figure this out using only the iron filings? What information do the iron filings provide? Distribute to each group a small compass and have them observe how the compass behaves with respect to each magnetic pole.

Expand

1. Have students model the 3-dimensional nature of the magnetic field by using the Windows to the Universe Terrabagga activity. The link for this activity is

http://www.windows.ucar.edu/tour/link=/teacher_resources/magnetism/teach_terrabagga.html

Evaluate

1. Have students summarize what they learned through this activity by making a poster or a Power point. See the original lesson for specific suggestions.

Blackline Master

1. Student Page (See original lesson, page 4)

Supplementary Resources

Windows to the Universe: The Earth's Magnetic Field

http://www.windows.ucar.edu/tour/link=/physical_science/magnetism/planetary_magnetism.html

http://www.windows.ucar.edu/tour/link=/earth/images/earth_magneto_image.html

An explanation of how the Earth's magnetic field is similar to a dipole magnet. Images and links to additional information.

Windows to the Universe: Terrabagga activity.

http://www.windows.ucar.edu/tour/link=/teacher_resources/magnetism/teach_terrabagga.html

Activity in which students will build a simulated planet with a magnetic field. They will use a simple magnetometer to determine the orientation of the "planet's" magnetic field.