

MAGNETISM--THE UNSEEN FORCE

Grade Level: Second Grade

Presented by: Elaine Rinehart, Blake Elementary, Lakeland, Florida

Length of Unit: Six Lessons, 8 - 12 days

I. ABSTRACT

May the force be with you. Just like Luke Skywalker used an unseen force in *Star Wars* to work for him, you are surrounded by an invisible force known as magnetism. We will define this unseen force and make it visible.

II. OVERVIEW

A. The students will learn about magnets, magnetic fields, and magnetic poles. The students will make observations and conduct experiments. The children will learn that there is a relationship between force and motion. The students will learn that one way to change how something is moving is to give it a push or a pull. The students will learn that magnetism demonstrates that unseen forces act upon objects.

B. Through experimentation and observations, the student will learn about magnetism. All eight content areas listed in the *Core Knowledge Sequence* are covered in this unit.

C. During the course of this unit, the student will:

1. Observe
2. Describe
3. Classify
4. Experiment
5. Predict
6. Demonstrate
7. Discover
8. Draw and Write
9. Use a compass and Map Skills

III. BACKGROUND KNOWLEDGE

A. For Teachers:

B. For Students: An introduction to magnetism was presented in the Kindergarten Core Knowledge Science Unit. Kindergarten students were introduced to the idea that there are forces we can not see. These forces act upon objects.

IV. RESOURCES

A. Books

1. Ardley, Neil. *The Science Book of Magnets*. Harcourt Brace Jovanovich, Publishers, 1991.
2. Branley, Franklyn. *What Makes A Magnet?* Harper Collins, 1996.
3. Challand, Helen. *Experiments with Magnets*. Childrens Press, 1986.
4. Feigen, Mel. *Hands-On-Minds-On-Science MAGNETISM and ELECTRICITY-Primary*. Teacher Created Materials, Inc., 1994.
5. Holden, Raymond. *Magnetism*. Golden Press, 1962.
6. VanCleave, Janice. *Janice VanCleave's Magnets*. John Wiley & Sons, Inc., 1993.
7. Whalley, Margaret. *Experiment With Magnets and Electricity*. Lerner Publications Company, 1992.

B. Charts

1. Student generated
 2. Teacher generated
- C. Guest Speakers
1. Local retired scientists
 2. Parents or school volunteers

V. LESSONS

Lesson One : Magnetic Poles: the “unseen force”

A. Daily Objectives:

1. Lesson Content:
 - a. Magnets - contain iron
 - b. Lodestones - naturally occurring magnets
 - c. Magnetism - the unseen force that acts upon objects
2. Concept Objective: make the “unseen force” become visible with demonstrations.
3. Skill Objectives: to observe and classify objects as magnets.

B. Materials:

1. Book - *What Makes a Magnet?* by Franklin M. Branley
2. Small rectangular magnets, bar magnets, horse shoe magnets, wand magnets, pieces of iron, and some lodestones.
3. Surfaces in the classroom (file cabinet, TV cart, magnetic chalkboard, desk legs, chair legs, mini magnetic boards).
4. Chart and Markers

C. Prior Knowledge for Students

1. Kindergarten: Magnetism Unit
 - a. Most magnets contain iron
 - b. Lodestones are naturally occurring magnets
2. Review Background Knowledge with class. (see section III)
 - a. What is Magnetism?
 1. Greeks and Romans
 2. Asia Minor
 3. Magnesia
 4. Shepherds

D. Key Vocabulary:

attract, repel, force, magnet, lodestones, magnetism, magnetic field.

E. Procedures / Activities:

1. Read the book - *What Makes A Magnet?* by Franklin M. Branley.
2. Engage students in a classroom discussion about everyday uses of magnets.
 - a. What shape are the magnets?
 - b. Why do people use them?
 - c. Where have you seen magnets in use? (possibilities: “*Mom displays my artwork at home on the refrigerator.*”)
3. Brainstorm and chart.
4. Explain vocabulary terms and show the different types of magnets.
5. Explore, manipulate, and discover uses for magnets during small cooperative learning groups.
6. Now draw what you just saw today. Write a sentence to go with your picture.

F. Evaluation:

Teacher evaluates drawing that students made of what they observed during the activity.

G. Standardized test OBJ:

1. Main Idea
 - a. Magnets stick to surfaces in the classroom - “unseen force”
2. Vocabulary Meanings
 - a. Reinforce word meanings by using flashcard Vocabulary terms in CLOZE sentences.

Lesson Two: The Law of Magnetic Attraction

A. *Daily Objectives:*

1. Lesson Content: Law of Magnetic Attraction - unlike poles attract, like poles repel.
2. Concept Objective: show the “unseen force” - the Law of Magnetic Attraction.
3. Skills Objective: to observe that invisible magnetic fields spread out around a magnet causing magnetic attraction.

B. *Materials:*

1. plain white paper or a plastic lid (one per small group).
2. iron shavings (per group).
3. magnet (bar magnets work best; one per group)
4. Appendix A - Now Let's Picture That! (one per student)

C. *Prior Knowledge for Students*

1. see lesson one

D. *Key Vocabulary:*

1. lodestone, iron shavings, magnetic attraction.
2. see vocabulary list for lesson one

E. *Procedure / Activity:*

1. Review magnetism characteristics and the definition for magnetism.
2. Students will use a plastic lid or a piece of plain white paper, a magnet, and some iron shavings or iron filings to demonstrate the magnetic attractions.
 - a. Place bar magnet on flat surface (desktop).
 - b. Place plastic lid or paper over the magnet.
 - c. Sprinkle iron filings lightly onto the lid or paper.
 - d. Observe what happens and draw this on #1 on Appendix A.
 - e. Tap the lid or paper lightly with your finger.
 - f. Observe what happens now and answer #2 on Appendix A. Discuss what students have just observed.
 - g. Have the students predict what will happen if they tap the lid lightly again.
 - h. Repeat the process. Tap the lid or paper lightly. (Note to teacher - The lines in the pattern made by the iron filings show how the very “invisible” magnetic field spreads out around the magnet. The poles of the magnet will be in the center of the pattern.)

F. *Evaluation*

1. Check results noted on Appendix A.
2. Teacher Observations.

G. *Standardized Test / State Test Connection*

1. Main Idea
 - a. unlike poles attract, like poles repel
2. Facts and opinions
3. Predicting

Lesson Three: Magnetic Fields:

A. *Daily Objectives:*

1. Lesson Content:

- a. Magnetic Poles (north-seeking pole and south-seeking pole)
- b. magnetic fields
- c. magnetic attraction
2. Concept Objective: see what happens to the magnetic field when you bring two magnets together.
3. Skills Objective: through demonstrations, observations, and predictions, the student will learn how magnetic fields change as magnets attract or repel each other.
- B. *Materials:* (per group)
 1. Iron filings
 2. Two bar magnets with their poles marked red for north and blue for south (or N and S).
 3. One plastic lid
 4. Appendix B - Magnetic Fields
- C. *Prior Knowledge for Students*
 1. see lessons one and two
 2. Kindergarten Unit
- D. *Key Vocabulary*
 1. see lessons one and two
- E. *Procedures / Activity:*
 1. Place the plastic lid on a table.
 2. Sprinkle iron filings onto the plastic lid.
 3. Dip one magnet's north pole (red end) and another magnet's south pole (blue end) into the iron filings in the lid.
 4. Next, bring the two poles containing the iron filings together. Observe what happens.
 5. Record your observations on Appendix B. Follow directions on that sheet. (Note to Teacher - The iron filings are held together in the magnetic field. The magnetic fields around the unlike poles (red to blue) join up.)
 6. Predict what might happen if you pulled the magnets a tiny distance apart.
 7. Now, pull the two magnets a tiny distance apart. Observe.
 8. Record your results on Appendix B #2. Follow directions on that sheet. (Note to Teacher - The iron filings hang in the air but stay joined to the magnet.) If the magnets are pulled too far apart, this process will not be observed.
 9. Try the experiment again, only this time dip the north pole (red end) of each magnet into the lid containing the iron filings.
 10. Observe what happens as you bring the two (red ends) north poles together.
 11. Record your results on Appendix B #3. Follow Directions on that sheet. (Note to Teacher - This time the filings bend away from the red ends of the magnet. The magnets repelled each other.)
- F. *Evaluation:*
 1. Check results listed on Appendix B.
 2. Teacher Observations
- G. *Standardized Test / State Test Connections:*
 1. Predicting
 2. Observing
 3. Inferring

4. Recording

Lesson Four: Magnetic Poles to Fishing Poles - Attraction Action!

A. *Daily Objectives:*

1. Lesson Content: Law of Magnetic Attraction - unlike poles attract, like poles repel.
2. Concept Objective: To learn if a magnet's power can work through water.
3. Skill Objective: To demonstrate how the Law of Magnetic Attraction works.

B. *Materials:*

1. bowl of cool water
2. small cut outs of paper fish
3. tape
4. small horseshoe magnet
5. steel paper clips
6. pencil or rod
7. thread or string
8. paper towels
9. flat table - work surface
10. journal for writing assignment

C. *Prior Knowledge for Students:*

1. See Kindergarten: Magnetism Unit
2. See previous lessons in Grade 2 Unit

D. *Key Vocabulary:*

1. see previous lessons in Grade 2 Unit

E. *Procedure / Activity:*

1. Place bowl of cool water on the table or flat work surface.
2. Slide a steel paper clip onto each fish.
3. Put the fish in the bowl of cool water. Do not worry if the fish sinks!
4. Tie the thread or string firmly onto one end of the horseshoe magnet.
5. Tie the other end of the thread or string onto the pencil or rod. Use tape to keep the string from slipping. Now you have made a magnetic fishing rod.
6. Hold the fishing rod over the bowl of fish and lower your magnet into the bowl of water. (Note: the magnet will pick up the fish.)
7. Discuss why the magnet works in the water. (Note: The "invisible force" is with you. The magnet works through the water because the "force" is there to attract your fish. You can even catch the fish that try to escape and hide on the bottom of the bowl.)
8. Now write in your journal about what you observed today. You may draw and label your picture too.

F. *Evaluation:*

1. Teacher Observation
2. Journal Checks
3. Conference with child

G. *Standardized Test / State Test Connections:*

1. Main Idea
2. Predicting
3. Modeling
4. Evaluating - Drawing Conclusions

Lesson Five: Windows to the North??

A. *Daily Objectives:*

1. Lesson Content: Orienting - use of a magnetized needle in a compass, which will always point to the north.

2. Concept Objective: To explain how to find directions when using a magnetic compass.
3. Skill Objective: Demonstrate the use of a magnetic compass
- B. *Materials:*
 1. Magnetic compass
 2. Teacher made chart of a compass face
 3. Teacher made overhead transparency of a compass
 4. Appendix C Simple Map of School
 5. Overhead transparency - School Map
 6. Teacher made quiz
- C. *Prior Knowledge for Students:*
 1. Kindergarten: Magnets
 2. Grade Two: Unit materials to date
- D. *Key Vocabulary:*
 1. magnetic north
 2. magnetized arrow
 3. compass
 4. Cardinal directions (on flash cards: N, E, S, W)
 5. oriented - lined up
 6. previous vocabulary from earlier lessons in this unit.
- E. *Procedure / Activities:*
 1. Brainstorm possibilities for using a compass - chart ideas
 - a. helps you if you are lost in the woods
 - b. guide ships and airplanes
 2. Show overhead transparency of the compass
 3. Discuss how a compass works: A compass contains a tiny magnet that is shaped like an arrow. This small arrow or needle is mounted on a sharp point, allowing it to spin around. When the compass stops spinning, one end always points to the north. If you turn the compass around, the needle always keeps pointing the same way - north.
 4. Allow students to practice using the compass in the classroom. They need to hold the compass flat in their hand.
 5. Have them identify the cardinal directions. Use the flash cards and mount them on the four walls. (Note: Our windows face the north) Show overhead transparency of the school map. Point out our windows and the north.
 6. Students will now use Appendix C, Simple Map of School, to locate and label the cardinal directions N, E, S, W on their maps. They may check the labels on the walls for help.
 7. Using the maps, students will answer oral questions about their school such as "the office is located north of room 506." Students may color the rooms on this map that they located.
 8. After several oral samples, the students may use appendix C and their journals. Have students write questions like the oral samples. Color the rooms on the map.
 9. Allow them to pair up and exchange journals and answer each others questions.
 10. Return journals to rightful owners and check answers together in pairs. Discuss errors.
 11. Hand out the teacher prepared quiz . Allow time for directions, and then give the class time to answer the questions.
- F. *Evaluation:*
 1. Teacher Observations

2. Oral Discussions
 3. Journal Samples
 4. Teacher made quiz
- G. *Standardized Test / State Test Connections*
1. Cause and Effect
 2. Map Skills
 3. Main Idea
 4. Drawing Conclusions

Lesson 6: Earth - A Huge Magnet - (You may choose to make this a 2-3 day lesson plan)

- A. Daily Objectives:
1. Lesson Content: North Magnetic Pole and South Magnetic Pole make Earth a big magnet.
 2. Concept Objective: To explain what the difference is between magnetic north and geographic north (or true north).
 3. Skill Objective: To use a model of Earth to compare Magnetic north to geographic north.
- B. *Materials:*
1. *Magnetism* by Raymond Holden
 2. *Experiments with Magnets* by Helen Challand
 3. Teacher made overhead transparencies - which may be overlaid
 - a. cross section of Earth
 - b. world map - Earth axis geographic north
 - c. world map - Magnetic north
 4. String and bar magnet
 5. Globe mounted on axis
 6. Journals
 7. World map
- C. *Prior Knowledge for Students*
1. Kindergarten Unit: Magnetism
 2. Grade Two Unit : Magnetism materials covered to date.
- D. *Key Vocabulary*
1. crust
 2. mantle
 3. outer core
 4. inner core
 5. minerals
 - a. iron
 - b. nickel
 6. axis
 7. vocabulary terms from previous lessons in this unit
- E. *Procedure / Activity Day 1 Lesson 6*
1. Introduce this lesson by sharing pages 40 - 45. *Experiments with Magnets* by Helen Challand.
 2. Use the teacher prepared overhead transparency of the cross section of the Earth.
 3. Discuss the vocabulary terms crust, mantle, outer core, and inner core.
 - a. inner core: made up of iron and nickel - probably solid
 - b. outer core: made up of a thickened pudding-like substance
 - c. mantle: the layer of Earth between the crust and the core
 - d. crust: the outer most layer of the Earth

4. Show the globe to the class. Explain that Earth slowly spins around on its axis (axis: the imaginary line drawn through the Earth that reaches from the North Pole to the South Pole).
5. Explain that the globe is mounted so that it leans a little to one side. This tilt makes the differences in the seasons as the earth rotates around the Sun.
6. Refer again to the overhead transparency and explain that the movement of the inner core inside the outer core makes a magnetic field.

Day 2 Lesson 6

7. Now take the string and tie it to the middle of the bar magnet. Let the magnet hang free until it stops moving. One end of the magnet will point to the Earth's magnetic pole and the other end of the magnet will point to earth's magnetic South Pole. Earth's magnetic field or force causes the free hanging magnet to line up pointing to the north and south.
 8. True north can be located outside about noon by looking for the shortest shadow on a sunny day. The smallest shadow will point in the north direction of true north. This is because the Earth rotates around its axis. On the north wall of the classroom, place a sign that says north. True north is the direction of the North Pole. The opposite wall will be in the direction of the South Pole.
 9. On the world map or the globe, point out the location of the Arctic Circle and the North Pole. This spot is called geographic north.
 10. Refer to the overhead transparency that marks geographic north and south poles.
 11. Explain that magnetic north and south are not the same location as the true North Pole and South Pole.
 12. Magnetic North Pole is located about eleven degrees from true north. The Magnetic North and South Poles move or drift very slightly. This movement is called Polar Wandering.
 13. Locate the Northern magnetic Pole on the world map or globe. It is located near the Western Coast of Bathurst Island in Canada's Northwest territory about 800 miles Northwest of Hudson Bay.
 14. Locate the southern magnetic pole on the world map or globe. It is near the Adelie Coast of Antarctica Northwest of Little America about 1200 miles from the South Pole.
 15. Show the teacher made overhead transparency of the Earth that labels the Magnetic and Geographic North Poles. Review that the poles are not the same. Magnetic north or bar magnet north or compass needle north is one location. The other location is the point on the axis of rotation for the Earth or the true North Pole.
 16. Use the student journals: Ask the students to write about the difference in Magnetic north to Geographic north. Students might find that drawing and labeling pictures of the globe would be better than written explanations. Provide circle patterns that can be traced for drawing the globe in their journals.
- F. *Evaluation / Assignment:*
1. Teacher observation
 2. Oral Discussion
 3. Journal samples
- G. *Standardized Test / State Test Connections:*
1. Cause and Effect

2. Drawing Conclusions
3. Map Skills
4. Word Meaning
5. Main Idea

VI. Culminating Activity

- A. Language Arts:
 1. Students can make a mini - book about classifying objects. They could refer the resources books for items that are attracted or repelled by magnets. They could illustrate and write simple explanations for their drawings.
- B. Art:
 1. Students can create a design for the compass face using poster board, crayons, and markers.
- C. Social Studies:
 1. Students could make a simple neighborhood map with the school building used as one of the objects on their map.
- D. Math:
 1. The students can count how many paces from their room to the room next door. They could count the paces it took for each direction they had to travel. They could try different students paces and compare which paces were the greatest and which paces were the least. Next, they could use a meter stick to measure the same distances. A chart could be made with the information the students learned while measuring these directions.
 2. Extend the use of measuring tools and review how to change meters into centimeters.
 3. Continue the comparisons, and explain how to change yards into inches.
 4. Allow students to make their own graphs showing the data they have gathered.
 5. Have students practice reading graphs and charts.
- E. Guest Speakers:
 1. See Resources list
- F. Reading and Phonics Skills
 1. Using the book *What Makes a Magnet?* by Franklyn M. Branley, read to the children the author's ideas. Discuss these ideas together and chart items that can be picked up by a magnet. Use bright colors of markers for each beginning letter.
 2. Find words in the book that begin with the same letter as the vocabulary or spelling lists being used that week. Have children place the science words in groups by the beginning letter. Next, group the vocabulary or spelling words in the correct group with the science words. Have the children say each word after the teacher says the word for each group. Practice that beginning sound. See that beginning letter.
 3. Place the science words and the vocabulary or spelling words on individual cards. Turn each card over until all cards are face down. Play a match game. The person who can turn up two cards with the same beginning letter wins that pair of words. Continue the process until all cards are collected by the students.

VII. Handouts / Worksheets

- A. Appendix A Now Let's Picture That!!
- B. Appendix B Magnetic Fields
- C. Appendix C Simple Map of School

VIII. Bibliography

1. Ardley, Neil. *The Science Book of Magnets*. Harcourt Brace Jovanovich, Publishers, 1991. ISBN 0-15-200581-1.
2. Branley, Franklyn. *What Makes A Magnet?* Harper Collins, 1996
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3. Challand, Helen. *Experiments with Magnets*. Childrens Press, 1986.
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ELECTRICITY-Primary*. Teacher Created Materials, Inc., 1994. ISBN 1-55734-643-7.
5. Holden, Raymond. *Magnetism*. Golden Press, 1962.
6. VanCleave, Janice. *Janice VanCleave's Magnets*. John Wiley & Sons,
Inc., 1993. ISBN 0-471-57106-7.
7. Whalley, Margaret. *Experiment With Magnets and Electricity*. Lerner
Publications Company, 1992. ISBN 0-8225-2457-0.

Appendix C
Simple Map of School

This simple xeroxed map represents the school campus for Blake Elementary. Locate and label the Cardinal Directions for Room 506. You may color the rooms on this map that you wrote about in your journal.

