AMAZING MAGNETS!

Grade Level: Second
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School
Length of Unit: 11-13 sessions

I. ABSTRACT

The overall goal of this unit is to provide students with hands on experiences, while learning about magnets. This unit shows you how to engage students in experiments which explore magnet force and compass use. Using constructive techniques, this course of study focuses on asking thoughtful, open-ended questions which, in turn, encourage students to ask questions of each other.

II. OVERVIEW

A. Specific content from the Core Knowledge Sequence to be covered: lodestones, magnets, and compasses.

B. Science skills to be taught: Hypothesizing, predicting, observing, classifying, comparing and contrasting, interpreting data, drawing conclusions.

C. Student learning goals: As a result of this unit, students will demonstrate a deeper understanding of magnets and properties of magnetism, knowledge of the earth’s magnetic field and how a compass works, and practical uses of magnets in today’s world.

I. BACKGROUND KNOWLEDGE


I. RESOURCES


I. LESSONS

A. Lesson One: MAGNETIC HUNT

1. Objectives/Goals
   - To illustrate that magnets produce an invisible force, and that some things respond to magnetic force or pull, others do not

2. Materials
   - chart paper and markers, 10 to 15 horseshoe magnets, science journals (Appendix B)

3. Prior Knowledge for Students
   - None

4. Key Vocabulary
   - Magnet, magnetic, force

5. Procedures/Activities
   1. Introduce the unit of study. Display chart paper with the heading, "What we already know about magnets." As students offer responses, record them on the chart. Do not correct the students' inaccurate responses. This will be helpful in ascertaining the students' prior knowledge, including accurate and inaccurate assumptions. This chart can be referred throughout the unit of study as a way for students to reflect upon their learning and to rethink inaccurate ideas.

   2. The study of magnets begins with an open exploration of magnetic and non-magnetic objects. Provide each pair of students with a horseshoe magnet. Have the students work with a partner to go on a "magnetic hunt." They explore the room, predicting what objects are magnetic and what objects are not magnetic. As they test their hypotheses, they record their findings in their science journals. **IMPORTANT: It might be a good idea to tell students which objects they should not test with magnets, i.e. computer screens, computer disks, audio cassette tapes, etc.

   3. Have students come back together to share their findings. Discuss any objects the students found in common. Allow students to share any other observations or things they noticed in experimenting with the magnets.

   4. Evaluation/Assessment: Teacher evaluates student responses and science journals.
B. Lesson Two: WHAT CAN A MAGNET ATTRACT?

1. Objectives/Goals
   a. To illustrate that magnets produce an invisible force and that some things respond to magnetic force or pull; others do not
   b. To classify objects and formulate hypotheses regarding materials and their magnetic properties

2. Materials for each cooperative group
   a. A bag of objects containing: a pencil, eraser, paper clip, butter knife, keys, coins, piece of cloth, piece of paper, small comb or other plastic object, nail, an aluminum can, tin can, marble
   b. A bar magnet
   c. Two pieces of construction paper, different colors, labeled "Magnetic" and "Non-Magnetic"
   d. For each student: science journal (Appendix C)

3. Prior Knowledge for Students
   a. Magnetic, hypothesis, conclusion

4. Key Vocabulary
   a. Magnetic, hypotheses, conclusion

5. Procedures/Activities
   a. Pass out bags of materials to each group. As a class, ask students to predict which objects will be attracted to the magnet. Record their predictions on the board or chart paper. From these predictions, ask the students to formulate a hypothesis i.e. "Metal objects are attracted to magnets." Also record the hypothesis on the board so that it may be referred to at the end of the lesson.
   b. Each group experiments with the objects in the bag to determine if they are magnetic or not. As each item is tested, students sort the objects into two groups by placing them on the appropriately labeled construction paper.
   c. As each object is classified, the students record the results in their science journals. The students then record what material the object is made of (wood, plastic, metal, glass, etc).
   d. After the groups have completed the activity, bring the class together for discussion: Were more objects magnetic or non-magnetic? Were there any objects that surprised you? Why? Do you see anything in common among the objects that are magnetic? Were all the metal objects magnetic? Was our hypothesis correct? What conclusions can we draw from our observations?
   e. Following discussion, have the students write about the conclusions they can make from their observations.

6. Evaluation/Assessment
   a. Teacher evaluates student responses and science journals.

C. Lesson Three: MAGNETIC FORCE FIELD

1. Objective/Goals
   a. To illustrate: magnetic pull is greatest when the object is closest to the magnet; magnetic power passes through objects it attracts, however the magnetic force decreases with distance; a magnetic force can hold a limited amount of weight.

2. Materials
   a. For each pair of students: a horseshoe magnet, straight pins, steel ball bearings, paper clips, hairpins, staples
   b. For each student: Science journal (Appendix D)

3. Prior Knowledge for Students
   a. Lessons One and Two
4. Key Vocabulary
   a. Magnetic force field

5. Procedures/Activities
   a. Introduce the lesson by asking students to consider how far magnetic force reaches, and introduce the vocabulary, "force field." Model the procedure for the lesson. Ask students to predict which items the magnet will be able to hold the most (straight pins, ball bearings, paper clips, hairpins, or staples). Ask students to explain their hypotheses for their predictions (explain why they made that prediction). Have students record their own hypothesis in their science journal (Appendix D).

   b. Each pair of students works together to explore the strength of the horseshoe magnet by picking up a straight pin with the end of the magnet. They add another pin to the first, then another and another. They keep adding pins in a dangling string from the magnet until the last one no longer sticks. How many pins could the horseshoe magnet hold? They record their findings in their science journals (Appendix D).

   c. The students repeat the procedure with each of the objects, recording their findings.

   d. When students have completed their experimentation, bring the class together to discuss their findings: Which object did the magnet hold the most? The least? Were our predictions correct? Were our hypotheses correct? Did everyone get the same answers? Why did the magnet hold more (staples) than (ball bearings)? What conclusions can we make?

   e. Have students write their conclusions in their science journals.

6. Evaluation/Assessment
   a. Teacher evaluates student responses and science journals.

D. Lesson Four: MAGNET STRENGTHS

1. Objectives/Goals
   a. To illustrate: Magnets come in many different shapes and sizes; magnets possess varying degrees of strength.

2. Materials
   a. For each pair of students: horseshoe magnet, disk magnet, and bar magnet; a paperclip.
   b. For each student: science journal (Appendices E and F)

3. Prior Knowledge for Students
   a. Lessons One through Three

4. Key Vocabulary
   a. Horseshoe magnet, disk magnet, bar magnet

5. Procedures/Activities
   a. Discuss the concept that magnets come in different shapes and sizes. Introduce the three different types of magnets that the students will be using in the activity.

   b. Ask students to predict which magnet they think is the strongest and hypothesize why they made that prediction. Have students record their hypothesis in their science journals (Appendix E).

   c. Using the student page (Appendix F), the students experiment with a partner to determine which magnet has the strongest magnetic pull. Students record their results in their science journals (Appendix E).

   d. Bring the class together to discuss and compare results: Which magnet was the closest when it "grabbed" the paperclip? Which magnet was the farthest when it "grabbed" the paperclip? What conclusions can we make? (Which magnet was the weakest? Strongest?)

   e. Have students record conclusions in science journals (Appendix E)
E. Lesson Five: ATTRACTION AND REPULSION

1. Objective/Goals
   a. To illustrate that every magnet has a north pole and south pole; unlike poles attract each other; like poles repel each other.

2. Materials
   a. For each pair of students: two bar magnets, with poles marked, 12-inch piece of string, two 2-inch strips of electrical tape
   b. For each student: science of journal (Appendix G)

3. Prior Knowledge for Students
   a. Lessons One Through Four

4. Key Vocabulary
   a. Poles, attract, repel

5. Procedures/Activities
   a. Introduce the vocabulary. Demonstrate the north and south poles on a bar magnet.
   b. Ask students to form a hypothesis: What will happen when two like poles are put together? What will happen when two unlike poles are put together? Have students write their hypotheses in their science journals (Appendix G).
   c. Demonstrate how to set up the experiment (without actually demonstrating the results; this is for the students to discover): Tie the string around the center of one of the bar magnets. Hold the string in the air, so that the magnet dangles below. Have your partner take the other bar magnet and move the north pole towards the north pole of the dangling magnet. What happens? Tell the students to experiment in this way; also trying the unlike poles, putting together a south pole and a north pole.
   d. Have students record results in their science journals (Appendix G).
   e. Bring the class together for discussion: What happened? Were our hypotheses correct? What conclusions can we make? (Unlike poles repel, while like poles attract).
   f. Have students write about their conclusions in their science journals (Appendix G).
   g. Next, with this new knowledge, have students cover the poles of one of their bar magnets with the strips of electrical tape. Have them experiment with the magnets to see if they can predict which is the north pole and which is the south pole. After, they can remove the tape to check their predictions.

6. Evaluation/Assessment
   a. Teacher evaluates student responses and science journals.

F. Lesson Six: MAGNETISM TRAVELS THROUGH OBJECTS

1. Objectives/Goals
   a. To demonstrate that magnets can exert force through various materials; thicker materials lessen the magnetic force.

2. Materials
   a. For each cooperative group: paper plate, plastic margarine tub, playing card, piece of cardboard, piece of flat cork board, magazine, plastic lid (to coffee can), thin sheet of plywood
   b. For each student: science journals (Appendix H).

3. Prior Knowledge for the Students
   a. Lessons One through Six

4. Key Vocabulary
   a. Review of previously learned terms
5. Procedures/Activities
   a. Ask students whether they think magnetic force can travel through objects.
      For example, if a magnet is placed on top of a paper plate, will another magnet
      held on the underneath side be able to move it? Ask students to write their
      hypotheses in their science journals (Appendix H).
   b. Pass out materials to cooperative groups and have students work together to
      Test their hypotheses with the variety of objects. Students record observations in
      their science journals (Appendix H).
   c. Bring class together to share observations: What happened? Did each group get the
      same results? Why? Why not? Were our hypotheses correct? What conclusions can
      we make?
   d. Students record conclusions in their science journals (Appendix H).

6. Evaluation/Assessment
   a. Teacher evaluates student responses and science journals.

G. Lesson Seven: THE EARTH'S CORE IS MAGNETIC

1. Objective/Goal
   a. To emphasize prior knowledge about the Earth (1st grade Core Knowledge)
   b. To illustrate that the Earth’s core generates a magnetic field

2. Materials
   a. Journal, magnets, tissue paper, newspaper, starch and paint (optional)

3. Prior Knowledge for Students
   a. Lodestones are rocks which are naturally magnetic.
   b. Knowledge about magnets and magnetic pull as learned in earlier lessons.

4. Key Vocabulary
   a. core, layers, magnets, earth

5. Procedures/Activities
   a. Children are questioned on prior knowledge about the Earth learned in first grade.
   b. A magnet is handed out to each child.
   c. Explain to the children that the Earth’s core generates a magnetic field like the bar
      magnet.
   d. Hand each child a piece of tissue paper.
   e. Imagining that the bar magnet represents the core of the Earth, ask the children
      how they could use the tissue paper to create a layer of Earth to cover the core.
   f. After they have found they could wrap the magnet in the tissue paper, pass out 10
      more pieces to continue layering the "core." Walk around and question each child
      to find out if they understood the concept of core and layers of the Earth.
   g. Again reviewing, ask children what they know about the top layer of the Earth i.e.,
      75% of the earth’s surface is water, the differing habitats (1st grade Core
      Knowledge), etc.
   h. Demonstrate a top layer of the Earth by taking strips of newspaper dipped in starch
      to cover the tissue layers of the Earth (if time permits, painting the paper-mache
      Earth once it has dried would make an excellent art project).
   i. After each child has completed the activity, have them draw an Earth on the back
      of Appendix H, labeling the core, differing layers and top layer of the Earth.
   j. Pull the children together in a circle for discussion. Ask questions such as "Were
      you surprised the Earth’s core is magnetic? Why or why not. Have you ever had an
      experience seeing the different layers of the Earth? What have you noticed about
      the top layer of the Earth? What conclusions can you draw from this activity? Do
      you have any predictions about tomorrow’s lesson which will focus on the Earth’s
H. Lesson Eight: FINDING THE EARTH’S MAGNETIC POLE

1. Objectives/Goals
   a. Students will use a bar magnet to find the direction of the Earth’s magnetic north pole.

1. Materials
   a. A bar magnet, thread, several heavy books, tape, ruler and chart paper, globe, map

2. Prior Knowledge
   a. Information from Lesson Seven

3. Key Vocabulary
   a. pole, balanced, force

4. Procedures/Activities
   a. Review the knowledge of magnetism gained through lessons 1-7 by asking open-ended questions.
   
   b. Ask students if they know where the North Pole is. Allow students time to look at a map or globe to find their answers. Tell students there is also a magnetic north pole, and ask for predictions of what that might mean. Write their predictions on a piece of chart paper. Tell students they will find the magnetic north pole by the end of this lesson.
   
   c. Have students mark the north pole of the magnet using information from Lesson Five. Finding the middle of the magnet, have students wind a 7”-8” piece of thread around the magnet and tie into a knot. When the children hold the other end of the thread, the magnet should be balanced and parallel to the ground. Take the free end of the thread and tape it to the end of the ruler.
   
   d. Place five books on the edge of a counter, sliding the ruler between the top two books. The magnet will be hanging down and able to move about.
   
   e. Once the magnet comes to rest, where does the north pole of the magnet point? Move the magnet again to find if it settles in the same spot. Move about the room as well as outside. Does the pole continually point in the same direction.
   
   f. Allow ample time for students to experiment then gather in a group. What did the student’s experiments find? Were their results consistent?

5. Evaluation/Assessment
   a. Students record their findings in Appendix I, teacher evaluates student’s findings.

I. Lesson Nine: MAKING AND USING A COMPASS

1. Objectives/Goals
   a. Students will create their own magnetized compass.
   
   b. Students will be able to use their created compasses and find the directions of north, south, east and west.

2. Materials
   a. Horseshoe magnet, sewing needle, iron filings, flat piece of cork, plastic bowl with water, tape, chalk, paved area, journals, pencil and real compass

3. Prior Knowledge
   a. Information gained in lessons 1-8

4. Key Vocabulary
   a. compass

5. Procedures/Activities
   a. Stroke the needle on the north pole of horseshoe magnet from the center to the tip,
always moving in one direction. Stroke the needle up to 30 times. Repeat these
directions going from center of the needle to the eye of the needle on the south pole
of the magnet. Check its magnetism with iron filings. If the needle picks the filings
up, it is magnetized.
b. Tape the center of the needle to the flat piece of cork and place it in a plastic bowl
filled with water. What happens to the needle? Move the cork; what happens to the
needle now?
c. Have students write in their journals (Appendix I), and hypothesize why the needle
is continuing to turn in a north/south direction. Students should remember in
Lesson Five that opposite poles attract, therefore, the north pole of the compass will
face the South Pole of our Earth and the south pole of the magnets will face North
Pole of our Earth.
d. Allow plenty of time for students to experiment with their compasses and write in
their journal. Once each child has completed the above, bring the class outside to
an open area. Using a real compass, mark north, south, east and west on the
pavement with chalk. Encourage students to find northeast, southeast, northwest
and southwest.
e. Have students try their created compasses with the "pavement compass."

What happens when they stand in the middle with their needle compasses? Have
students write about their findings in their science journals.
f. Students should be given enough time to experiment with their compass and the
real compass. Students should be able to record north, south, east and west in their
journals.

6. Evaluation/Assessment
   a. Teacher reviews journals and assesses their performance for understanding.

J. Lesson Ten: FIND THE MAGNETIC NAIL

1. Objectives/Goals
   a. To magnetize a nail and compare its properties to non-magnetized nails

2. Materials
   a. Horseshoe magnet, nails, paper clips or tacks

3. Prior Knowledge
   a. Information learned in lessons 1-9

4. Key Vocabulary
   a. Prior vocabulary

5. Procedures/Activities
   a. Each child magnetizes a nail as learned in Lesson Nine.
   b. Each child also has three nails which are not magnetized.
   c. Children test the nails with paper clips to assure their nail has become magnetized.
   d. Students put their four nails on their desk and mix them up.
   e. Ask students if they can tell by looking which nail is the magnetized nail. Ask
students how they can figure out which nail is magnetized.
   f. Students trade places with another student and try to find the magnetized nail.
   g. When students have tried this with a variety of partners, students gather together in
a group to discuss their findings: Did the magnetized nails look different from the
non-magnetized nails? Did they feel different? How could you tell the difference
between the magnetized and non-magnetized nails? (Only by testing them with a
magnetic material, because magnetism, like gravity, is a force that cannot be seen).
   h. Students may be invited to create a game they could play with a partner using
magnetized and non-magnetized materials. Students may document this game in
their journals, Appendix J.
K. Lesson Eleven: HOW DO WE USE MAGNETS EVERY DAY?

1. Objectives/Goals
   a. To expose students to the roles magnets play in our everyday life.

2. Materials
   a. Journal, pencil, chart paper, objects (or pictures of objects) that utilize magnetism: refrigerator magnets, can opener, computer diskettes, cassette recorder and tape, speakers, VCR and VCR tape, clothes dryer, refrigerator, etc.

3. Prior Knowledge
   a. Information gained in Lessons 1-9

4. Key Vocabulary
   a. Prior vocabulary

5. Procedures/Activities
   a. Students gather together in a group. Teacher begins discussion. We have learned a lot about magnetism. What can you tell me that you have learned? Teacher writes on a chart paper headed with "What we have learned about magnets." This paper should be posted next to chart paper completed in Lesson One. After completing, discuss with students the similarities and differences of their responses then and now. Why have some theories changed? Allow students to lead the discussion and question each other.

   b. Ask students, now knowing what magnets are and what they attract, to brainstorm (on chart paper) ways we use magnets every day. Allow all thoughts to be put on paper.

   c. Now show students items or pictures (can opener, diskettes, etc.). As you display each item, ask students to predict whether or not that item utilizes magnetism to work.

   d. After all items have been displayed, point out that all these objects use magnetism in one way or another.

   e. Students write and draw in journals, Appendix K, explaining ways in which magnets are used every day.

   f. Students are directed to take home journals and find at least two more ways they use magnets at home.

6. Evaluation/Assessment
   a. Teacher will assess student’s understanding based on contributions to class discussions and journal entries.

I. OTHER SUGGESTED ACTIVITIES

A. Centers

B. The study of magnets lends itself to many hands-on center activities that the students can work on independently. Refer to resources for great center ideas.

C. Culminating Activity

D. The culminating activity of this unit is the student’s own creation using magnets.

    Their creation must reflect knowledge attained from Lessons 1-10 of the magnet unit. Students should be given plenty of time and materials to create an invention. Partner or group work is acceptable as long as all children have participated equally. This process may take one to three sessions of science.

    This activity may also be done as a take home assignment.

VII. HANDOUTS/STUDENT WORKSHEETS (see Appendices)
VIII. BIBLIOGRAPHY

- Bibliographic notes are found in sections III. Background Knowledge and IV. Resources.