MAGNETS: A Hands-On Science Unit

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MAGNETS: A Hands-On Science Unit

Written by Julie Meyer • Edited by Amanda Post

This magnet unit was created with first grade in mind, but it could be used in other primary grades. The lessons are hands-on, encourage cooperative learning, and reference Indiana state standards.

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Lesson 1 - To Stick or Not to Stick

Objectives:

Ø Students will observe, describe, and draw different objects.
Ø Students will determine and classify objects as either metals or nonmetals using magnets.

Materials:

Ø For each pair of students
  • bar magnet
  • donut or ring magnet
  • horseshoe magnet
  • student data sheet
Ø Plastic bag containing magnetic and nonmagnetic objects
  • twist-tie (plastic-coated wire)
  • marble
  • Popsicle stick
  • metal paper clip
  • plastic-coated paper clip
  • penny
  • cotton ball
  • piece of drinking straw
  • rubber band
  • plastic bottle cap
  • bolt
  • toothpick
  • washer
  • pop tab

Remind students to show concern, respect, and responsibility for equipment and others while experimenting in science. Demonstrate the importance of respecting all ideas and opinions, and treating others as they would wish to be treated.

Indiana State Standards

Science 1.1.1, 1.1.2, 1.1.4, 1.2.7
Social Studies 1.5.3, 1.5.4
Language Arts 1.6.1

Procedure:

1. Display the three different types of magnets. Ask students to identify them and their uses.
2. Identify them as a bar, donut, and horseshoe magnets.
3. Distribute bags containing the miscellaneous objects to each pair of students.
4. Instruct students to choose four objects from their bag and to make a drawing of each object in the first row of the data table. The objects may be taken out of the bag.
5. Once the drawings have been checked by the teacher, the student may have the bar magnet.
6. Experiment and record whether each of the objects attract or don't attract to the magnet. Write yes if it attracts and no if it does not attract in the second row of the data table.
7. Instruct students to record in the third row of the data table what each object is made of: wood, plastic, metal, cement, cotton, etc. and record in the data table.
8. If any group is working quietly or finishes early, encourage them to test something in the room with their magnets, excluding computers, and record it on the back of their data tables.
9. Gather for whole group instruction.
10. Elicit from students what they know about magnets.
11. Ask students to share some of their findings about the magnets with the class.
12. If there are discrepancies with some of the items attracting or not attracting to magnets, re-test the items and discuss the ideas of multiple trials in science.
13. Ask students to explain why their magnets stick to some metals but not others. (The reason some metals attract and others do not is because of the arrangement of their atoms. It is not necessary to share this information with the students. Let them discover that the metals must be somehow different. Magnets attract to only three types of metals: cobalt, nickel and iron.)
14. Conclude the lesson by asking children if they have any questions about magnets they would like to investigate. Write these down on the board or large piece of paper.
## To Stick or Not to Stick - Data Sheet

<table>
<thead>
<tr>
<th>Magnet</th>
<th>Objects</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar</td>
<td>Object 1</td>
<td>Object 2</td>
</tr>
<tr>
<td></td>
<td>Draw object</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Did it attract?</td>
<td>Yes or No</td>
</tr>
<tr>
<td></td>
<td>What is it made of?</td>
<td></td>
</tr>
<tr>
<td>Donut</td>
<td>Object 1</td>
<td>Object 2</td>
</tr>
<tr>
<td></td>
<td>Name or Draw</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Did it attract?</td>
<td>Yes or No</td>
</tr>
<tr>
<td></td>
<td>What is it made of?</td>
<td></td>
</tr>
<tr>
<td>Horseshoe</td>
<td>Object 1</td>
<td>Object 2</td>
</tr>
<tr>
<td></td>
<td>Draw</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Did it attract?</td>
<td>Yes or No</td>
</tr>
<tr>
<td></td>
<td>What is it made of?</td>
<td></td>
</tr>
</tbody>
</table>
Lesson 2 – Amazing Magnets

Objectives:

- Students will investigate by observing and describing ways in which metallic objects can be moved using magnets.
- Students will use magnets and metallic objects to follow different patterns to include straight, zigzag, round-and-round, and back-and-forth lines.
- Students will design an obstacle course including these four patterns for others to manipulate using metallic objects and magnets.
- Students will manipulate metallic objects through a maze using a magnetic wand.

Materials:

- One class set:
  - Laminated straight lined, zigzag, round-and-round, and back-and-forth designs
  - 8½” x 11” tag board (cardboard found at the back of a pad of paper or clipboards could be used)
  - paper clips
  - magnetic wand
  - magnetic marbles
  - pre-made maze (instructions follow)
  - crayons or colored pencils
  - white sheets of paper

- Make available:
  - additional types of magnets - horseshoe, bar, donut/ring
  - metallic chips or other small metallic objects

Indiana State Standards
Science 1.1.1, 1.1.2, 1.1.4, 1.2.6, 3.4
Social Studies 1.5.3, 1.5.4

Pre-activity Teacher Preparation:

1. Create mazes by gluing Popsicle sticks in the lid of a box. Use thin box lids like those that package transparencies. Glue a sheet of white construction paper to the inside bottom of the lid. Glue short and long Popsicle sticks inside the box lid. Color a green dot at the start location and a red dot at the end of the maze. (Rope could be used instead of Popsicle sticks.)

2. Laminate copies of the straight, zigzag, round-and-round, and back-and-forth patterns for each student to have at least one design.

Procedure:

Part I –

1. Ask students to draw a straight line in the air with their finger.
2. Ask students to draw a straight line back and forth from right to left in the air with their finger.
3. Ask students to draw a straight line back and forth from top to bottom in the air with their finger.
4. Ask students to draw a straight line from front to back in the air with their finger.
5. Ask students to draw their finger round and round in the air.
6. Ask student to draw their finger in a zigzag motion in the air.

Continued on next page…
Lesson 2 – Amazing Magnets, Continued

**Part II –**

8. Distribute one laminated pattern (either straight lined, zigzag, back-and-forth, or round-and-round), tag board and paper clips, or a clipboard, to each student.

9. Instruct students to attach the laminated pattern to the tag board or clipboard with the design facing up.

10. Distribute a magnetic wand, or other type of magnet, and a magnetic marble to each student.

11. Instruct students to practice moving the magnetic marble along the path of the pattern using the magnetic wand. The wand may not touch the magnet. (Students should place the magnetic wand on the underside of the paper and tag board and the ball on the top side of the paper.)

12. Instruct students to trade patterns with a neighbor until they have followed all pattern types.

**Part III –**

13. Instruct students to use a pencil to create and draw a new pattern sheet using all four pattern types (zigzag, round-and-round, back-and-forth, straight lines).

14. Instruct students to then use four different colored crayons to mark over the four different pattern types on their sheet.

15. Instruct students to trade and try one another’s patterns using the magnetic wand and magnetic marbles.

16. Encourage students to try different types of magnets and metal objects to follow the patterns.

17. Discuss the challenges and obstacles encountered in using different magnets, metallic objects, and design patterns. Collect patterns.

**Part IV –**

18. Distribute one maze to each student and instruct students to find a way to move the magnetic marble from the green start dot to the red ending dot without touching the marble.


**Part V –**

20. Instruct students to record in their journal or discuss an animal or an object in nature that moves in a straight, zigzag, back-and-forth or round-and-round motion. Ask students to share their journal entries.
Lesson 3 – Mighty Magnets I

Objectives:

- Students will predict, explore, observe, compare, and explain the differences in strength among different magnets.
- Students will count and calculate the sums and differences between the numbers of metallic objects attracted to the different magnets.

Materials:

- For the class:
  - Horseshoe magnets
  - Magnetic wands
  - Bar magnets
  - Donut/ring magnets
  - Large paper clips
  - Hex nuts
  - Magnetic marbles
  - Magnetic discs
  - Data table sheet

Procedure:

Part I –

1. Elicit from students some common everyday uses for magnets.
2. Elicit from students whether or not they think magnets are of different strengths. Ask if they can give examples.
3. Elicit from students what they think makes one magnet stronger than others.
4. Instruct students to test the strength of the horseshoe magnet by picking up as many paper clips, as possible.
5. Count the number of paper clips lifted and record the number on the data sheet.
6. Repeat the procedure using the remaining magnets.
7. Repeat steps 4-6 using magnetic marbles, magnetic discs and hex nuts.
8. When finished collect the materials and ask each group of students to record their numbers on the class data table. (Use an overhead of the data sheet or the chalk/dry erase board.)

Part II –

1. When students have completed the activities in Part I, review their procedures.
2. Inform students that they are going to interpret their data.
3. Encourage students to complete the questions located on the bottom half of their worksheet.
4. Encourage students to try the challenge activities on the back of their worksheet.
5. As a class, discuss the results.
6. Compare how their answers are similar and different. Explain the reasoning behind these similarities and differences.
7. Explain the need for repeated trials in science. Discuss different ways of doing science.
8. Inform the students they are going to graph their data in the next lesson.

Indiana State Standards
(Mighty Magnets I and II)

Science 1.1.2, 1.1.4, 1.2.1, 1.2.2, 1.5.2
Social Studies 1.5.3, 1.5.4
Math 1.1.1, 1.1.10, 1.2.1, 1.2.2
L.A. 1.6.1
<table>
<thead>
<tr>
<th>Horseshoe Magnet</th>
<th>Number picked up</th>
<th>Magnetic Wand</th>
<th>Number picked up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper clips</td>
<td></td>
<td>Paper clips</td>
<td></td>
</tr>
<tr>
<td>Hex nuts</td>
<td></td>
<td>Hex nuts</td>
<td></td>
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<tr>
<td>Magnetic marbles</td>
<td></td>
<td>Magnetic marbles</td>
<td></td>
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<tr>
<td>Magnetic discs</td>
<td></td>
<td>Magnetic discs</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Bar Magnet</th>
<th>Number picked up</th>
<th>Donut/ring Magnet</th>
<th>Number picked up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper clips</td>
<td></td>
<td>Paper clips</td>
<td></td>
</tr>
<tr>
<td>Hex nuts</td>
<td></td>
<td>Hex nuts</td>
<td></td>
</tr>
<tr>
<td>Magnetic marbles</td>
<td></td>
<td>Magnetic marbles</td>
<td></td>
</tr>
<tr>
<td>Magnetic discs</td>
<td></td>
<td>Magnetic discs</td>
<td></td>
</tr>
</tbody>
</table>

Draw a picture or write the name of the magnet that:

1. attracted the most **paper clips**? _______________ Least? _______________
2. attracted the most **hex nuts**? _______________ Least? _______________
3. attracted the most **magnetic marbles**? _______________ Least? _______________
4. attracted the most **magnetic discs**? _______________ Least? _______________

5. What is the **total** number of **paper clips** attracted by all four magnets? _______________
6. What is the **total** number of **hex nuts** attracted by all four magnets? _______________
7. What is the **total** number of **magnetic marbles** attracted by all four magnets? _______________
8. What is the **total** number of **magnetic discs** attracted by all four magnets? _______________

9. Challenge: Use the data tables to calculate the differences between the most and least attracted objects in questions 1-4. Show your work and answers on the back side of this sheet.
Lesson 4 – Mighty Magnets II

Objective:
- Students will make picture graphs to explain their observations.

Materials:
- For the class:
  - Data sheet
  - Graph paper (4 per student)
  - Colored pencils or crayons

Procedure:
1. Inform students they are going to use their four data tables (completed in Mighty Magnets I), along with colored pencils/crayons and graph paper to create bar graphs.

2. Instruct students to write the title, “Horseshoe Magnets” on the top of their graph paper.

3. Instruct students to draw paper clips, hex nuts, magnetic marbles and magnetic discs under the titles located along the X axis.

4. Instruct students to count the number of squares equal to the number of large paper clips picked up by the horseshoe magnet. Color in the squares equal to the number of paper clips attracted by the horseshoe magnet.

5. *Note: The graph is numbered by 2’s elicit from students how they would go about graphing an odd number.

6. Repeat the procedure with the other four types of items picked up by the horseshoe magnet.

7. Have the teacher check the graph. If OK, move on to the bar magnet data and repeat the graphing procedure. Give suggestions, tips, or teach the proper ways to graph the data if it is incorrect.

8. Again, check the graph before moving on to the wand and donut graphs.

9. Collect the graphs.

10. Discuss the graphing procedure. Ask students which they think are easier to read, data tables or graphs, and why?

Remind students to show concern, respect, and responsibility for equipment and others while experimenting in science. Demonstrate the importance of respecting all ideas and opinions, and treating others as they would wish to be treated.
Mighty Magnets II - Data Sheet

<table>
<thead>
<tr>
<th>Name _________________________</th>
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<td>2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>large paper clips</th>
<th>hex nuts</th>
<th>magnetic marbles</th>
<th>magnetic discs</th>
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</table>
Lesson 5 – Magnetic Attractions

Objectives:
- Students will predict, explore, observe, collect data, and ask questions to seek answers about the real world.
- Students will use tools such as magnets to seek answers and solve problems.

Materials:
For the class:
- Data sheets
- Magnets
  - Magnetic wands
  - Horseshoe magnets
  - Bar magnets
  - Donut/ring magnets
- Barriers
  - Cardboard sheets
  - Paper towel or toilet paper rolls
  - 8 ½ “ x 11” tag board (or the cardboard found on the back of a pad of paper)
  - Pieces of laminate wood
  - Pieces of plastic (lids to Cool Whip® containers)
  - Baby food jars
- Magnetic items
  - Paper clips
  - Magnetic discs
  - Magnetic marbles
  - Washers

Indiana State Standards
Science 1.1.2, 1.1.4
Language Arts 1.61
Social Studies 1.5.3, 1.5.4

Procedure:
1. Review with students the evidence for different strengths that magnets possess from the Mighty Magnet activity.
2. Distribute Magnetic Attractions data sheet to each student.
3. Identify and show the students the “barriers” they will be using during this investigation.
4. Elicit from students predictions of whether a magnet will go through each of the barriers on the worksheet.
5. Instruct students to record yes if they think the magnet will be strong enough to work through the barrier or no if they think it is not.
6. Explain to students this is called a hypothesis, something that scientists do before experimenting. Explain that it is by testing our predictions and hypothesis that we find out answers to many questions.
7. Break the class into groups of two.
8. Instruct students to complete the observation part of the worksheet by testing each barrier with each of the magnets and magnetic items. Write yes if the magnet was strong enough to attract through the barrier and no if it was not.
9. Gather for whole group instruction.
10. Compare predictions and results. Discuss.
11. Elicit from students why they think the magnets, magnetic items, and barriers behaved the way they did.
12. Discuss thickness, strength of magnet, and material of barrier.
13. Discuss ways in which we use magnets everyday.
## Magnetic Attractions – Making a Hypothesis

### Name _________________________

<table>
<thead>
<tr>
<th>Barrier</th>
<th>cardboard</th>
<th>paper roll</th>
<th>poster board paper</th>
<th>wood</th>
<th>plastic</th>
<th>glass</th>
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<tbody>
<tr>
<td><strong>Magnet Type</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Magnetic wand</td>
<td>Prediction</td>
<td>Result</td>
<td>Prediction</td>
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<td></td>
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</tr>
<tr>
<td>Horseshoe magnet</td>
<td></td>
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</tr>
<tr>
<td>Bar magnet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donut/ring magnet</td>
<td></td>
<td></td>
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</tbody>
</table>
## Magnetic Attractions - Data Sheet

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Magnetic Wand</th>
<th></th>
<th>Horseshoe Magnet</th>
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<tbody>
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<td>Result</td>
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<th>Donut/Ring Magnet</th>
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Lesson 6 – Magnet Magic

Objectives:

- Students will problem-solve using magnets.

Materials:

Part I –

- For each student
  - Clear sealed plastic tubes containing sand and iron filings
  - Magnifying glass
  - Magnet Magic data sheet
  - Any type of magnets

Part II –

- For each student
  - Piece of thread (approximately 20 cm) tied to a paper clip
  - Any type of magnets
  - Masking tape

Part III –

- Donut/ring magnets (as many as possible)
- Dowel rod or new pencil

Pre-activity teacher preparation:

1. Mix 2 parts white sand with 1 part iron filings.
2. Pour a small amount of the mixture into clear plastic tubes with lids.
3. Glue the lid on the tube.
4. Tie approximately 20 cm of thread to a paper clip. Prepare one for every student in the classroom. Store them in such a way that they will not become entangled.

Procedure:

Part I –

1. Distribute the above listed materials to each student.
2. Elicit from students what they think is inside the tubes.
3. Ask students to shake their tubes and lay them on their sides on the top of the desk.
4. Instruct students to observe the contents of the tube using a magnifying lens.
5. Instruct students to make a drawing of the tube contents on the Magnet Magic data sheet.
6. Instruct students to use the tools provided to separate the mixture without opening the tube.
7. Instruct students to make a drawing of the tubes contents after separating the mixture.
8. Discuss with the students the purpose of using a magnifying glass.
9. Elicit from students what the mixture looked like to the naked eye compared to using the magnifier.
10. Discuss with the students how and why the mixture became separated.

Indiana State Standards

Science 1.1.1, 1.1.2, 1.2.5
Social Studies 1.5.3, 1.5.4
Lesson 6 - Magnet Magic, Continued

Part II –

1. Distribute materials to students.

2. Instruct students to suspend the paper clip attached to the string in the air using the materials provided. The paper clip may not hang from the string and the paper clip may not touch the magnet.

3. Instruct students to make a drawing of their “trick”.

4. Ask students to share their drawings and explain them.

Part III –

1. Instruct students to place the donut/ring magnets over the dowel rod in such a manner that they do not touch. Make them appear as they are floating.

2. Instruct students to make a drawing of their “trick”.

3. Challenge students to suspend the magnets over the dowel rod forming different patterns.

4. Challenge the students to try it without the dowel rod.

5. Gather for group instruction.

6. Discuss the terms “repel” and “attract”.

7. Explain that every magnet has two parts, a north and a south pole. Like or same poles repel and unlike or opposite poles attract.

8. Ask students to predict what would happen if we put a south side against a south side. A north side against a north side. A south side against a north side.

9. Ask students to work in partners using two magnets to demonstrate repel and attract.

10. Instruct students to make drawings of two magnets repelling and two magnets attracting on the Magnet Magic data sheet.

11. Ask the question, “Do any of you hang your school work on the refrigerator?” “What do you use to do this?” Is this an example of two north poles, two south poles, or a north and south poles?
Part I

Combined Mixture

Separated Mixture

Part II  Paper Clip Trick

Part III  Suspended Magnet Trick

Two magnets repelling

Two magnets attracting
Lesson 7 – Magnet Showtime

Objectives:

- Students will choose from the pictures provided to create/write a story.
- Students will create puppets out of their pictures by taping a paper clip to the back of the picture.
- Students will design a backdrop for their story and use magnets to manipulate the characters in the story.

Materials:

- For groups of two:
  - Character pictures
  - Magnet discs glued to the end of Popsicle sticks
  - Paper clips
  - Tape
  - Shoebox lid or file folders
  - Crayons
  - Plain paper
- Book: The Giving Tree by Shel Silverstein

Pre-activity teacher preparation:

1. Glue small magnetic discs to Popsicle sticks. Make at least one for each student.

Procedure:

Part I –

1. Elicit from students some uses for trees.
2. Read “The Giving Tree” by Shel Silverstein to the students. While reading, ask students to predict what will happen next in the story.
3. Elicit from students the: who, what, when, where, why and how questions of the story.
4. Discuss which attributes of the trees are real and unreal.
5. Display the character pictures. Inform students they are to select a set of characters to use for a story that they will be creating/writing. Post the characters in the front of the room. Do not allow students to have the characters until the story is created/written. (They could design their own characters.)
6. Inform students that each story must include talking plants and/or animals, and each story must include descriptive words.

Part II –

1. After the teacher has checked the story, students may write their final draft. At this time, the students may obtain their characters.
2. Instruct students to color and cut out their characters.
3. Instruct students to tape a paper clip to the back of their characters.
4. Instruct students to cut a sheet of paper to fit the inside size of their shoebox lid or file folder. This is the students’ “backdrop” for their story. Inform students to decorate the backdrop accordingly. Glue the backdrop to the bottom of the shoebox lid/file folder.
5. Instruct students to use the magnets to practice manipulating their “puppets” while reading their story.

Indiana State Standards

Science 1.3.4, 1.4.1
Language Arts 1.2.3, 1.2.7, 1.5.1, 1.7.10, 1.2.6, 1.3.1, 1.3.2, 1.7.5
Social Studies 1.5.3, 1.5.4
Lesson 7 – Magnet Showtime, Continued

Part III –

1. Inform students they will be reading and dramatizing their stories in front of the class.

2. Instruct each group to identify the title, authors and illustrators of the story before telling the story.

3. Students read and dramatize their story using the magnets, scenes and characters created in parts I and II.

6. Elicit from students how the stories are similar or different from plays.

7. Elicit from students how the stories are similar of different from real life situations.

8. Ask students to identify examples of when stories allow animals and/or plants to speak. (Movies: Stuart Little, Ralph S. Mouse, Babe, Charlotte’s Web etc.) Explain the fact that stories give plants and animals certain characteristics that they actually do not possess.
Magnet Showtime Characters – Set 1

- Armadillo
- Butterfly
- Pig
- Monkey
- Alligator
- Chicken
- Sheep
- Dragonfly
- Spider
- Bird
- Cow
Magnet Showtime Characters – Set 2

- Crab
- Dolphin
- Chick
- Cat
- Fish
- Octopus
- Coral
- Dog
- Jellyfish
- Bee
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