

Making Predictions About Invisible Forces *(modified for ADEED)*

Overview:

Students make a hypothesis, perform an experiment to test the hypothesis, and collect data. Students observe the changes in strength of a magnetic field due to interference by different materials.

Objectives:

The student will:

- test a hypothesis based on the accumulation of data and observation;
- obtain control data;
- record data;
- average test results;
- identify the kinds of material that affect a magnetic field, and to what extent; and
- determine that some material hinder the passage of a magnetic field.

Alaska Grade Level Expectations Addressed:

Science

- [5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations to create inferences and predictions.
- [6] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations.
- [7] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze (i.e., range, mean, median, mode), interpret data, and present findings.
- [8] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct repeatable investigations, in order to record, analyze (i.e., range, mean, media, mode), interpret data and present findings.
- [7] SB1.1 The student demonstrates an understanding of the structure and properties of matter by using physical properties (e.g., density, boiling point, freezing point, conductivity) to differentiate among and/or separate materials (i.e., elements, compounds, and mixtures).
- [8] SB1.1 The student demonstrates an understanding of the structure and properties of matter by using physical and chemical properties (i.e., density, boiling point, freezing point, conductivity, flammability) to differentiate among materials (i.e., elements, compounds, and mixtures).
- [10] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by explaining that different kinds of materials respond to electric and magnetic forces (i.e., conductors, insulators, magnetic, and non-magnetic materials).

Math

- [6] S&P-3 The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating; drawing or justifying conclusions) by using mean, median, mode, or range.

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- [7] S&P-3 The student demonstrates an ability to analyze data (comparing, explaining, interpreting, evaluating; drawing or justifying conclusions) by determining mean, median, mode, or range.
- [7] PS-5 The student demonstrates the ability to apply mathematical skills and processes across the content strands by using real-world contexts such as science, humanities, peers, and community.
- [8] PS-5 The student demonstrates the ability to apply mathematical skills and processes across the content strands by using real-world contexts such as science, humanities, peers, community, and careers.

Materials:

- Paper clips (each group will need more paper clips than their magnet can pick up)
- Bar magnets (one for each experimental group)
- Steel
- Fabric
- Thin cardboard
- Sheet aluminum
- Corrugated cardboard
- Brass
- Sheet copper
- VISUAL AID: “Making Predictions”
- STUDENT WORKSHEET: “Making Predictions About Invisible Forces”



Teacher Note: *The materials used in this experiment can be changed based on what is available. Other material possibilities include leather, furs, various fabrics, or large leaves.*

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Activity Procedure:

1. Distribute the STUDENT WORKSHEET: “Making Predictions About Invisible Forces.”
2. Show VISUAL AID: “Making Predictions.” Explain scientists often make a prediction about how or why something works. This prediction is an “educated guess” called a **hypothesis**. Experiments are conducted to test a hypothesis.
3. Explain this experiment examines how magnetic fields are affected by passage through various materials.
4. Ask students to check the hypothesis they think will be most accurate at the top of their STUDENT WORKSHEET: “Making Predictions About Invisible Forces.”
5. Explain **Control Experiments** are performed so scientists will have data with which to compare their test results. Ask students what the control experiment should be in this case. (*Answer:* Students will need to know how many paper clips their magnets pick up when no material is between the magnet and the paper clips.)
6. Divide students into groups. Provide each group with the items from the materials list and ask students to perform the Control Experiment listed on the STUDENT WORKSHEET: “Making Predictions About Invisible Forces.”
7. After completing the Control Experiment, groups should perform the tests described in the Procedure section of the STUDENT WORKSHEET: “Making Predictions About Invisible Forces” and record their data in the data table.

Answers to Student Worksheet:

Data: Answers will vary based upon the materials you supply.

Analysis of Data:

1. Answers will vary
2. Answers will vary

Conclusion: A magnetic field is affected differently by different materials it passes through. Other answers will vary.

Further Questions:

1. B. an educated guess
2. Answers will vary, but students should understand that increasing the strength of the magnet will increase the number of paper clips it can pick up, even through other materials. Decreasing the strength of the magnet will decrease the number of paper clips it can pick up.
3. Answers will vary, but students should understand that Earth’s magnetic field passes through all the material in Earth’s mantle, crust and atmosphere to surround Earth. This means it is a powerful magnetic field.



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Testable Question:

How does the strength of a magnetic field change as it passes through materials?

Background Information:

All magnets have an invisible force field. This magnetic field is affected by passage through different materials. The strength of a magnet is determined by the magnetic field. The number of paper clips a magnet can pick up is determined by the strength of the magnet.

Scientists often make a prediction about how or why something works. This prediction is an “educated guess” called a hypothesis. Experiments are conducted to test a hypothesis.

Hypothesis:

Use the background information provided by your teacher or on this worksheet to make a hypothesis (Check one):

_____ A magnetic field is affected in the same way by any material it passes through.

_____ A magnetic field is affected differently by different materials as it passes through.

_____ A magnetic field is not affected by passage through materials.

Control Data:

How many paper clips does my magnet pick up with no material between it and the paper clips? _____

Experiment:

Materials:

- Paper Clips
- Bar Magnets
- Thin Cardboard
- Steel
- Fabric
- Sheet Aluminum
- Corrugated Cardboard
- Brass
- Sheet Copper

Procedure:

1. Place paper clips on the table top and choose one sheet of material. Place material between the magnet and the paper clips. Before performing the experiment, fill out the “Material” column in the Data Table on the next page.
2. Using your magnet, pick up as many paper clips as possible through the material you chose.
3. Record results in the “Test #1” column of the Data Table of this worksheet.
4. Repeat the test exactly the same way. Record results in the “Test #2” column of the Data Table.
5. Calculate the average of the two results and record the answer in the “Average” column of the Data Table.
6. Continue testing each of the materials in the same way, and record results.

Name: _____

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Data: In the table below, record the data you collect while performing the experiment.

Data Table

Material	Test #1 (number of paper clips)	Test #2 (number of paper clips)	Average
<i>Example:</i> Paper	8	6	$(8+6) \div 2 = 7$

Analysis of Data:

1. Which of the materials you used in the experiment allowed the most paper clips to be picked up?

2. Which of the materials you used in the experiment allowed the least paper clips to be picked up?

Name: _____

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Conclusion: Place a check next to your conclusion:

- _____ A magnetic field is affected in the same way by any material it passes through.
_____ A magnetic field is affected differently by different materials as it passes through.
_____ A magnetic field is not affected by passage through materials.

Was your original hypothesis proved or disproved? Use complete sentences.

Explain what evidence supports your conclusion. Use complete sentences.

Further Questions:

1. What is a hypothesis? Circle the correct answer.
A. a data table C. a fact
B. an educated guess D. a proven scientific theory
2. How would changing the strength of the magnet affect the number of paper clips the magnet could pick up through various materials?

3. Earth's core generates a magnetic field that surrounds Earth and stretches into space. What does this field have to pass through to surround Earth, and what does that tell you about the strength of Earth's magnetic field? Write your answer on the back of this page.