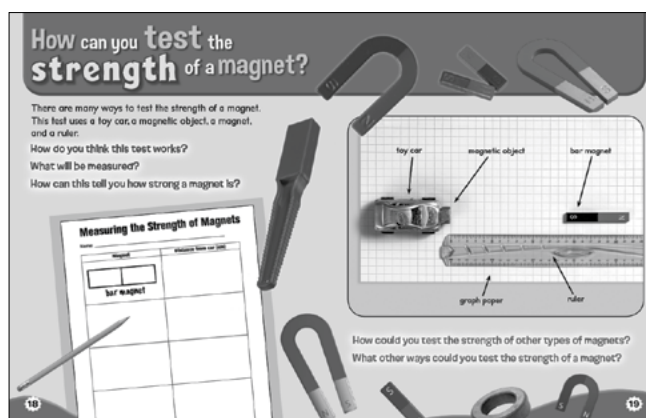


What Affects the Strength of Magnets?



Focus: Students explore the strength of various magnets and design an investigation to test how different conditions affect the force of magnets.

Specific Curriculum Outcomes

Students will be expected to:

- 43.0 identify conditions that affect the force of magnets [GCO 1/3]
- 14.0 propose an answer to an initial question or problem and draw a simple conclusion [GCO 2]

Performance Indicators

Students who achieve these outcomes will be able to:

- plan an investigation to identify and test one condition that affects the strength of magnets

NOTES:

Attitude Outcome Statements

Encourage students to:

- be open-minded in their explorations and investigations [GCO 4]
- consider their own observations and ideas when drawing a conclusion [GCO 4]

Cross-Curricular Connections

Math

It is expected that students will:

- construct, label, and interpret bar graphs to solve problems [3SP2]

English Language Arts

Students will be expected to:

- communicate information and ideas effectively and clearly, and to respond personally and critically [GCO 2]
- use writing and other forms of representation to explore, clarify, and reflect on their thoughts, feelings, experiences, and learnings; and to use their imagination [GCO 8]

Art

Students will be expected to:

- explore a range of art materials, processes, and vocabulary to develop art making skills [1.3.4]

Getting Organized

Components	Materials	Before You Begin	Vocabulary
• Student Magazine, pages 18–19 • BLM <i>Measuring the Strength of Magnets</i> • <i>What Is the Inquiry Process?</i> poster Literacy Place • <i>Magnetic Racetrack</i> (Shared Reading–Sequencing Strategy Unit)	• magnet, paper clip, glass of water • magnets of different shapes and sizes (e.g., bar, horseshoe, donut, ring) • variety of magnetic objects • various materials to act as barriers such as cardboard, paper, wood • various mediums such as sand or yogurt • humidifier or spray bottles • various craft materials to build magnetic racetracks and large pieces of cardboard (e.g., a pizza box)	• Gather craft materials and large pieces of cardboard (e.g., pizza boxes) for students to build magnetic racetracks.	• magnetic force

Science Background

- An important aspect of scientific investigation is to ensure that a test is fair—this is done by limiting tests to changing only one variable at a time.

Possible Misconceptions

- Many students believe that bigger magnets are always stronger than smaller ones. Provide a large, weak magnet and a small, strong magnet for students to test.

ACTIVATE

Change of Medium

Demonstrate using a magnet to lift a magnetic object, such as a paper clip, from the tabletop. Then repeat the demonstration using the same magnet to pull the same magnetic object from a glass of water. Invite students to observe any differences in the attraction between the magnet and the object in the two instances.

Class List

Remind students that because magnetism either pushes (repels) or pulls (attracts), it is a force. As a class, compile a list of conditions that might affect the magnetic force, or strength, of magnets. If not suggested by students, introduce the following conditions:

- the size or shape of the magnet
- type of magnetic material
- barriers between the magnet and the magnetic material (an object or material placed between the two)
- distance between the magnet and the magnetic material
- medium (e.g., air, water, yogurt, sand) surrounding the magnetic material
- humidity (moisture in the air)
- temperature (e.g., inside vs. outside)

CONNECT



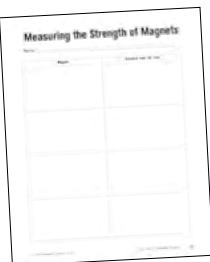
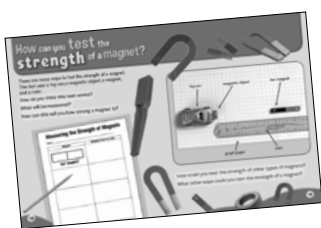
Investigation Set-Up

Have students examine pages 18–19 of the Student Magazine and clarify that this spread shows a set-up for an investigation. Ask:

- **What is this set-up testing?** (the strength of a magnet)
- **What condition is being tested?** (the distance at which the magnet attracts the car with the magnetic object attached)
- **How can this test reveal how strong a magnet is?**
- **Would this test work to test the strength of other types of magnets?**
- **What other ways could you test the strength of a magnet?**

Strong or Weak?

Provide a variety of magnets of different shapes and sizes. Invite students to design a procedure to test the strength of the different magnets. Have them record their results as they test the magnets. Students could create a



bar graph of their results. Encourage students to sequence the magnets from weakest to strongest.

If any students require assistance with this activity, have them follow the investigation shown on pages 18–19 of the Student Magazine and record their observations on BLM *Measuring the Strength of Magnets*.

Discuss students' observations and results in a whole-group discussion. Prompts might include:

- **Do all magnets have the same strength?**
- **How could you tell if one magnet was stronger than another?**
- **Which magnet was the strongest?**
- **Is the largest magnet always the strongest?**
- **Is the smallest magnet always the weakest?**

CONSOLIDATE



Testing Different Conditions

Challenge pairs or small groups of students to pose a question about how any one condition affects the strength of magnets. Questions will vary but they should be testable.

Students can refer to the list of conditions for ideas and plan an investigation. Review the *What Is the Inquiry Process?* poster with students. You may also display the following steps for students who need more assistance:

Step 1: Pose a question.

Step 2: Record your prediction.

Step 3: Draw a diagram to help you set up the investigation.

Step 4: List the materials you will need.

Step 5: Do your investigation and record the results in any way you'd like (e.g., sketches and jot notes or take digital photos).

Step 6: Draw a conclusion by answering the question you posed in the beginning.

As a class, discuss the various results and make conclusions about how each of the different conditions affects the force of magnets.



Literacy Place Connection:

Read or revisit *Magnetic Racetrack* with students. Discuss the activity together, then ask:

- Will the magnet work through the cardboard of the track to pull or push the car?
- What other materials could be used for the track (e.g., paper, wood, plastic, aluminum foil)?
- Do you think any of these materials would affect the strength of the magnet? Would the magnet still be able to pull or push the car along the track?
- How could we find out?

Start Your Engines!

Invite students to use what they have learned about affecting the strength of magnets to build their own magnetic racetrack and race their cars to the finish.

EXPLORE MORE

Magnetic Art

Students create art by placing a small amount of tempera paint on a sheet of construction paper. They then place a paper clip or other small magnetic object such as a metal nut or washer in the paint and move the object from below with a magnet.

Measuring the Strength of Magnets

Name: _____

Magnet	Distance from car (cm)