ACTIVITY 26

Magnetic Force

BROWARD COUNTY ELEMENTARY SCIENCE BENCHMARK PLAN

Grade 1—Quarter 3
Activity 26

SC.B.2.1.1
The student recognizes systems of matter and energy.

SC.C.1.1.2
The student knows that there is a relationship between force and motion.

SC.H.1.1.1
The student knows that in order to learn, it is important to observe the same things often and compare them.

SC.H.1.1.2
The student knows that when tests are repeated under the same conditions, similar results are usually obtained.

SC.H.1.1.3
The student knows that in doing science, it is often helpful to work with a team and to share findings with others.

SC.H.1.1.4
The student knows that people use scientific processes including hypothesis, making inferences, and recording and communicating data when exploring the natural world.

SC.H.2.1.1
The student knows that most natural events occur in patterns.

ACTIVITY ASSESSMENT OPPORTUNITIES

The following suggestions are intended to help identify major concepts covered in the activity that may need extra reinforcement. The goal is to provide opportunities to assess student progress without creating the need for a separate, formal assessment session (or activity) for each of the 40 hands-on activities at this grade level.

1. Tell students that one thing scientists do is repeat tests and compare their results. Ask, *What results did you compare when you did the tests in this activity?* (We compared how many paper clips in a chain were pulled by a magnet. We compared different distances between a paper clip and a magnet. We compared different materials that might block the pulling force of a magnet.) Ask, *What happens to magnetic force when a paper clip gets farther away from a magnet?* (The force gets weaker.)

2. Use the Activity Sheet(s) to assess student understanding of the major concepts in the activity.

In addition to the above assessment suggestions, the questions in bold and tasks that students perform throughout the activity provide opportunities to identify areas that may require additional review before proceeding further with the activity.

ACTIVITY 26

Magnetic Force

OBJECTIVES

Students learn how the strength of magnetic force is affected by certain materials and by an object's distance from the magnet.

The students

- observe that a magnetic force can pass through a paper clip to attract additional paper clips
- discover that a magnet's force becomes weaker as distance from the magnet's pole increases
- test different materials for their ability to stop a magnetic force from passing through

SCHEDULE

About 50 minutes

VOCABULARY

magnetic force

MATERIALS

For each student

1	Activity Sheet 26

For each team of four

1	magnet, bar, with poles labeled
10	paper clips, small
1	ruler

For the class

1 pc	aluminum foil
1 pc	cloth*
1	cup, plastic, 9-oz
1 sht	paper, plain, 8 ½" × 11"*
1	skillet, metal*
1	tongue depressor
1 pc	waxed paper

*provided by the teacher

PREPARATION

1. Make a copy of Activity Sheet 26 for each student.
2. Cut pieces of cloth, waxed paper, and aluminum foil into pieces about the size of the plain paper.

BACKGROUND INFORMATION

Students often think that magnetic force, like X rays and light, can be blocked by some materials. This is not true. A magnetic field begins on a magnet's north pole and must move to its south pole. However, the force produced by the field can be redirected around an object if that object is surrounded by other, more magnetic materials. The magnetic force then flows along this material and avoids the object before returning to the magnet's other pole. It can be said that the material that surrounds the object is acting as a magnetic shield. Lead, a material that is often used to shield a person from dental X rays, is not a good magnetic shield.

The force of a magnet is affected by distance from the magnet. Magnetic force decreases with the square of the distance between the magnet and the object on which it acts. Thus, force decreases rapidly as an object moves farther away from a magnet.

▼ **Activity Sheet 26**

Magnetic Force

1. Where does the magnetic force become too weak to attract the paper clip? Measure the distance between the magnet and the paper clip.

_____ in. Answers will vary, but the distance will be relatively short.

2. Count the number of paper clips that stick to a bare magnet. Then count the number of paper clips that stick to the magnet with each material between the magnet and the paper clips.

Answers will vary.

Material	Number of paper clips that stick to bare magnet	Number of paper clips that stick to magnet through material
Plastic cup		
Paper		
Waxed paper		
Aluminum foil		
Cloth		
Wood		
Skillet		

Guiding the Activity

1 Distribute a bar magnet, 10 paper clips, and a ruler to each group. Instruct students to put the paper clips on the desk, hold the magnet horizontally with one hand, and stick a paper clip on one pole of the magnet as they did in Activity 25. Tell them to pick up a second paper clip and carefully try to stick it onto the dangling end of the first paper clip. Have students continue to add paper clips to the chain until no more clips are attracted to it. Ask, **Why do you think the paper clips were able to stick to each other?**

Explain that the paper clips stuck to each other because the pulling force of the magnet moved from the magnet into the first paper clip, then into the second paper clip, and into each additional paper clip until it became too weak to attract another paper clip. Write the term *magnetic force* on the board. Tell students that the pull of a magnet is called its **magnetic force**.

Additional Information

Accept all answers.

Guiding the Activity

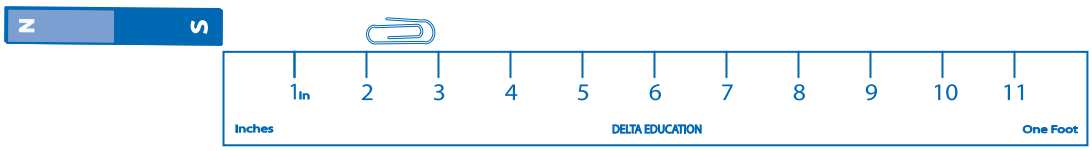
Additional Information

2 Distribute a copy of **Activity Sheet 26** to each student. Have students put the magnet on the desk and place a paper clip about one-half inch away from one pole of the magnet. Ask, **Is there a magnetic force from the magnet near the paper clip? How do you know?**

There should be a strong magnetic force from the magnet at this distance. The paper clip should "jump" onto the magnet.

Instruct students to move the paper clip so it is 1 inch from the pole. Again ask if there is a magnetic force from the magnet near the paper clip. Have students move the paper clip progressively farther away from the magnet. When the paper clip is no longer attracted to the magnet, have students note the distance from the magnet pole to the paper clip and record it in question 1 of the activity sheet.

If students place the ruler on the desk with the magnet's end at zero, they will be able to note the distance from the pole to the paper clip throughout the activity. Refer to Figure 26-1.



▲ ***Figure 26-1.*** *The magnet and paper clip should be placed above the ruler so distance can be measured easily.*

Explain that forces can push or pull from a distance. Tell students that they have just observed that magnetic force gets weaker and weaker as the paper clip moves farther away from the magnet's pole.

Collect the paper clips, rulers, and magnets.

3 Set up seven activity stations with a magnet, ten paper clips, and one of the seven materials at each station.

Ask, **If you hold a piece of paper between a magnet and a paper clip, do you think the magnet will still attract the paper clip?**

Accept all answers.

Guiding the Activity

4 Tell students that they are going to test seven different materials to see if a magnetic force can move through them. Explain that each team will visit seven stations. Students will first test the bare magnet to see how many paper clips it can pick up. Then students will test the material at each station to see if the magnetic force moves through it from the magnet to the paper clips. Students should count the number of paper clips that are picked up with the bare magnet and through each material and record the numbers in the data chart on the activity sheet. Give students the following specific instructions.

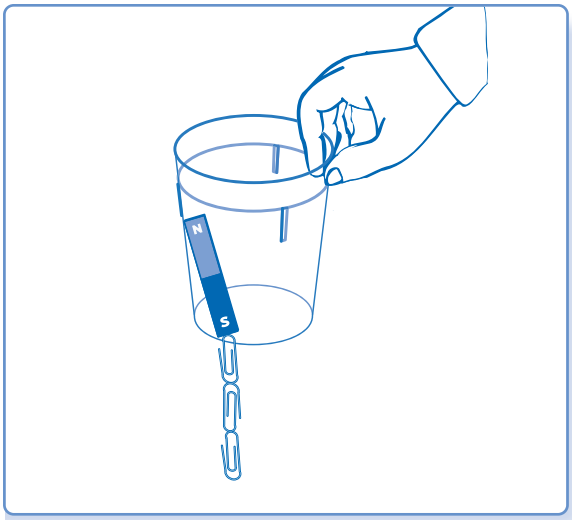
To test the plastic cup: Put the magnet *inside* the cup. Scatter the 10 paper clips on the desk. Move the cup containing the magnet over the paper clips to gather them up. Students can count the number of clips stuck to the outside of the cup. See Figure 26-2.

To test paper, cloth, foil, and waxed paper: Spread out the 10 paper clips on the desk in a small area. Cover them with the piece of paper, cloth, or foil. Slide the magnet around on top of the paper to gather up the paper clips under the paper. Slide them to one area, look under the paper, and count the clips that have stuck.

To test wood (a tongue depressor): Line up the 10 paper clips in a row on the desk and cover them carefully with the tongue depressor. Slide the magnet around on the tongue depressor to gather up the paper clips. Slide them to one end, look under the tongue depressor, and count the clips that have stuck.

To test metal (a skillet): Spread out the 10 paper clips on the desk in a small area. Cover them with the metal skillet. Place the magnet inside the skillet, and slide the skillet around to gather up the paper clips. Look under the skillet and count the paper clips that have stuck.

Additional Information



▲ ***Figure 26-2.*** *A magnet inside a plastic cup can gather up paper clips outside the cup.*

Guiding the Activity

	Additional Information
5 After students have visited all seven stations and recorded their data, call them together. Ask, **What did you learn about stopping magnetic force?**	*Students should say that magnetic force cannot be stopped by any of the materials they tested.*
Ask, **What can you conclude about how magnetic force changes as you move farther away from a magnet?**	*Students should say that the magnetic force gets weaker as you move farther away from a magnet.*

Reinforcement

Have students repeat the experiment using materials of their choice. For example, they can test paper toweling, cardboard, or multiple sheets of paper. Be aware, though, that when testing many sheets of paper or other thick materials, the distance from magnet to paper clips plays a more important role than the material being tested.

Science Journals

Have students place their completed activity sheets in their science journals.

Cleanup

Have students discard the foil, paper, and waxed paper. Magnets, paper clips, and all other materials should be returned to the kit.

Connections

Science Extension

Students can make a device that tests the ability of various materials to stop a magnetic force. Stopping a magnetic force is called magnetic shielding. Have students make a shielding device as follows. Attach two pencils or dowels to the long edges of a piece of cardboard about 5 cm × 7 cm. Attach a second piece of cardboard the same size to the pencils or dowels. Tape a magnet onto the top piece of cardboard near an edge. Bring the paper clips up to the bottom of the "shielding sandwich" one at a time. Students will observe that the paper clips are attracted to the magnet and will hang from the bottom of the cardboard sandwich. Now, insert a popsicle stick into the sandwich and observe what happens. (The paper clips should not be affected.) Remove the popsicle stick, and insert a metal butter knife. Move the knife from side to side and observe. The paper clips should fall off. The magnetic force coming from one pole of the magnet does not pass through the metal knife. Instead, it moves down the metal knife and re-enters the magnet at the other pole. The knife acted as a magnetic shield. Have students test other materials by inserting them into the sandwich.

Science Challenge

The hidden magnet game is an interesting way to show students that a magnet can exert a force at a distance, acting through a material such as paper. Tape a magnet inside each of several empty boxes or milk cartons. Tape the cartons shut once the magnets have been secured inside. The point of hiding the magnets is to develop the idea that knowledge can be gathered from indirect evidence. Number the cartons. Have groups try to find where the magnet is located in each box.

Science and Health

Tell students that magnetic force has been used for thousands of years to relieve pain in humans and horses. Have students see if they can find ads for jewelry that contain magnets. Have them design a piece of jewelry that contains a magnet. The jewelry may be a necklace or bracelet, or it may be something that attaches to another part of the body. Encourage students to be creative.

Science and Language Arts

Have students make small two-dimensional puppets to represent the characters in a story. Tape or glue a magnet to the back of each puppet. Draw a background scene for the story on a sheet of thin cardboard. Place the puppets on the cardboard so that the cardboard can be supported with a few students able to work the puppets with other magnets. Have the students move the puppets to where they have to go during different parts of the story. It might be easier if the students working the puppets from behind the cardboard had a tracing on the back of the cardboard of the things in the background scene on the front so they have a better idea of where to place the puppets.