Magnets:
Distance of Attraction

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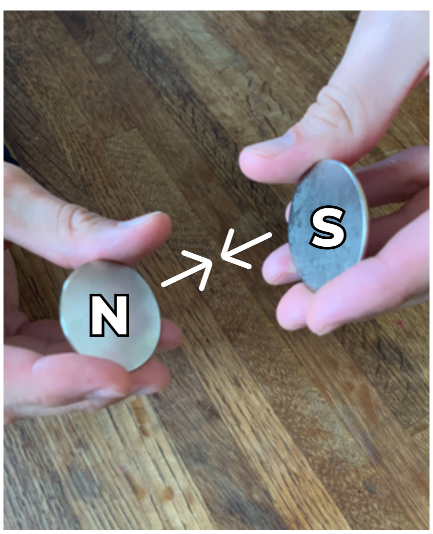
With this experiment, you will measure the greatest distance of attraction of a magnet. We can see how strong a magnetic field is and gather data about how it changes depending on the magnet type.

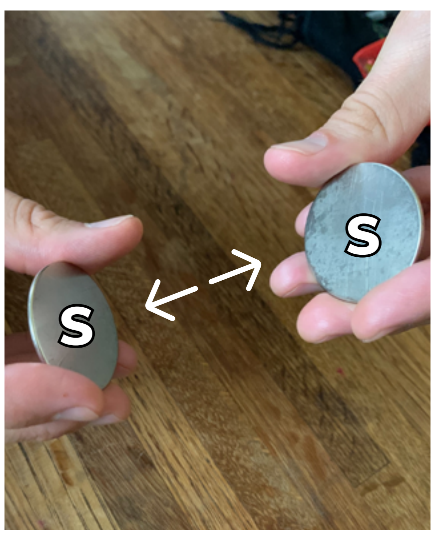
We will see how big the magnetic field is around that magnet by how long it can hold on to the paperclip.

The Push & Pull of Magnets

Magnets are really cool; they have **Polarity**. That means they have a plus side and a minus side, but we call it the North and South poles. The North Pole will *only* attract or stick to the South Pole. If two North poles, or two South poles touch, they push away from each other. When they stick, they "Attract" and when they push away they "Repel."

So, when we do our experiment and need our two magnets to stick together we'll want to be sure they have North and South sides touching. You'll know if they don't stick!





STEM Skills:

- Magnetic force
- Problem solving

Experience Level:

Grades 3–5
(Students can also work in teams.)

Duration:

30–60 Minutes

Supplies:

- String (approx. 6 inches per team)
- Paperclip, metal (1 per team)
- Scotch tape
- Plastic or wood ruler (1 per team)
- Magnets (various sizes and shapes, 4 different ones per team)
- Distance of Attraction Worksheet (1 per student)

Additional Resources:

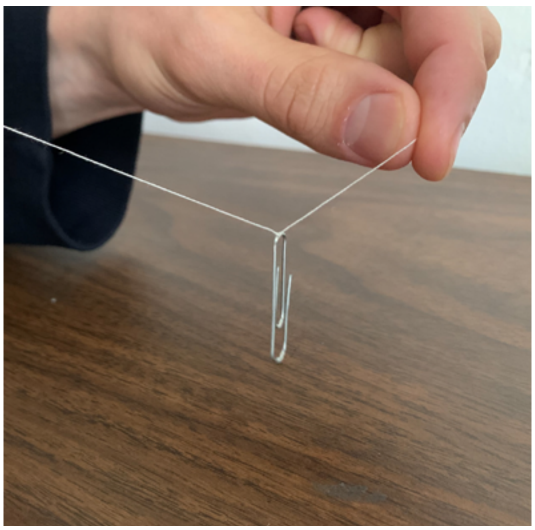
- Magnet Maze Activity

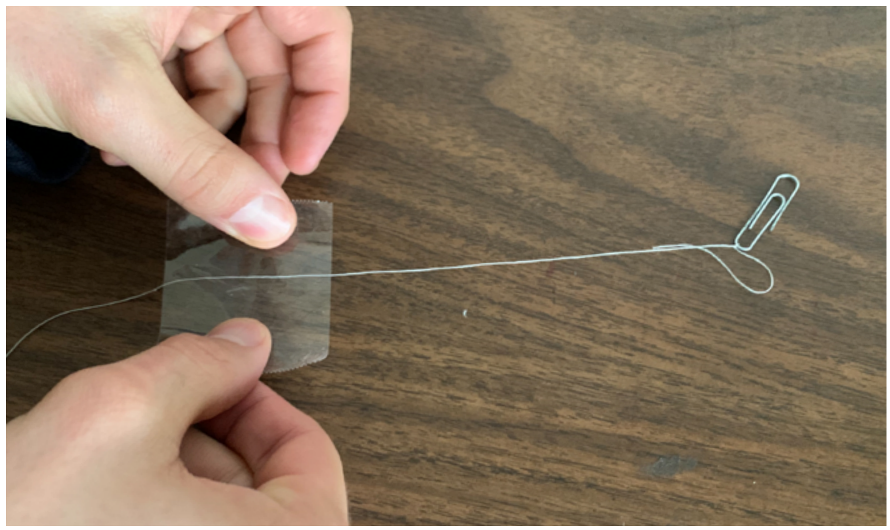
A few hints for your experiment:

- Make sure to keep the pile of magnets away from your paper clip!
- Plastic or wood rulers work best for this experiment; metal rulers may become magnetized making it tricky to get accurate readings.
- When you measure, you want to keep your ruler **perpendicular** to the table. Perpendicular means at a right angle to the table.

The Experiment

1) **Tie** one end of a string to a paperclip. **Tape** the other end of the string to a desk.



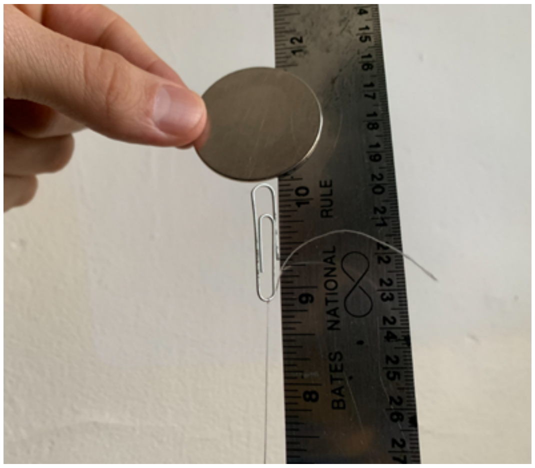


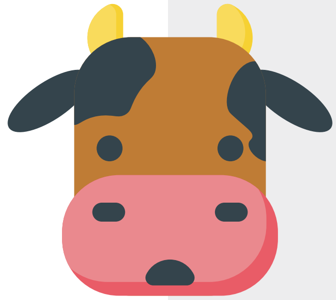
2) **Hold a ruler**, as shown, near the tape.

Fun Fact: The earth is one big magnet, but its magnetic field is about 1,000 times weaker than a typical bar magnet.

This magnetic field is what causes a compass to point North.

3) **Use one magnet.** Touch it to the paperclip. Pull the paperclip up the ruler until the string and paperclip are straight up.





Fun Fact: Some farmers give their cows a magnet to swallow. This magnet attracts any metal pieces that a cow may accidentally eat, and prevents that metal from harming the rest of the cow's digestive system.

4) **Measure** the height at the top of the paperclip. **Record** it in Row 2 of the chart in your worksheet.

5) Slowly move the magnet up away from the paperclip. In Row 1 of the chart, **record** the height of the magnet when the paperclip falls.

6) **Subtract Row 2 from Row 1** to find the magnet's greatest distance of attraction.

7) **Repeat** the test using additional or different magnets. Continue to record the results.

What would happen if you used several magnets stuck together?

Things to think about:

- Which magnet had the greatest distance of attraction?
- How did adding magnets change the distance of attraction?
- Why were the magnets able to hold up the paperclip without touching it?
- Do you think magnets can work through solids, such as paper, plastic, or glass? Why?

Magnets Worksheet: Distance of Attraction

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Name ______________________________

Magnets Tested:
(Draw and describe them.)

Magnet 1	Magnet 2
________ ________ ________	________ ________ ________

Magnet 3	Magnet 4
________ ________ ________	________ ________ ________

Instructions

1) **Tie** one end of a string to a paperclip. **Tape** the other end of the string to a desk.

2) **Hold a ruler** near the tape, perpendicular to the desk.

3) **Use one magnet.** Touch it to the paperclip. Pull the paperclip up the ruler until the string and paperclip are straight up.

4) **Measure** the height at the top of the paperclip. **Record** it in Row 2 of the chart in your worksheet.

5) Slowly move the magnet up away from the paperclip. In Row 1 of the chart, **record** the height of the magnet when the paperclip falls.

6) **Subtract Row 2 from Row 1** to find the magnet's greatest distance of attraction.

7) **Repeat** the test using additional or different magnets. Continue to record the results.

Magnet Type or How Many Magnets *(Draw it!)*				
Height of magnet when the paperclip fell				
Height at the top of the paperclip				
Magnet's greatest distance of attraction				

8) **Share** your data with other teams.

9) **Analyze Data:** Use your data and data from other teams to make a bar graph. (See next page.)

Distance of Attraction: Bar Graph

Greatest Distance of Attraction									
Draw magnet type									
2 Inches									
1 ¾ Inches									
1 ½ Inches									
1 ¼ Inches									
1 Inch									
¾ Inch									
½ Inch									
¼ Inch									
	1 Magnet				2 or More Magnets				

10) **Compare:** What was the greatest distance of attraction?

11) **Conclude:** How did adding magnets change the distance of attraction?

12) **Draw Conclusions:** Why could the magnets hold up the paperclip without touching it?

13) **Infer:** Do you think magnets can work through solids, such as paper, plastic, or glass? Why?