

Magnetic field lines



**ASSIGN
BUSTER**

Student Exploration: Magnetism Vocabulary: attract, bar magnet, ferromagnetic, magnetize, North Pole, repel, South Pole Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. What happens when you place two magnets close together? It depends on the sides when the two North Pole sides are meant then they get pulled together. And if it should be the opposite way then they will move each other away.

2. What objects do magnets stick to? Make a list iron and steel, zinc, gold nickel, copper, and brass.

3. What do these objects have in common? They are all made of metal and are so magnetized to the objects shown above this answer. Gizmo Warm-up: What is attracted to magnets? A bar magnet is a simple rectangular magnet. If you hang a bar magnet by a string, the north pole (N) of the magnet will tend to point north while the south pole (S) of the magnet points south.

1. Look at the materials at the bottom of the Gizmo™. Which ones do you think will stick to a bar magnet? Nickel, and Iron.

2. Ferromagnetic materials are strongly attracted to magnets. Drag a bar magnet and the piece of nickel onto the scribbled line. Press Play ([pic]). A. Is nickel ferromagnetic? Yes B. How do you know? The atoms in ferromagnetic materials like to align their magnetic dipoles with the external field.

3. Test copper, wood, glass, and iron. Which ones are ferromagnetic?

Question: How do magnets interact?

1. Observe: Drag two bar magnets onto the paper and press Play. Then click Reset. Change one of the magnets (either from N-S to S-N, or vice-versa). Click Play again. A. What happened the first time? They move apart B. What happened the second time? They still move apart.

2. Form hypothesis: Magnets are either pulled together (attracted) or pushed apart (repelled). Based on what you have seen, when are magnets attracted and when are they repelled?

North poles are attracted to south poles, but like poles repel. Two north poles or two south poles will invariably push against each other.

3. Predict: Based on your hypothesis, which pairs of magnets will be attracted to each other? Which will be repelled? Record your predictions below. (Leave the result blank for now.)

4. Run Gizmo: Test your predictions using the Gizmo. Record your results in the table.

5. Draw conclusions: Fill in each blank below with the correct word. A. The south pole of a magnet is attracted to the north pole of another magnet. B. The south pole of a magnet is repelled by the south pole of another magnet. C. The north pole of a magnet and the north pole of another magnet will move apart of each other.

Question: If you scatter iron filings (little slivers of iron) around a magnet, you will see a pattern of magnetic field lines. What do these lines show you?

1. Observe: Drag one magnet onto the paper. Click Sprinkle filings and then Tap table five or six times. Sketch the pattern you see in the box: What do you notice about the iron filings? They make lines that connect the North Pole and the south pole of the magnet.
2. Observe: Drag a second magnet next to the first. Click Sprinkle filings and then click Tap table several times. Sketch what you see. Will these magnets be attracted or repelled? Poles that “ face each other” are one N and one S, as shown, the magnets will be attracted
3. Observe: Now switch one of the magnets. Click Sprinkle filings and then click Tap table several times. Sketch what you see. Will these magnets be attracted or repelled? If the poles that “ face each other” are either S’s or both N’s, as shown, the magnets will be repelled.
4. Draw conclusions: Compare the magnetic field lines you have sketched. How can you use the field lines to tell if magnets will be attracted or repelled? If the field lines connect one magnet to the other, the magnets will attract. If the field lines do not connect one magnet to the other, the magnets will be repelled.
5. Extend your thinking: Observe the magnetic field lines produced by an N-S magnet and the mystery magnet. Will these magnets attract or repel each other? First, make a prediction below. Then, check your answer on the Magnetic forces tab.

Question: Why do magnets attract certain materials?

1. Observe: Click Sprinkle filings and then click Tap table several times. Look closely at the filings near the copper bar. Does copper have any effect on the filings? _No there won't be any magnet field because copper isn't ferromagnetic.

2. Observe: Repeat the experiment with iron. What effect does iron have on the filings? Iron bends the filings around it like a magnet would. Magnetic field lines also connect the iron bar to the magnet. 3 The Iron does have a small magnetic field contains a ferromagnetic force.

3. Analyze: Which of these materials is ferromagnetic? Iron

4. Draw conclusions: How can you tell if an object is ferromagnetic by looking at its field lines? Discuss your answer with your teacher and classmates.

When they are next to a magnet, ferromagnetic materials create magnetic field lines just like a magnet, although not as strong.

5. Apply: Select the Magnetic forces tab and experiment with the Gizmo. Try to answer the questions below. Share your findings with your classmates and teacher. A. Can a magnet ever repel a ferromagnetic material? No B. In the Gizmo, does one ferromagnetic material attract another? No

6. Experiment (optional): When a ferromagnetic material like iron is placed near a magnet, it becomes magnetized—it actually becomes a magnet! (Look at the field lines when iron is near a magnet.) Even after the magnet is removed, iron can stay magnetized for a while. In “ real life” (not in the Gizmo), rub a metal paper clip with a magnet. What happens when you touch another paper clip with your magnetized paper clip? . The paper clips

are attracted to one another because the permanent magnet temporarily aligns the magnetic domains in the clips, making them magnetic.