

Background Information

A magnet exerts a force in the region around itself called a magnetic field. Lines of force within the magnetic field reflect the strengths and directions of the forces within the field. The lines of force are invisible but their effect on certain materials, such as iron filings, can be observed. Iron filings line up along the field lines of a magnetic field, allowing you to see where the field lines are and the strength and direction of the magnetic field. The closer together lines of force are to each other, the stronger is the magnetic field.

Problem

What is the shape of the magnetic field around a magnet?

Goals

In this investigation, you will investigate the lines of force of a magnetic field surrounding a bar magnet.

Materials

2 small bar magnets
iron filings

sheet of thick paper
string

Procedure

- 1. Observe** Work with a partner. Obtain a bar magnet. Hang the magnet from a string. Describe what happens.
2. Bring the north pole of the other magnet near the north pole of the magnet on the string, describe what happens.
3. Bring the south pole of the other magnet near the north pole of the magnet on the string, describe what happens.
4. Place the sheet of thick paper over a bar magnet. Sprinkle iron filings on the paper and tap it. Observe what happens to the filings.
5. On a separate sheet of paper, draw the magnet and the field lines you see. Label your drawing of the magnet with the locations of the north and south poles. Then, pour the filings back into their containers.
6. Place a second bar magnet under the paper and in a line with the first magnet. Do so in such a way that two unlike poles of the magnets are close together, but not so close that the magnets touch. Again, sprinkle the paper with filings and observe what happens.
7. Draw your observations on a separate sheet of paper. Then, pour the filings back into their container.
8. Turn one of the two magnets around so that the two like poles are close together. Place the paper over the magnets and sprinkle with the iron filings. Observe and draw what happens to the filings.
9. Draw your observations on a separate sheet of paper. Then, pour the filings back into their container.

Observations

1. Describe the pattern formed by the iron filings sprinkled over a single bar magnet.
2. Describe the pattern formed by iron filings sprinkled over two magnets whose opposite poles were close together.
3. Describe the pattern formed by iron filings sprinkled over two magnets whose like poles were close together.

Analysis

- 1.** What did the patterns formed by the iron filings show about the field lines of the bar magnets?
- 2.** What are the start and end points of the field lines, as indicated by the filings? Did any of the lines cross each other?
- 3.** Where are the field lines of the bar magnet closest together? What does this mean about the field there?
- 4.** What happens to the distance between the field lines at greater distances from the magnet? What does this mean about the field?
- 7.** Given what you know about attraction and repulsion, and what you have learned about the field lines what is happening to the magnets when unlike poles of magnets are close together and when like poles are close together?