Magnetism

Name: ________________________ **Date: ___________**

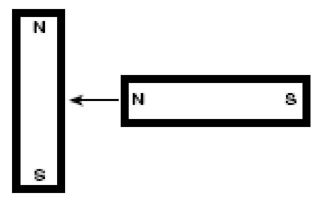
<u>Purpose:</u> Investigate the properties of the field surrounding a magnet and elate distance and field strength of a magnet.

<u>Material:</u> 2 bar magnets with labeled poles, aluminum foil strips, cardboard, 1 sheet, compass, 1.8 cm Diameter, graph paper, iron filings in a shaker, paper, paper clips, plastic pen, plastic cup, rubber band, metric ruler, scissors, staples

The Nature of Magnets - Part I

<u>Procedure:</u>

1. In each hand, hold a bar magnet by its center. Point the ends labeled *N* toward each other. Slowly move them close together, but do not let them touch. Observe what happens, and record your observations in your notebook.
2. Point the ends labeled *S* toward each other. Slowly move them close together, but do not let them touch. Observe what happens, and record your observations in your notebook.
3. Still holding the magnet by its center, rotate one magnet 180° and point the N end toward the S end of the other magnet. Slowly move the magnets close together, but do not let them touch. Observe what happens and record your observations in your notebook.
4. Rotate one magnet 90° so that the magnets are perpendicular to one another, as shown. Point the N end of one magnet toward the center of the other magnet. Observe what happens, and record your observations.
5. Repeat step 4, pointing the N end of one magnet toward several different points along the side of the other magnet. Observe what happens, and record your observations in your notebook.
6. Repeat steps 4–5, pointing the S end of one magnet toward the center of the other magnet. Observe what happens, and record your observations in your notebook.
7. Move one end of the magnet toward a paper clip. Observe what happens, and record your observations in your notebook.
8. Repeat step 7 with a variety of different objects, including a plastic cup, a pen, staples, aluminum foil, a rubber band, a pair of scissors, and paper.



Observations:

Questions:

A. Do the magnets have to be in contact to interact?

B. Was the interaction stronger between the magnets when they were perpendicular or when the magnets were held with their ends facing one another?

C. Which ends of the magnet repelled one another?

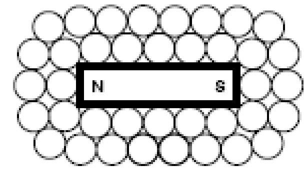
D. Which ends of the magnets attracted one another?

E. Classify the objects that were attracted and repelled by the magnet. Whatdid the objects attracted to the magnet have in common?

Mapping a Magnetic Field – Part II

Procedure

9. Place a sheet of paper on a nonmetallic tabletop. Place a bar magnet in the center of the paper so that the N end of the magnet points to the right. Make sure that the magnet is far away from any other magnets. Trace around the magnet and label the ends *N* and *S* on the paper.
10. Place a small compass on the paper beside the magnet. Trace a circle around the compass with a pencil.
11. Move the compass to a new position beside the magnet, and repeat step 10. Continue until you have traced a pattern of circles around the magnet as shown.
12. Move the compass far away from the magnet. Observe which way the needle points.



13. Place the compass in one of the circles on the paper. Mark the edge of the circle to indicate the direction that the needle points. Remove the compass. Draw an arrow in the circle to represent the position of the compass needle. The tip of the arrow should touch the mark on the edge of the circle, and the tail of the arrow should pass through the center of the circle.
14. Repeat step 13 until all the circles contain arrows.

Questions:

F. Does the compass needle always point the same direction?

G. Does the compass needle always point to the same end of the magnet?

H. Which end of the bar magnet does the compass needle point toward? Which end of the bar magnet does the needle point away from?

I. What kind of force causes the compass needle to change direction, a contact force or a field force?

The Shape of a Magnetic Field – Part III

Procedure

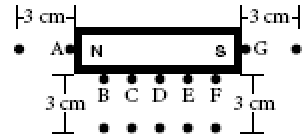
15. Place the bar magnet on a nonmetallic tabletop. Make sure that the magnet is far away from any other magnets. Place a sheet of cardboard on top of the bar magnet so that the magnet is under the middle of the cardboard. Support the cardboard at the edges with rectangular erasers so that it remains level. Place one sheet of paper on top of the cardboard.
16. Carefully sprinkle iron filings on top of the paper over and around the magnet.
17. Carefully tap the cardboard a few times. When the filings settle into position, observe the pattern formed.
18. Draw the pattern of iron filings in your lab notebook.

Questions:

J. Compare the pattern made by the iron filings with the pattern of the arrows made by the compass needle. Does the iron-filing pattern have any relationship to the pattern of the arrows?

K. Did it require a force to move the iron filings into position? If so, was it a contact force or a field force?

The Strength of a Magnetic Field – Part IV



Procedure

19. Place a sheet of graph paper on a nonmetallic tabletop. Place a bar magnet in the center of the graph paper. Make sure that the magnet is far away from any other magnets.
20. On the graph paper, mark positions next to the magnet, as shown. Label these positions A–G.
21. Move a compass to each position on the graph paper. Observe how quickly the compass needle moves at each position. Using the words *strong*, *medium*, and *weak*, label how the force that moves the compass needle varies at each position.
22. On the graph paper, measure and mark a distance of 3.0 cm from each marked position, as shown.
23. Place a paper clip on a position marked 3.0 cm from the magnet. Point the end of the paper clip toward the magnet.
24. Slowly move the magnet toward the paper clip until the paper clip begins to move toward the magnet. Mark the position of the magnet on the paper. Using appropriate SI units, measure the distance the magnet was from the paper clip. Record the measurements in your lab notebook.
25. Repeat steps 23–24 for each position marked 3.0 cm from the magnet.

Questions:

L. Is the strength of the force the same everywhere, or does it vary along the length of the magnet? Explain.

M. Is the force that caused the paper clip to start moving a contact force or a field force?