Name _____ Section _____ Date _____

CONCEPTUAL PHYSICS	Activity

Seeing Magnetic Fields

Purpose

To explore the patterns of magnetic fields around bar magnets in various configurations

Apparatus

3 bar magnets
iron filings and paper or a magnetic field projectual (iron filings suspended in oil encased in an acrylic envelope)

Discussion

An electric field, as we have learned, surrounds electric charges. In a similar way, a magnetic field surrounds magnets. (Magnetic fields surround other things, too, as we'll learn later.) In this activity, we'll examine the magnetic fields surrounding bar magnets. Although the fields can't be seen directly, their overall shape can be seen by their effect on iron filings.

Procedure

Step 1: Place a bar magnet on a horizontal surface such as your tabletop. Use the iron filings to see the pattern of the magnetic field.

PART A: IRON FILINGS AND PAPER METHOD

Cover the magnet or magnets with a sheet of paper. Then sprinkle iron filings on top of the paper. Jiggle the paper a little bit to help the iron filings find their way into the magnetic field pattern.

PART B: PROJECTUAL METHOD

Step 1: Mix the iron filings by rotating the projectual. Use the glass rod inside the projectual to help stir the iron filings into a fairly even distribution. Hold the projectual upside down for several seconds before placing it on the magnet or magnets. Take care not to scratch the surface of the projectual by moving it across the magnets once it is in place.

Sketch the field for a single bar magnet in Figure 1.

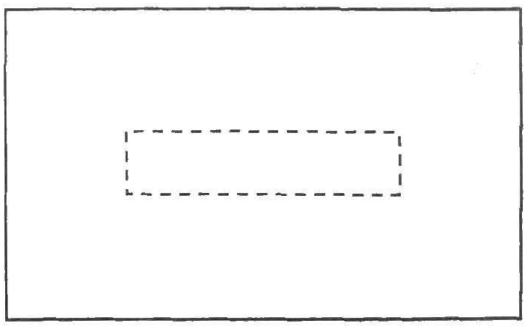

Figure 1

Step 2: Arrange two bar magnets in a line with opposite poles facing each other. Leave about 1 inch between the poles. Use the iron filings to see the pattern of the magnetic field. Sketch the field for opposite poles in Figure 2.

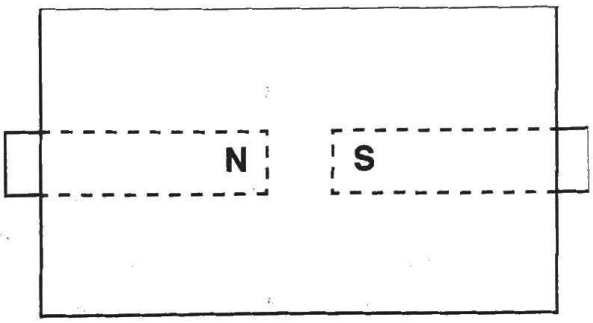

Figure 2

Step 3: Arrange two bar magnets in a line with north poles facing each other. Leave about 1 inch between the poles. Use the iron filings to reveal the magnetic field. Sketch the field for north poles in Figure 3.

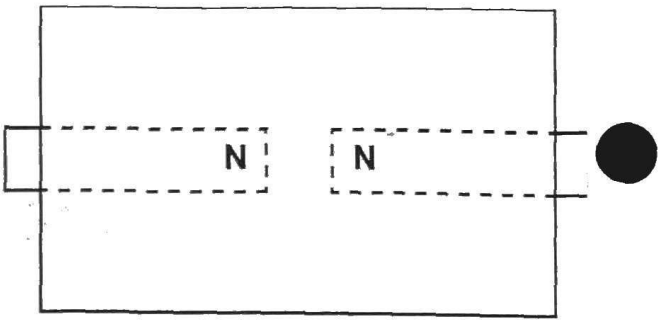

Figure 3

Step 4: Predict the pattern for the magnetic field of two south poles facing each other as shown in Figures 4.a and 4.b. Make a ***predictive*** sketch in Figure 4.a. Then arrange two bar magnets in a line with south poles facing each other. Leave about 1 inch between the poles. Use the iron filings to reveal the magnetic field. Sketch the ***observed*** field for south poles in Figure 4.b.

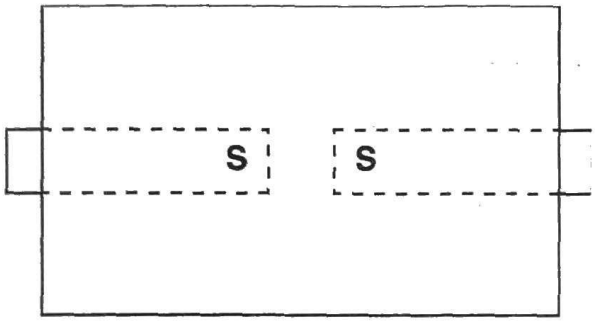

Figure 4.a

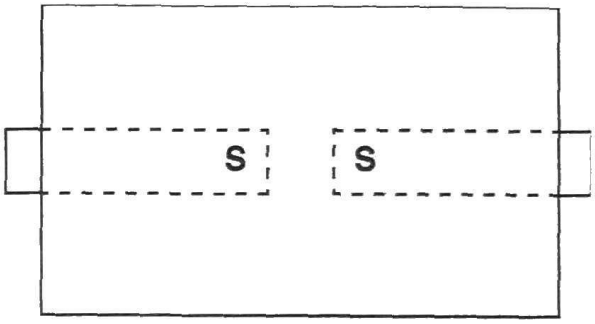

Figure 4.b

Step 5: Predict the pattern for the magnetic field of two bar magnets parallel to each other as shown in Figures 5.a and 5.b. Make a ***predictive*** sketch in Figure 5.a. Then arrange two bar magnets parallel to each other. Use the iron filings to reveal the magnetic field. Sketch the ***observed*** field for two magnets parallel to each other in Figure 5.b.

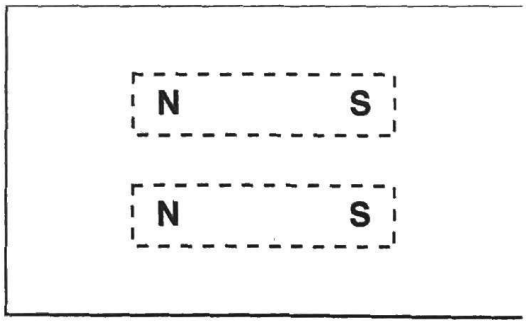

Figure 5.a

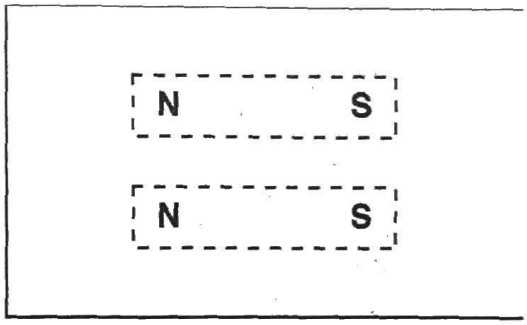

Figure 5.b

Step 6: Predict the pattern for the magnetic field of two bar magnets anti-parallel to each other as shown in Figures 6a. and 6.b. Make a ***predictive*** sketch in Figure 6.a. Then arrange two bar magnets anti-parallel to each other. Use the iron filings to reveal the magnetic field. Sketch the ***observed*** field for two magnets parallel to each other in Figure 6.b.

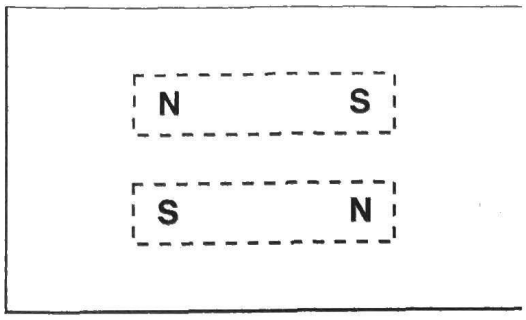

Figure 6.a

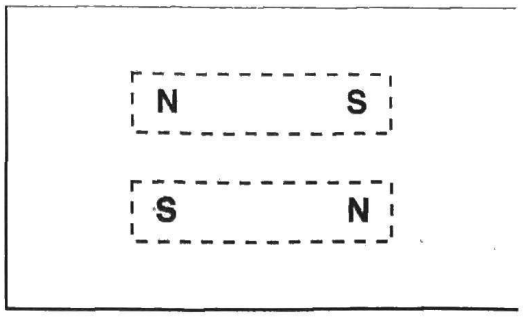

Figure 6.b

Step 7: Can you arrange three bar magnets to create the magnetic field shown in Figure 7? If so, how? Is there more than one way to do it?

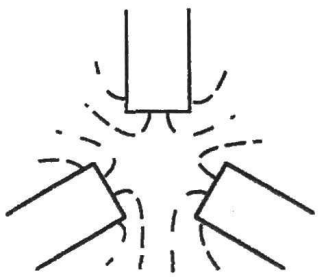

Figure 7

a. Does this pattern show attraction or repulsion?

Step 8: Can you arrange three bar magnets to create the magnetic field shown in Figure 8? If so, how? Is there more than one way to do it?

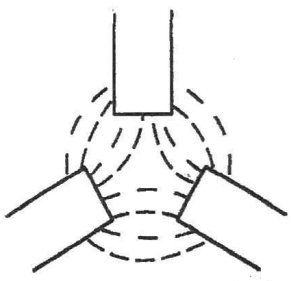

Figure 8

a. Does this pattern show attraction or repulsion?

Summing Up

1. Suppose you see a magnetic field pattern as shown in Figure 9. Can you say for sure which pole is north and which pole is south?

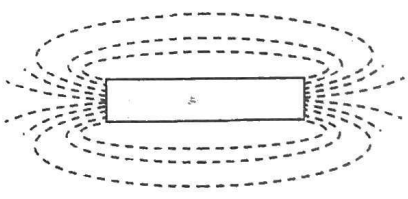

Figure 9

2. Suppose you see a magnetic field pattern as shown in Figure 10. Can you say for sure which pole is north and which pole is south?

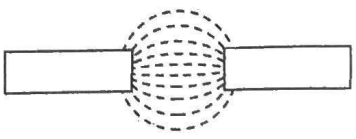

Figure 10

3. Suppose you see a magnetic field pattern as shown in Figure 11. If pole A is a north pole, what is pole B?

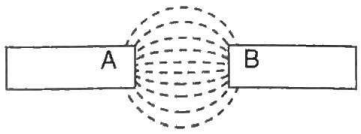

Figure 11

4. Suppose you see a magnetic field pattern as shown in Figure 12. If pole C is a north pole, what is pole D?

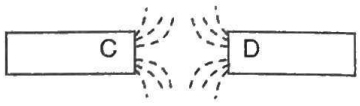

Figure 12

5. Suppose you see a magnetic field pattern as shown in Figure 13. If pole E is a north pole, what are poles F, G, H, I, J, K, and L?

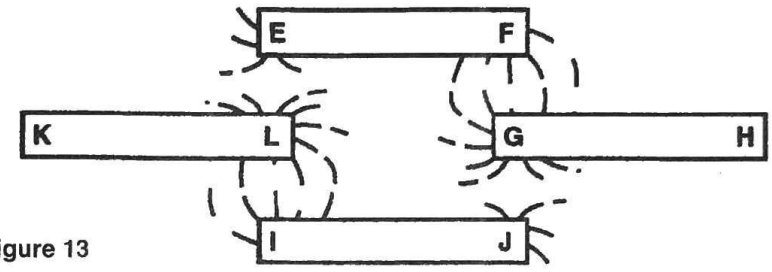

Figure 13

Pole E: North Pole F:_____ Pole G:_____ Pole H:_____

Pole I:_____ Pole J:_____ Pole K:_____ Pole L:_____

6. Which of the patterns in Figure 14—if either—is/are possible using three bar magnets?

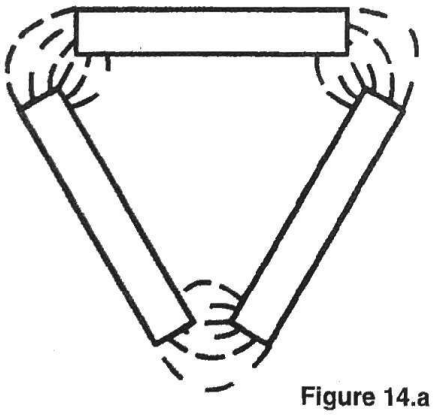

Figure 14.a

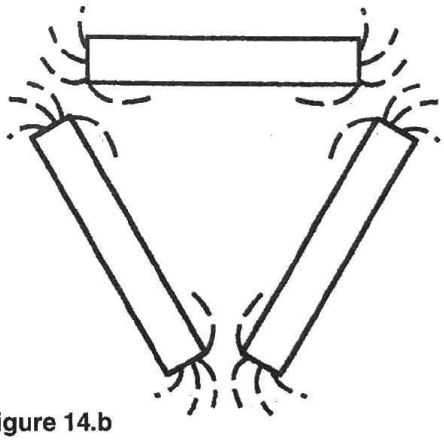

Figure 14.b