

**Chapter 36: Magnetism****Magnetic Field Lines****97****3-D Magnetic Field****Purpose**

To explore the shape of magnetic fields

**Required Equipment/Supplies**

2 bar magnets

iron filings

strong horseshoe magnet

sheet of clear plastic

5 to 10 small compasses

jar of iron filings in oil

paper

**Discussion**

A magnetic field cannot be seen directly, but its overall shape can be seen by the effect it has on iron filings.

**Procedure**

**Step 1:** Vigorously shake the jar of iron filings. Select the strongest horseshoe magnet available. Place the jar over one of the poles of the magnet and observe carefully. Place the jar at other locations around the magnet to observe how the filings line up.

1. What happened to the iron filings when they were acted upon by the magnetic field of the magnet?

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**Step 2:** From all your observations, draw a sketch showing the direction of the magnetic field all around your magnet, as observed from the side. Also, draw a sketch as viewed from the end of the magnet.

*Sketch magnetic field.*

Observe orientation of compasses.

**Step 3:** Obtain two bar magnets and 5–10 small compasses. Note which end of each compass points toward the north. As you proceed with the activity, represent each compass as an arrow whose point is the north-pointing end.

Trace magnetic field lines.

**Step 4:** Trace one of the bar magnets on a piece of paper. Move the compasses around the magnet, and use arrows to draw the directions they point at each location. Link the arrows together by continuous lines to show the magnetic field.

Sketch magnetic field lines.

**Step 5:** Obtain a small quantity of iron filings and a sheet of clear plastic. Place the plastic on top of one of the bar magnets, and sprinkle a small quantity of iron filings over the plastic. It may be necessary to gently tap or jiggle the plastic sheet. The filings will line themselves up with the magnetic field. In the following space, sketch the pattern that the filings make. Repeat this step using the other bar magnet.

Repeat using two magnets.

**Step 6:** Repeat Step 5 for two bar magnets with like poles facing each other, such as N and N or S and S, and with unlike poles facing each other. Sketch the pattern of the filings in both situations.

2. Compare the methods of Steps 4 and 5 in terms of their usefulness in obtaining a quick and accurate picture of the magnetic field.

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3. Are there any limitations to either method?

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4. What generalizations can you make about magnetic field lines?

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