Mapping a Magnetic Field

The region around a magnet where magnetic force acts is called a magnetic field. In this experiment, you will map the magnetic field at one-centimeter intervals along a bar magnet.

OBJECTIVES

In this experiment, you will

- Measure and graph magnetic field strength at points along a bar magnet.
- Analyze data.
- Make conclusions about the magnetic field at various points on a bar magnet.

MATERIALS

- computer
- bar magnet
- Vernier computer interface
- clear tape
- Vernier Magnetic Field Sensor
- ruler

PROCEDURE

1. Using clear tape, tape a ruler to your desktop. Place a bar magnet beside the ruler. Position the S-pole end of the magnet at the 3 cm mark as shown in Figure 1. Tape the magnet to the tabletop.
2. Set the switch on the Magnetic Field Sensor to 6.4 mT (low amplification). Plug the Magnetic Field Sensor into the computer interface. Start the Vernier data-collection program and open the file “27 Magnetic Field” from the *Middle School Science with Vernier* folder.

   a. Make sure the sensor is far away from the bar magnet.
   b. Bend the tip of the sensor so that it points down. Hold the handle parallel to the table.
   c. Click **Zero** to zero the sensor.

4. Click **Collect** to begin data collection.

5. Collect data at the 0 cm distance.
   a. Place the Magnetic Field Sensor perpendicular to the bar magnet as shown in Figure 1 with the white dot facing down. Center the tip of the sensor at the 0 cm mark of the ruler. Keep the white spot oriented directly downward throughout the experiment. When the reading has stabilized, click **Keep**.
   b. Type 0 in the edit box (for 0 cm).
   c. Press ENTER. The magnetic field strength value for 0 cm is now saved.

6. Move the sensor, and repeat the Step-5 procedure at 1 cm intervals until you have reached a point 3 cm beyond the N-pole end of the bar magnet.

7. Click **Stop** to end data collection. Record the magnetic field strength values displayed in the table in your data table.

8. Print copies of the graph as directed by your teacher.

**DATA**

<table>
<thead>
<tr>
<th>Distance (cm)</th>
<th>Magnetic field (mT)</th>
<th>Distance (cm)</th>
<th>Magnetic field (mT)</th>
<th>Distance (cm)</th>
<th>Magnetic field (mT)</th>
</tr>
</thead>
<tbody>
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<td>9</td>
<td>18</td>
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</table>
PROCESSING THE DATA

1. Where on the bar magnet was the largest positive magnetic field strength reading observed?

2. Where on the bar magnet was the most negative magnetic field strength reading observed?

3. At what centimeter distance does your graph have a zero value magnetic field strength value? At what point is this on the bar magnet?

4. Why does the graph have both positive and negative magnetic field strength values?

EXTENSION

1. Test the strengths of different magnet types at the same distance from the sensor. Which magnet types are strongest? Weakest?
THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:

- Safety information
- Essential instructor background information
- Directions for preparing solutions
- Important tips for successfully doing these labs

This lab is intended for students ages 13 and older. For students ages 12 and under, we recommend that teachers perform the experiments as demonstrations.

The complete *Middle School Science with Vernier* lab manual includes 38 labs and essential teacher information. The full lab book is available for purchase at:

http://www.vernier.com/cmat/msv.html