

Iona Prep Physics

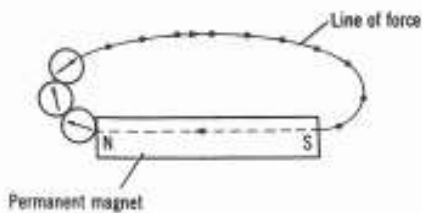
Title: To map a magnetic field

Problem: A magnet exerts forces on compasses or any magnets placed in its neighborhood. The space around a magnet in which it exerts these forces is called its magnetic field. In this experiment you will map a magnetic field. The map will show the strength and direction of the forces it exerts at any point in the area.

Procedure:

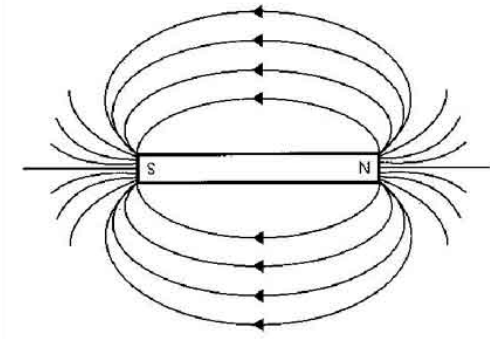
1. Obtain a magnet, a compass, and a large piece of paper.
2. It will be necessary for you to determine which end of your compass needle is the north end. Ordinarily the north end is colored blue or red, however it is possible for the compass polarity to become reversed when it is subjected to strong fields. This frequently happens during physics experiments -- or when students are playing with the compass and a magnet. To determine which end is the North pole, take the compass away from other magnets and see which end points in the geographical direction called North. That is the North pole of the compass. If your compass begins to act strangely during the experiment, check to make sure it has not had its polarity reversed.
3. Place your compass at different points around the magnet. Note that at each point the compass is acted upon by the magnet and the needle points in a specific direction. The direction in which the north pole of the compass points is said to be the direction of the magnetic field at that point.

Your first line will look something like this:



4. To make a map of the magnetic field around the magnet, you draw a series of lines around it such that the direction of the magnetic field at any point on one of the lines is along the tangent to the line at that point. Each of the lines is called a line of force. An infinite number of lines would be needed to show the magnetic field at every point, however, if you draw a sufficiently large number of lines you will have an effective picture (or map) of the forces that act in the area of the magnet.

The final picture will look something like this:



5. To map the magnetic field

- Begin by putting the magnet in the middle of a large sheet of paper and outlining its form on the paper with a pencil. Label the N and S poles of the magnet on the paper.
- Put a compass at one corner of the N pole of the magnet as shown in the diagram. On the paper, using dots, mark the positions of the N and S poles of the compass needle.
- Move the needle a little further from the magnet until the new position of its S pole coincides with the dot marking the previous position of its N pole. Mark the new position of the N pole by a dot.
- Again move the compass making the S pole coincide with the previous location of the N pole and mark the new position of the N pole by a dot.
- Continue the process until the compass reaches the S pole of the magnet. This closed curve is a complete line of force. Place an arrow on it, showing its direction (away from the N and toward the S).
- Beginning at another point on the N pole of the magnet, trace a second complete line of force.

Continue with this process until you have a minimum of 8 lines of force. They should be somewhat symmetric and balanced. If they are not, look for other magnets in the area.

If time permits, map the field between two pole configurations assigned by your instructor.

Questions:

1. Are the lines more concentrated in some areas than in others? That does that tell you about the relative strength of the field in those places?
2. You read in books that lines of force never cross. Why is it that lines never cross?