CHAPTER 16

Magnets, Motors, and Generators

CHAPTER CONTENTS

Electromagnets come in all sizes. Large, powerful electromagnets are used in industry to move heavy materials. Tiny electromagnets are used to read and write the data on the disk drive of a microcomputer. While electromagnetism is a common phenomenon today, it was first discovered purely by accident in 1819. Until that date, electricity and magnetism were believed to be completely separate phenomena. Immediately recognized for its importance, the discovery of electromagnetism marked the birth of modern science and technology. Without an understanding of electromagnetism, devices such radios, televisions, computers, tape recorders, VCRs, CD players, lasers, electric motors, and generators, could not have been invented.

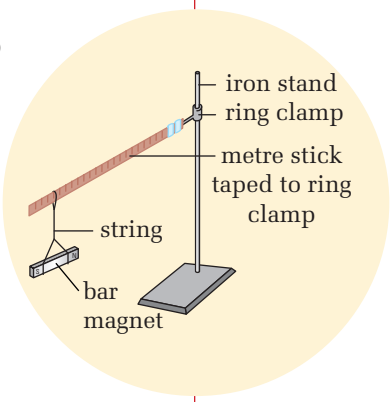
In this chapter, you will study the properties of natural magnetism and electromagnetism. You will investigate how electricity and magnetism are related. You will also learn how electromagnetism is used to create electromagnetic devices such as electromagnets, loudspeakers, motors, and meters.

MULTI LAB

Magnetic Interactions

Invisible Lines

Use a string to create a hanger for a bar magnet. Allow the magnet to hang freely, away from the influence of any other magnets or magnetic materials. Allow enough time for the magnet to come to rest in the absence of vibrations or air currents.

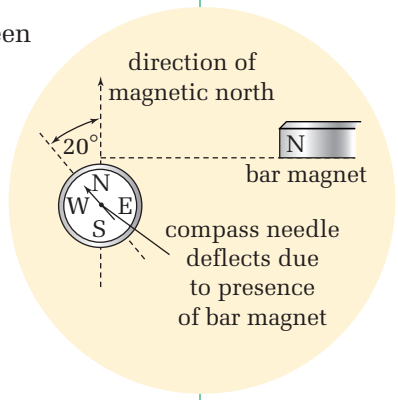


Analyze and Conclude

1. Note and record the orientation of the long axis of the magnet once the magnet has come to rest.
2. Compare the final direction of your magnet's rest position with the positions of your classmates' magnets.
3. Draw conclusions about the final orientation of the suspended bar magnet.

Magnets and Materials

In this activity, you will test the properties of magnetic forces between magnets in the presence of various materials using a sensitive magnetic compass. Place a compass on your desktop. Once the needle has come to rest, position the body of the compass so the 0° mark is under the N-pole of the compass needle. Place a bar magnet on a line perpendicular to the axis of the compass needle. Slowly move the bar magnet closer to the compass until it causes the compass needle to deviate about 20° from its original position. Place several different types of materials between the compass and the magnet. Carefully observe any change in the direction of the compass needle. Test the effect of changing the orientation of the material separating the compass and the magnet. Use a second bar magnet to determine which substances are magnetic and which ones are not. Organize your observations in a table. Possible substances to test: copper, zinc, aluminum, iron, lead, plastic, glass, wood



Analyze and Conclude

1. Did the presence of the material placed between the magnet and the compass affect the amount of deflection of the compass needle?
2. Did the orientation of the material placed between the magnet and the compass affect the amount of deflection of the compass needle?
3. Draw conclusions about the ability of different materials to affect the interaction between magnets (the bar magnet and the compass needle magnet)? How do you think this occurs?