

**Materials**

& Rubber magnets

1 U-shaped magnet

Magnetic compass

"Mag Chips" (Iron filings do same work)

- Small sheet of glass or plastic
- Meter stick, string
- Variety of objects made of metal, wood, plastic, rubber, etc.

**Procedure**

1. Use a rubber magnet to determine what kinds of objects have magnetic properties; i.e., are attracted to a magnet.
2. Place a rubber magnet under a piece of cardboard or a paper plate and some metal paper clips on top. Move the magnet around. What other materials can magnetism penetrate?
3. Tie a string around the middle of one of the rubber magnets and suspend it from a horizontally mounted meter stick. Adjust the string so that the magnet is balanced horizontally and can turn freely. In what geographic direction does its north pole point? Bring the north pole of one rubber magnet close to the north pole of the suspended magnet. What happens? Now approach the north pole of the suspended magnet with the south pole of the magnet in your hand. Result?
4. Place a rubber bar magnet under a clear sheet of glass or plastic. Sprinkle Mag Chips on the glass sheet while tapping it lightly with your finger. The pattern which emerges indicated the presence of a magnetic field surrounding the magnet. Place the two rubber magnets end-to-end with "unlike" poles facing each other (but separated by about 2 cm). What pattern results from this alignment? Change one of the magnets so that "like" poles are facing. What is the pattern of the magnetic field now? Replace the bar-shaped magnets with the U-shaped magnet. How does its field differ from the previous one?
5. The pointer of a compass is designed to point to the earth's magnetic North Pole. Place the magnetic compass within the field of one of the rubber bar magnets. Which pole of the bar magnet attracts the pointer of the compass? Is there a contradiction here?

**Key Concepts**

1. Most of the ordinary objects which are attracted by a magnet contain iron. However, certain other metals, like nickel and cobalt and alloys, may also be responsive. Copper, aluminum, zinc, silver, and gold are examples of metals which are not magnetic.
2. Magnets can be made in many different shapes.
3. Magnets always have two poles: the one which points north (when suspended freely) is called its north pole; the other pole is called its south pole.
4. Like poles attract each other; unlike poles repel.
5. Magnetism is a force and can produce motion.
6. Magnetic force is strongest at the poles.
7. Magnetism can occur through some intervening materials.
8. The north pole of a magnet is more correctly called the "north-seeking" pole.
9. A magnetic field surrounds each pole of a magnet.

**Teaching Tips**

1. The demonstrations of magnetic fields (with Mag Chips) can be performed on an overhead projector for easy visibility by the entire class.
2. The rubber bar magnets can be cut in half to demonstrate that magnets are always **bipolar**.
3. Do not store magnets in close proximity to a compass.
4. **Challenge Question:** Given two steel bars which are identical in every way, except only one is a magnet, is there a quick and simple way to identify the magnet without using any other objects except your hands?