Build a Compass

CONTENT STANDARD: Earth Science

CONTENT TOPIC: Earth and the compass

CONTENT OBJECTIVE: To understand the earth's magnetic field and a compass

INSTRUCTIONAL OBJECTIVES: The learner will:

- Observe and report observations.
- Plan and conduct simple experiments.
- Formulate simple research questions.
- Predict results.
- Use data to construct a reasonable conclusion.
- Know and explain science information.

Key Concepts

The Earth has minerals that are naturally magnetic. The mineral magnetite is a natural magnet and is found in Greek writings as early as 800 B.C. The compass was the first use of magnetism and some people believe it was first used in China. Others believe that the magnet was invented by Italians or Arabs.

In 1600, William Gilbert of England said that the Earth itself is a magnet. In 1800, Michael Faraday discovered that all iron (Ferrite) objects could become magnetic to a greater or lesser degree.

If a magnet is suspended so that it can rotate freely, one end will seek magnetic north and the other end magnetic south. This is the basis of using a magnet to find direction. If iron filings are sprinkled over a magnet, they will cling to the magnet in a definite pattern.

There are many kinds of compasses. In a mariner's compass, the liquid is a non freezable mixture of alcohol and water or glycerin and water. This mixture floats a card marked with the degrees of direction. Several magnets are fastened to the card. The students' water compass is a much simplified version of this compass.

There are 4 major directions that we reference with our compass (All directions can also be referenced by the degrees in a circle): North (0°), East (90°), South (180°) and West (270°). There are 4 other directions that are also referenced that are "in-between" the 4 major directions: NE (45°), SE (135°), SW (225°) and NW (315°). .

Lab:

Materials:
For the Student: (Teams of 3-4 students)

- 1 sewing needle
- 1 1-inch square piece of Styrofoam
- Bowl of water
- 1 Geomag

Instruction:

1. Explain to the students that each group is going to make a water compass.
2. Provide students with the historical information about compasses included in the background information above for this activity.
3. Explain and demonstrate the directions for making a compass.
    - **Stroke the magnet across the needle, in one direction only**.
    - Float the Styrofoam on the water and gently lay the needle on top of the Styrofoam.
4. Direct the students to observe the needle. You may wish to have the students write their observations of the movement of the needle.
5. Compare the water compass with those made by other groups. How are they similar? How are they different?
6. Direct the students to compare their water compass to a pocket compass. How are they similar? How are they different?
7. Ask the students what variables could be changed in their compass making activity. [needle size, magnet strength, different liquids, or paper clips instead of needles].
8. Have the student teams conduct their experiments.
9. Let the student teams share their findings with the class.
10. Discuss the results. What materials make the most effective compass?
11. Discuss how a magnet works. What makes the needle point north?
12. Have each group hold a magnet close to their compasses. What happens? [The needle is attracted to the magnet.] Why? [Magnets affect the needle at close distances. Earth's magnetic field affects the needle at great distances. Magnets close to a compass override the Earth's effect on the needle.]
13. Ask the students how the Earth's magnet field compares to the magnetic field of a magnet.

CLOSURE:

Ask the students to answer the following two questions:

1. How does a compass work?
2. Why does the needle of a compass point toward a magnet when the magnet is put close to the compass?