Making a Magnetic Compass

Purpose

This is a chance to make a compass for finding the directions on maps, using the Earth's magnetic field.

Overview

This is a relatively quick and simple way to make a compass. Kids in elementary school through high school ages (teenagers), can do this within about ten minutes.

Student Outcomes

We want students to be able to:

- Understand the Earth is a magnet;
- Show and use the fact that some materials, like a metal pin or needle, can become a magnet when touched to a magnet;
- Build a compass by having the magnetic needle float and spin around to align itself with the Earth's magnetic field;
- Know that humans have been using magnetic compasses for navigation, especially sailors when exploring the oceans, for thousands of years. Compasses were used before there was GPS.

Time

The whole process should take about fifteen (15) minutes.

Level

This can be done by any grade level and age, from early elementary school through high school (teenagers).

Materials and Tools

Materials Needed

- Sewing needle or paperclip
- Magnet (fridge magnet or stronger)
- Cork

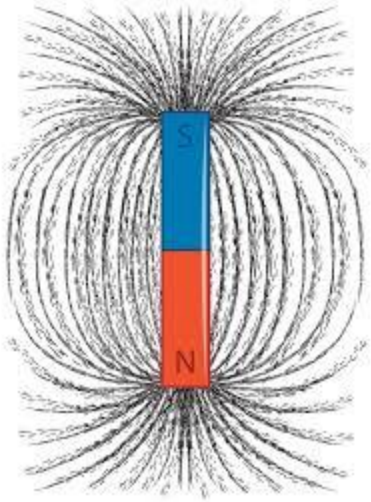
  , foam, or wax paper (for floating)
- Bowl of water
- Optional: Small container, scissors, pliers

Preparation

Have the materials ready for use. This can be done by individual students making their own, or groups of two students making one.

Prerequisites/Prelab

It can be interesting to build up a student's understanding of why compasses are important and useful, and some of the history behind using a compass. Students should be aware of what a magnet is, and how the earth is a magnet. If you have the means of showing a magnet with iron filings (iron dust) around the magnet, and the lines that are formed, let students know those lines indicate the magnetic field; a compass needle, being a magnet itself, lines up with those magnetic field lines.



Background

If you have ever stood on the shore of an ocean or large lake, where you cannot see any land as you look over the water, and it is cloudy so not even the sun can help determine which way you're looking over the endless water, how would you know which way you should travel to get somewhere else on the other side of the lake or ocean, which would be dozens, hundreds, or even thousands of miles away? You might have a map, but you need pretty accurate directional knowledge to not become lost.

A compass. This is what sailors needed on their boats and ships in order to determine which direction they were traveling, and how that direction lined up on their maps. It was a matter of life or death at times, to be sure of the direction being traveled.

Compasses line up with the earth's magnetic field, or if a magnet is stronger than the earth's magnetic field, the compass needle will line up that direction.

Teaching Notes

Students will need to magnetize their needle. THey can do so by rubbing a small permanent magnet over the needle 30-50 times, in the same direction. This can and should magnetize the needle of paper clip.

Assessment

The primary assessment is if the compass works! Does it point the correct direction? It should point to geographic north on a map; at noon in the northern hemisphere, the compass is pointing to north on a map, and south in the southern hemisphere. If the needle does not line up with a noon shadow's direction, then it is not properly magnetized or working properly.

Additional Information

Step-by-Step Instructions

1. Magnetize the Needle: Stroke the needle with the magnet (using one pole) at least 30-40 times in a single direction.
2. Prepare the Float: Cut a small, thin slice from a cork to serve as a base.
3. Assemble: Push the magnetized needle through the cork disk (or tape it to a small piece of foam or wax paper).
4. Float the Compass: Gently place the needle-cork assembly into the bowl of water, ensuring it floats freely.

5. Identify North: Allow the needle to rotate; the end that was stroked by the magnet will point towards magnetic north.

   This video demonstrates how to build a compass.

Tips for Success

- If the needle doesn't move, re-magnetize it by rubbing it more times.
- Ensure the bowl is on a flat, stable surface away from other magnets.
- Label the water container with cardinal directions (N, S, E, W) to make it a functional navigation tool.