

Finding Direction

SUMMARY INFORMATION

Keywords

Magnetism, magnets, compass, directions, North, South, East, West

Topics Covered

Physics

Target Grade(s)

6, 7, 8

Estimated Time Required

3 hours

LESSON

Goals and Pre Requisites

Goals

- Help students in making a basic magnetic compass
- Explain the use of magnetism in locating directions.

Pre Requisites

Knowledge on properties of magnets and principle of magnetism.

Instructional Objectives

Through this activity, students would be able to

- Demonstrate critical thinking
- Apply subject knowledge
- Formulate design thinking

Instructional Resources

Problem Statement

Before GPS or maps, people had to travel around using other means. When you cannot use a phone or map, how do you think you can find direction using the concept of magnetism? Can this save you when you are lost?

Background

Students need to be aware that the magnetic compass has been used for navigation for hundreds of years. At one time, it was the only reliable means of direction-finding on days when the sun and stars were not visible. Nowadays, sophisticated equipment is available that enables users to determine bearings accurately and to pinpoint locations to within a few metres. However, such equipment has not made the compass obsolete. It is still a very practical tool for navigation for many small craft and for people on foot. Even airplanes and ships equipped with more sophisticated equipment often carry compasses as backups.



Procedure for students

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before

constructing it. Students must be able to provide justification for their choice of materials.

6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.
7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

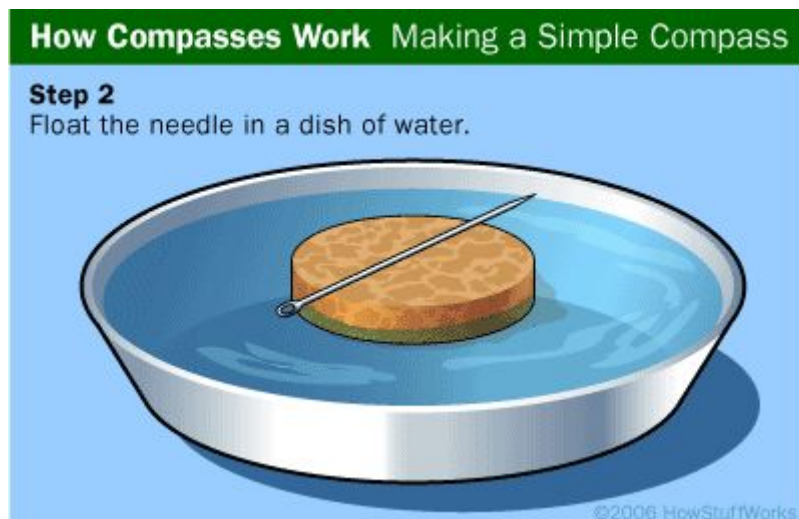
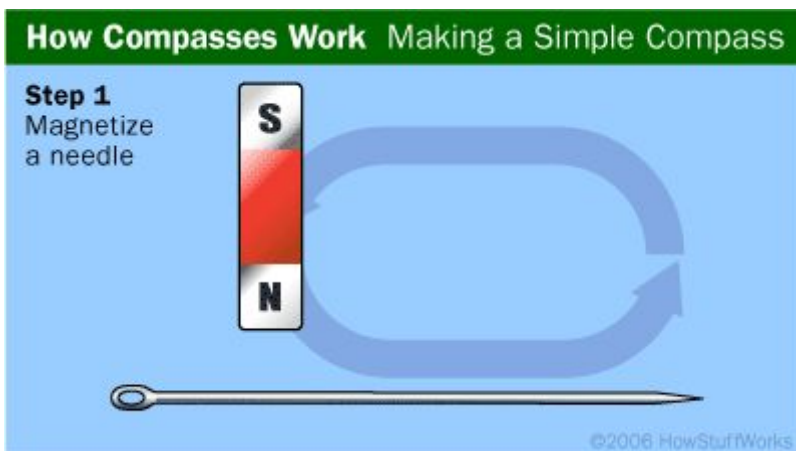
Materials Required

- Plastic bowl or wide plastic cup
- Sheet of blank paper
- Round cork from a bottle
- Scissors or sharp knife (to cut the cork)
- Sewing needle
- Magnet
- Water

Procedure

1. The paper must be cut into four pieces, and each piece needs to be labelled with a cardinal direction (North, South, East or West).
2. A circular piece of cork must be cut off with about half-an-inch thickness.
3. The bowl or cup must be filled with water.
4. Carefully holding the sewing needle by the eye (with the point facing away from you), it must be swiped along one side of the magnet in the same direction 30 to 40 times (this action makes the needle magnetic).
5. To test the needle's magnetism, it needs to be checked if it attracts a straight pin. If the magnetized needle picks up the pin, it should be ready to be the compass needle.

6. The needle must be carefully pushed through the middle of the piece of cork lengthwise, so that the needle is parallel to the circle ends of the cork (rather than up and down, or perpendicularly).
7. *Before adding the finishing touch to the compass, students can be made to predict which direction is north. The "North" label can be put down on that side of the bowl.*
8. The cork must be placed on the top of the water with one of the circle sides down so that the needle is parallel to the surface of the water.
9. Now, the cork must be let go off. Students can be asked the following questions – “What does the needle do? Which way does the tip point?” That is the magnetic north.
10. *And also – “Which way is south? What about east and west?”* The students can be made to place the labels accordingly.



Extensions

- Students can be given different locations and made to identify the directions. It can also be made into a learning activity, in the form of a treasure hunt game.

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- http://www.geomag.nrcan.gc.ca/mag_fid/compass-en.php
- <http://www.scientificamerican.com/article/find-magnetic-north-with-compass-bring-science-home/>
- <http://www.indiamart.com/devashish-drawing/magnetic-compass.html>
- <http://adventure.howstuffworks.com/outdoor-activities/hiking/compass2.htm>
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