STEM Program

Make a Simple Compass

Scouts like to hike and are very resourceful. Imagine being lost in the bush without a compass. Why not make your own simple compass to lead the way, then test its accuracy? At the end you'll find some interesting facts to understand why this works.

Plan

What you will need

- Magnet (stronger is better)
- Iron sewing needle
- A leaf or a cylindrical cork (or anything small that floats)
- Shallow plastic or ceramic bowl (a metal bowl might affect the experiment).
- Water
- A real compass (optional - to compare after the experiment)

Do

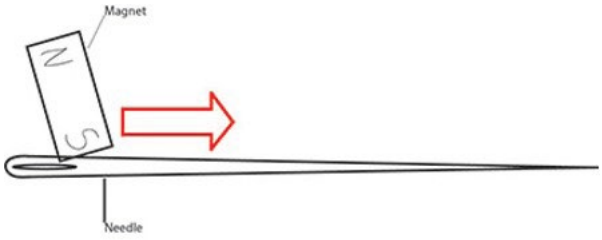
Method

1. Fill the bowl with about 3cm of water to allow the object to float.
2. Float the leaf or cork in the middle of the bowl.
3. Carefully stroke the needle lengthways along the bar magnet, in the same direction with the same end of the magnet, around 30 times.
4. Gently place the needle on the leaf or evenly through the cork and watch what happens.
5. The needle will give you a good north-south line, you will have to use the sun or stars to determine which way is north [Hint: Which direction does the Sun rise and set?]. Rather than thinking about the needle as being attracted to one of the poles, think about it aligning itself with the magnetic field lines. As a result, the needle will point to the nearest magnetic pole (north or south) depending on where you live.

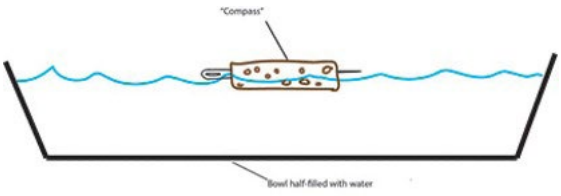
Review

Test some variables

- How many strokes along the magnet do you need to do before it works?
- Change the strength of the magnet (safety – use adult help with strong magnets!)
- Do different shape magnets make a difference?
- Would this work with pieces of copper, aluminium, zinc etc?
- What happens when the compass is held close to your belt buckle? When in a car? Or next to an electrical cable?
- Does a dry leaf vs moist leaf matter?



Step 3 – magnetising the needle.



Step 4 – floating the needle.

Tips

- Which end of the needle points north or south depends on which end of the magnet you use.
- If your needle keeps rolling off into the water, try piercing it through the leaf or cork horizontally until it sticks out at both ends evenly (so it's balanced).
- Once the needle is magnetised in step 3, keep it away from the magnet.
- If it's not working well, it's usually due to the magnetising process. Try using a stronger magnet to magnetise the needle, or stroke the needle for longer.
- If using a strong magnet such as Nd (rare earth) magnets, keep away from electronics or magnetic strip cards. Also be aware as it can be a pinching hazard.
- Generally, a metal sewing needle will work as it is made of iron and therefore ferromagnetic. If the needle is made of copper or aluminium, it will not be magnetised.
- Consider whether anything around you, ie building or wind might be affecting your experiment. Check if any Leaders nearby have titanium hips!

Why Does This Happen?

The Earth is like one gigantic magnet. Compasses are just smaller magnets that detect the North Pole of the Earth's magnetic field.

Rubbing the iron needle on the magnet aligns the domains within the needle, making it magnetic. Floating allows the magnetic needle to align with Earth's magnetic field. This type of compass has been around for hundreds of years. The properties of magnetite or 'lodestone' have been used for navigation. Lodestone literally means 'the stone that leads'.

Once the needle is magnetised it naturally wants to align with the Earth's stronger magnetic field. This field, called the magnetosphere, is created by electrical currents that are generated by a churning molten iron core deep inside the planet. The Earth acts as if it has a bar magnet running through it with the magnet's south pole located near the planet's geographic north. Since opposites attract, the north pole of a magnetised needle is attracted to the magnetic south pole of the earth (which is in the north).

Resources

Make A Simple Compass : Fizzics Education

How to Make Your Own Compass (U.S. National Park Service)

Variables & fair testing; teaching the heart of science experiments : Fizzics Education

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Science of Outdoors

The Science of Outdoors is a National Science Week project, undertaken in collaboration with Fizzics Education. These instructions and supporting videos were prepared by Scouts for Scouts.

Scouting has always been strong on STEM skills. Maths to calculate catering quantities and navigate, the science of water purification, the physics of abseiling, and the engineering of pioneering structures – they all have their place. In the current program for our youth members, STEM and Innovation forms one of six Special Interest Areas that enable Scouts to set goals and pursue their own ideas.

SciScouts OUTDOORS

Fizzics Education

national science week 2021

An Australian Government Initiative

Inspiring AUSTRALIA