

STEM

Activity Guide Magnetic Compass

Background:

Have you ever wondered how early ship captains navigated across oceans, before there was GPS? Of course, the sun and stars were used when the skies were clear, but it was difficult and time consuming to constantly determine direction by these astronomical markers. The magnetic compass was the constant companion of the steersman on an ocean going vessel and is still used today as a backup to modern day navigational aids.

Have you heard the one about the hikers who broke their compass? It went south rather quickly.

Let's make our own compass.

Link to video demonstration:

<https://youtu.be/Hh6MYfpLEsQ>

Materials Needed:

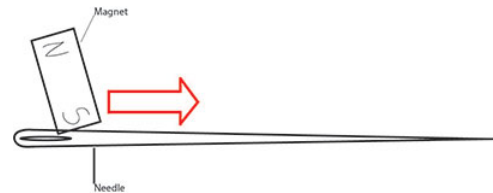
- A cork (If you don't have a cork; a piece of paper, cardboard, or leaf will work)
- A steel needle or pin
- A magnet (look on the refrigerator door)
- A bowl with a little water in it
- A pliers or multi-tool

Rules/Pre-Start Guidelines:

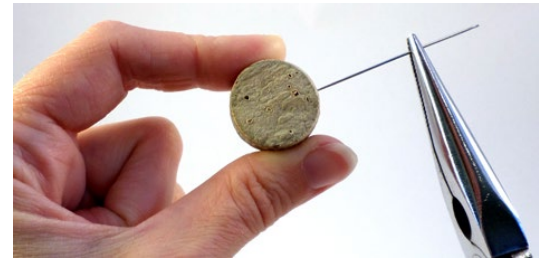
You may need a parent's help to cut the cork or foam and help to press the pin in, if you are younger. Be aware of the sharp end of the pin and be careful not to poke yourself.

Instructions:

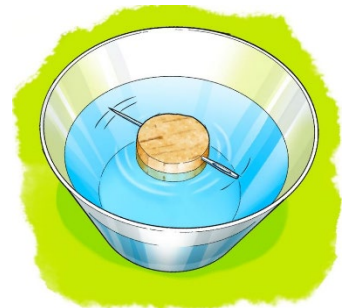
1. Gather your materials
2. Rub the magnet down the length of the pin several times (10 – 20 times is perfect), always rub the magnet in the same direction along the pin.



3. Cut your cork or foam into a $\frac{1}{4}$ " thick disk (cork) or $\frac{3}{4}$ " Square (foam).
4. Use the pliers to push your pin through the cork, be sure to be thinking about where the pin will come out on the other side to avoid poking yourself (or get some help).



5. Fill the bowl up with an inch or two of water
6. Place the needle and cork into the center of the bowl, avoid the edges of the bowl.
7. Watch what happens; The compass will point in one direction, this is either north or south.



8. Rotate the bowl $\frac{1}{4}$ turn, the compass should continue to point in the same direction.

Challenge: How to Take this to the next level:

Bring your magnet to the outside of the bowl. Does the compass follow the magnet? Why? [Because the magnetic field created by magnet is stronger than the magnetic field created by the earth] What happens if you flip your magnet over?

Try to determine which end of your compass is pointing north and mark the cardinal directions North, South, East, West on your cork.

What direction does the front of your house face? Which direction does the wind blow from? Which direction does the sun rise or set (why might it not be where you'd expect)?

Could you walk a straight line across your yard, by only looking at the compass? No, you can move perpendicular to the direction the compass points, the compass only tells you which direction you are facing.

At what point on the earth can you go south 1 mile, west one mile, and north one mile and end up back where you started? If you can think of both answers, I hear Elon Musk is hiring.

Research further:

What causes the earth's magnetic field?

Why does it sometimes move?

Can you feel the earth's magnetic field, can some animals?