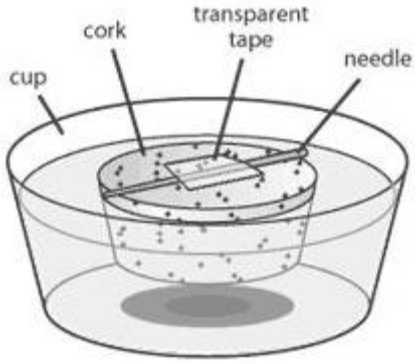
Name _____ Date _____ Period _____

Lab: Making a Homemade Compass

CONCEPTUAL PHYSICS: UNIT 6

Introduction: Have you ever used a compass to help you figure out what direction you should go? These can come in handy to help you navigate your way through a field or forest while camping, for example. Magnetic compasses work based on **Earth's magnetic field**. In this science activity you'll get to make your own magnetic compass. How well do you think it'll work? Get ready to find out!



Compass

Background: People have known about magnetism for thousands of years. Magnetism is the reason two magnets will push against one another or be pulled together. This can cause amazing things to happen, such as making an object hover above the ground because it is being pushed up by the magnetic force. Magnetism can also help people navigate; because Earth has a magnetic field, compasses can be made using a small magnetized bar or needle that points a certain direction (north or south) based on the field.

Although the phenomenon of magnetism has been known of for a couple thousand years, the first magnetic compasses used for navigation were not invented until relatively recently, approximately 1,000 years ago (sometime between A.D. 1000 and 1100). In this science activity you'll get to make your own compass, which may help you understand some of the challenges that early magnetic compass makers encountered! (*https://www.scientificamerican.com/article/steering-science-make-a-homemade-compass/*)

Materials:

- Metal sewing needle
- A magnet (It can be a flat refrigerator magnet or a more powerful magnet, such as a rare earth magnet—the most common type is made of neodymium—which can be purchased at many hardware stores. A stronger magnet will work best.)
- Assorted metal objects
- A thin slice of cork
- Clear tape
- A wide cup, drinking glass or bowl
- Water

***Caution**: Be careful when handling the magnet, especially if you are using a strong magnet, such as a rare earth magnet. Keep the magnet away from other magnets and electronic devices, such as computers, cell phones and TV screens. Use caution when you handle the needle.*

Procedure:

1. Rub the magnet against the sewing needle at least ten times. (If you are using a weaker magnet, such as a flat refrigerator magnet, rub the needle at least a twenty times.) Always rub the magnet in the same direction against the needle. Your needle should now be magnetized.
2. Now obtain a thin slice of cork from the teacher. It should be about ¼" thick or less. Laying the cork disk on a flat surface, carefully attach the needle on the top of the cork with a small piece of clear tape. (see diagram above)

Taken and modified from: https://www.scientificamerican.com/article/steering-science-make-a-homemade-compass/

3. Fill a wide cup, drinking glass or bowl with at least one inch of water.
4. Put the cork disk (with the needle) on the water in the cup. Try to keep the disk floating in the center of the water, away from the sides of the cup.

PART 1: Testing your compass

1. What does your needle do when you placed it into the cup of water?

2. When it stops moving, what direction does it point towards? (*You can use a real compass or smartphone compass for this.*)

3. Does your homemade compass seem to work well (*exactly how accurate is your compass*)?

4. How is your homemade compass limited in its use?

PART 2: How does a magnet or other metal objects affect your compass?

1. Put a magnet next to your compass. What happens to the needle as the magnet is moved close to it?

2. How close does the magnet need to be to affect the compass?

3. Try placing a steel object next to your compass. Do metal objects affect the way your compass works?

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PART 3: Testing magnets of different strength

1. If you have magnets with different strengths, such as a flat refrigerator magnet and a rare earth magnet, try making multiple compasses using the different magnets to magnetize the needles. How well do the different compasses work compared with one another?

PART 4: Alternative compasses

1. There are other ways you can make an inexpensive magnetic compass at home or while you are outdoors. For example, instead of using a piece of cork, you could try using a small leaf and setting the needle on top of the leaf while it floats in a still pool of water. How does a compass made using a leaf compare with one made using a piece of cork?

2. How else could you make a magnetic compass? (*Draw and label a diagram showing your design*)

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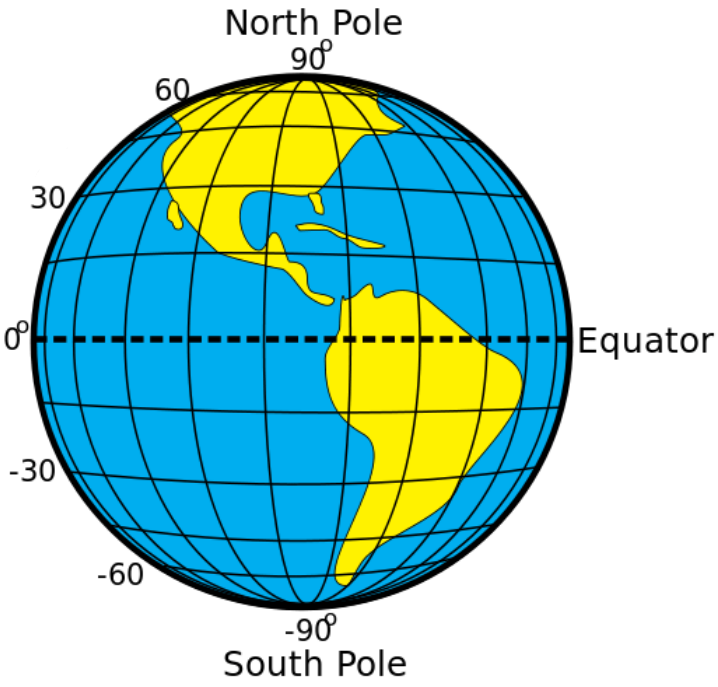
Part 5: How does your compass work?

1. Draw a diagram below to explain how your compass orientated itself to point North and South. (*<u>Draw</u>* ***magnetic field lines*** *on image of Earth below and show how they relate to direction the needle points on your homemade compass*)



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