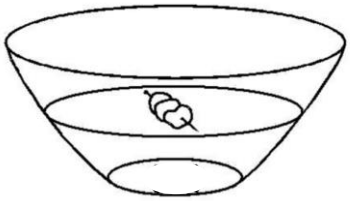
Wizards of Wright

Lesson: The Compass and Earth's Magnetic Field

Use WOW! Lesson Intro to begin.

Background Info for Wizards:	In this lesson, students will be introduced to the basics of navigation. The concepts of cardinal directions should be reviewed, as well as the use of a compass.
Materials:	packing peanuts (the non-biodegradable / non-water soluble type) plastic bowls straight pins or nails or metal paperclips magnets donut magnet on a string hand compasses jug for water
Lesson Time: ***45 minutes***	Introduction: 5 minutes Guided Lesson: 5 minutes Student Activity: 30 minutes Conclusion: 5 minutes
Learning Targets:	Students will learn what a compass is and how it works. Students will learn about the Earth's magnetic field and that it effects a compass. Students should review cardinal directions.
Introduction for Students: 5 minutes	The earth has a magnetic field that flows from the South Pole to the North Pole. The Earth's magnetic field is what causes a compass needle (which has been magnetized) to react. Luckily, the geomagnetic poles are close to the geographic poles. Therefore, when a compass needle points in the direction of the magnetic field (pointing towards the geomagnetic North Pole) it is pointing pretty close to the geographic North Pole (or, True North). The origin of the magnetic field is still a question that has not been fully resolved, but many geophysicists believe it is generated as the rotation of the earth causes slow movements in the liquid outer core.

Guided Lesson: 5 minutes	- A compass has a magnetic needle held on top of a pivot so the magnet can rotate and turn. - A compass shows direction on the earth's surface. - A compass points in a direction that lies along the magnetic field. The first compasses were just lodestones, a naturally magnetized piece of mineral that attracts iron, on small sticks placed in a bowl of water. This device, which pointed to the pole star, was used for navigation by sailors. People then discovered that a piece of iron or steel that had been rubbed with a lodestone would work the same way.
Student Activity: 30 minutes	Lead student pairs through the directions: 1. Review cardinal directions. Point out to students that North is already marked on the bowls they will be using. 2. Fill the bowl with enough water so the compass needle they make will be able to move freely.  3. Students will use a straight pin, nail, or metal paperclip as the needle to their homemade compass. They need to magnetize their "compass needle" by stroking it two dozen times against a magnet. *When magnetizing, students must stroke the needle* ***in one direction only****. Rubbing the needle back and forth, or not rubbing it enough times, will not magnetize it well enough.* 4. Stick the "compass needle" through the packing peanut. They may need to make adjustments and only use half of a packing peanut. Continue to make adjustments so that the needle is balanced and floats. - Remember, the peanut is only there to be used as a floatation device for the needle.

	5. Place the needle/peanut assembly into the bowl of water. What happens? (The needle should rotate to be oriented north/south. Verify orientation with a real compass to make sure.) 6. Have students stay at their desk, carefully pick up their bowl, and slowly rotate to face a different direction. What happens to the compass needle? (Answer: It should always rotate so that it is pointing north/south.) 7. Using the magnet they used to magnetize the needle, students should hold that magnet outside the sides of the bowl and get their "compass needle" to react. Can they move their needle around? Does using the opposite side of the magnet move the needle towards the magnet? Or away? 8. Have students hold a donut magnet on a string over their "compass needle" and watch it react. Can they move their needle around? 9. Students should remove the needle and packing peanut assembly from the water; and return the "needle" to you. *Some alert students might also realize that the compass and needle point at a direction that is not true north. This is magnetic north.*
Conclusion: 5 minutes	Collect materials. Review what a compass is and how it works and relates to the Earth's magnetic field. Please let teachers know: There are many activities online that can be used for more teaching on GPS, GIS, and Geocaching. There are ways to plan scavenger hunts, set waypoints, and much more. We want teachers to know that we have hand held receivers they can borrow through *WOW! on Wheels*.

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