

Lesson Title: Make a Magnetic Compass

Objectives: Students will develop an understanding of the impact of the magnetic compass on human society, exploration, and maritime history and the natural forces that make the magnetic compass work.

Materials:

1. Bar Magnets
2. Latex Balloons (optional)
3. Steel Needle
4. 9" Pie Pan
5. Water
6. Styrofoam Cup Lid or the bottom of a Styrofoam Cup
7. Masking Tape.
8. Marker
9. Magnetic Compass Student Handout
10. Vocabulary Sheet
11. A Magnetic Compass

Sunshine State Standards:

1. LA.A.2.1- The student uses the reading process effectively.
2. LA.A.2.2- The student constructs meaning from a wide range of texts.
3. SS.A.2.3- The student understands important technological developments and how they influenced human society.
4. SC.C.2.2- The student recognizes that forces of gravity, magnetism, and electricity operate simple machines.
5. SC.H.3.2- The student understands that science, technology, and society are interwoven and interdependent.

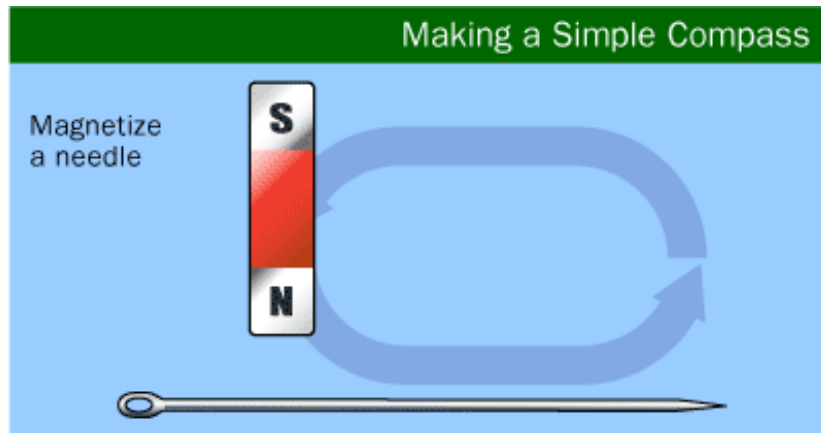
Procedures:

Vocabulary and Reading Assignments

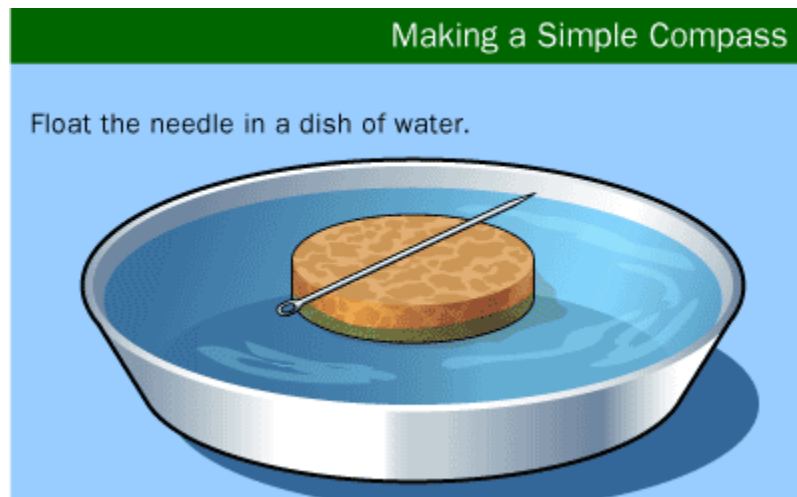
1. Define the vocabulary terms found in the reading assignment using the vocabulary worksheet provided.
2. Read "The Magnetic Compass" as a group or individually.
3. Students may participate in mini-experiments described in the body of the text using latex balloons and bar magnets.

Compass Construction Instructions

1. Apply a band of masking tape along the rim of the pie pan.
2. Magnetize the needle by rubbing it 20-30 times with one end of a bar magnet.

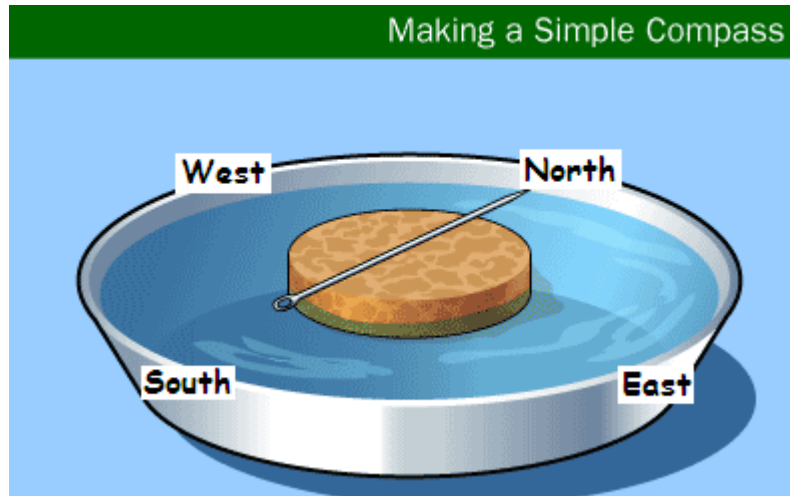


3. Fill the pie pan with 1 $\frac{1}{2}$ - 2 inches of water.
4. Make a float by placing the Styrofoam cup lid or cup bottom in the center of the pan.
5. Place the magnetized needle in the center of the float and center it in the middle of the pan.



6. Watch as the needle slowly spins. The needle will stop when its north pole (positive end) is pointing towards the Earth's Magnetic North Pole.

7. Draw an imaginary line along the needle to the edge of the pan. Write N, S, E, & W on the edge of the pan to identify the cardinal directions of North, South, East, and West. You have now made your very own simple Mariner's Compass.



For more information and resources related to magnetism and compasses, please visit the following websites:

Exploring Magnetism:

http://cse.ssl.berkeley.edu/SEGwayed/lessons/exploring_magnetism/Exploring_Magnetism/index.html

Earth's Magnetic Field:

http://www.windows.ucar.edu/tour/link=/earth/Magnetosphere/earth_magnetic_field.html

Navigation with a Map and Compass:

http://www.geocities.com/Yosemite/Falls/9200/navigation_map_compass.html

How Stuff Works:

<http://www.howstuffworks.com/compass.html>

The Magnetic Compass

Imagine sailing a ship in the middle of the Atlantic Ocean or along the coast on dark stormy night without a map or navigational instrument to help guide your way. Unable to see the sea or sky you would quickly become helplessly lost. You and everyone else onboard could easily find yourselves locked in a life or death struggle for survival, especially if reefs, rocks, or shallow sandbars were nearby.

People living today are very lucky to have a wide variety of navigational tools including the compass, sonar, and Global Positioning Satellites or G.P.S. to help them **navigate** in even the worst weather conditions. This was not the case, however, for people living thousands of years ago.

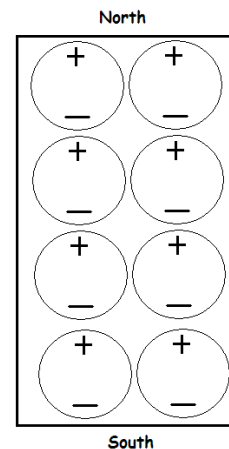
Long before the first navigational tool was invented, **mariners** could only tell direction using the positions of the sun, moon, and stars. However, on cloudy days or nights, they had no way of knowing which direction they were traveling in at all. Unwilling to put themselves and their ships in this kind of dangerous situation, most sailors avoided the open sea and never left the sight of land. This all changed with the invention of the **compass**.

Discovered by the Chinese around 2,000 B.C., a compass is a device that points in the direction of north regardless of the weather. The first compass was a naturally occurring **magnetite** called a loadstone that many sailors believed were magic because they would always point to the north when placed on a flat surface or hung from a string. Thanks to the compass, sailors were finally able to tell direction regardless of the weather, chart an accurate course across long distances, and begin exploring the world beyond the site of land.

As time went by, the Chinese discovered that an artificial **magnet** could be made by rubbing a lodestone over an iron needle. The magnetized needle was inserted through a piece of straw, cork or wood and placed in bowl of water where it would float on the surface. The needle would spin in the water until it pointed north. This discovery, along with addition of a ring around the needle that was used to identify specific directions, led to the invention of the mariner's compass in 1200 A.D.

You may be thinking, "I understand the compass has helped people navigate but how does it work?" The answer to this question requires a deeper look into the science of magnets themselves.

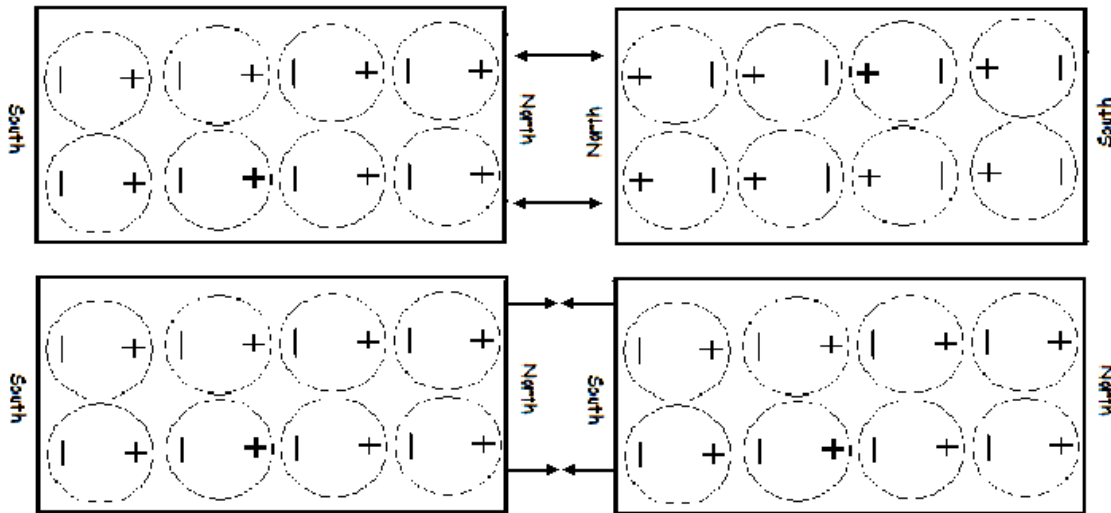
A magnet is any object (usually made of iron) with a strong magnetic field. A magnetic field is created when the electric charges contained within all of the iron's atoms point in the same direction.



Have you ever heard the term "opposites attract"? If so, you already know how magnets work. Objects with a positive charge are attracted to objects with a negative charge. Try this. Fill a balloon with air and rub it on the carpet. The balloon picks up electrons as it comes in contact with the carpet giving it a negative charge. Your hair, which has a positive charge, will point towards the negatively charged balloon as you put it next to your head.

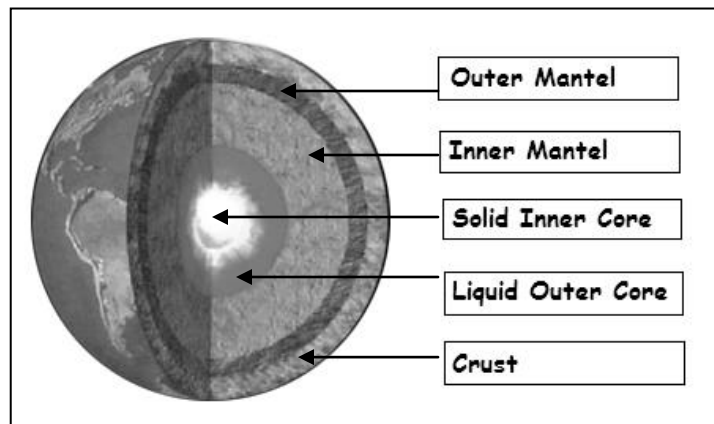
A magnet works the same way. Every magnet has a positively charged north **pole** and a negatively charged south pole. The attraction between the north pole of one magnet and the south pole of a second magnet pulls them together. What do you think

will happen when the south poles of two different magnets are moved together? If you said they will be pushed apart your right! Try this yourself using two magnets. Can you identify the positive and negative poles of each magnet? Remember, opposites poles attract and like poles push apart.



Did you know that the Earth is a magnet? It's true. If you were to cut the Earth in half you would see that the planet is made up of three parts, a hard thin outer shell called the **crust**, a semi-solid and liquid inner ring called the **mantel**, and a liquid and solid center called the **core**.

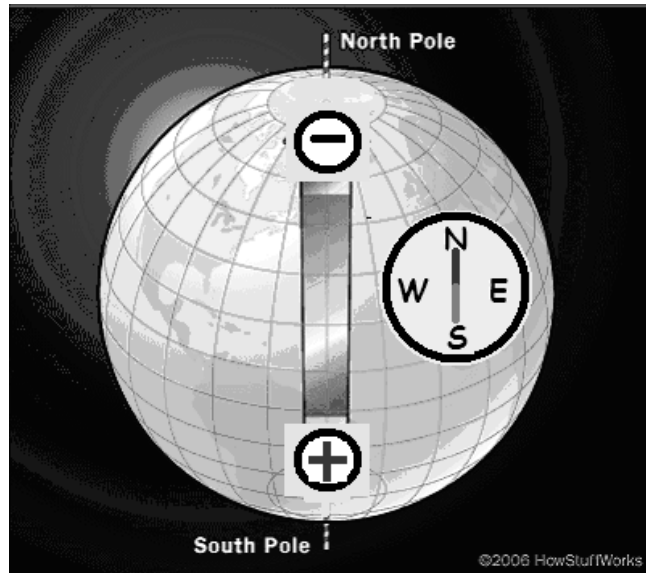
Almost the size of the moon, the Earth's solid **inner core** is a massive ball of magnetic iron surrounded by a sphere of molten metal the size of Mars known as the **outer core**.



Like all magnets, the Earth's core has both a **Magnetic North Pole** and a **Magnetic South Pole**.

Now that we have discussed what a magnet is and have learned that the Earth's core is a huge magnet as well, let's take another look at how a compass works.

The magnetic needles in most compasses are painted red at one end and white at the other. The end that is painted red is the needle's north (or positive) pole. The red end of the compass needle is attracted to the Earth's negative pole commonly known as the **Magnetic North Pole**. No matter



where you are on the face of the Earth, a compass needle will always be drawn to this location and will therefore always point to the north.

Name: _____

Date: _____

Directions: *Define each of the terms from your reading assignment "The Magnetic Compass" listed below.*

Vocabulary Word	Definitions
navigate	
mariner	
compass	
magnetite	
magnet	

pole	
Crust	
Mantel	
Inner Core	
Outer Core	
Magnetic North Pole	
Magnetic South Pole	