

Styro-Planets

Overview:

Students learn that Earth acts like a giant magnet. Students find the magnetic poles of Styrofoam™ planets (with magnet cores) and describe the location of each pole using latitude and longitude.

Objectives:

The student will:

- use a compass to find the magnetic North and South Poles of a Styrofoam™ planet;
- describe a location using latitude and longitude; and
- understand that Earth’s geographic and magnetic poles are not in the same place.

Materials:

- 5- or 6-inch diameter Styrofoam™ balls (1 per group of 3 students)
- 4-inch cylinder magnets or cow magnets (1 per student)
- Table knife or drill and drill bit (preparation)
- Masking tape (preparation)
- Serrated bread knife or saw (preparation)
- Cutting surface (preparation)
- Scissors (preparation)
- Permanent markers (two different colors for preparation)
- Small magnetic (navigational) compasses (1 per group of 3 students)
- Sticky dots
- TEMPLATE: “Circular Protractor”
- STUDENT WORKSHEET: “Styro-Planets”

About Cow Magnets

While grazing, cows eat everything from grass and dirt to nails, staples and pieces of bailing wire. Once swallowed, these bits of metal cause irritation and inflammation of the cow’s vital organs. This condition is known as Hardware Disease. It can cause appetite loss and decrease a cow’s milk output or her ability to gain weight. Cow magnets are fed to cows to help prevent this disease by attracting stray metal and keeping it from moving around inside the cow.

Answers to Student Worksheet:

Chart answers will vary.

1. *~70° N*
2. *False*
3. *latitude and longitude*

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Activity Preparation:

1. Cut the Styrofoam™ ball in half. Before pulling the halves apart, make 2 marks perpendicular to the cut so the halves can be put back together in their original position.
2. Mark the center of the ball on each half.
3. To insert the magnet, use a table knife or drill to make a hole 2 inches deep into the center of one side of the ball. To ensure proper depth, mark the table knife or drill bit with tape at 2 inches. The diameter of the hole should be slightly larger than the diameter of the magnet.
4. Place the magnet in the hole, then estimate the angle of the protruding half of the magnet to determine the angle of the second hole (see Figure 1). Make a 2-inch-deep hole into the center of the other half of the ball and fit the protruding magnet into it (see Figure 2). If the magnet is loose in the ball, use paper wadding to hold it in place.
5. Finish the styro-planet by using masking tape to reunite the two halves of the ball (with the magnet inside).
6. Cut out and use the TEMPLATE: “Circular Protractor” as a guide for drawing with a permanent marker an equator and lines of latitude at 45 degrees North and South.
7. Use a different color permanent marker and the protractor to draw lines of longitude at 45 degree intervals around the planet. Lines of latitude and longitude can be drawn by bracing a marker (see Figure 3) and rotating the styro-planet about a central point.
8. Label the latitude and longitude lines, the equator, and the Prime Meridian on the styro-planet.
9. Depending on class size, make several styro-planets, inserting the magnet at different angles in each one. Record the angle of the magnet in each planet.

Examples:

Figure 1



Figure 2



Figure 3



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Activity Procedure:

1. Explain that Earth has **geographic** North and South Poles and **geomagnetic** North and South Poles. The geographic and geomagnetic poles are not located in the same place on Earth's surface. This is true for most planets in our solar system that have a magnetic field.
2. Set the styro-planets at different stations in the classroom and divide students into groups of three or four. Explain that each planet has a magnetic field, and then identify the latitude and longitude lines drawn on each.
3. Distribute a compass to each group, and the STUDENT WORKSHEET: "Styro-Planets" to each student. Demonstrate how to use a compass to find the magnetic North and South Poles on a styro-planet using the following steps:
 - Set the compass on the edge of a table or other stable flat surface.
 - Hold the styro-planet in front of the compass (just out from the edge of the table). Turn the styro-planet slowly along the lines of **latitude** until the compass needle points toward the planet center.
 - Rotate the styro-planet 90 degrees. Turn the styro-planet slowly along the lines of **longitude** until the needle points to the planet center. This point is the geomagnetic North Pole! Ask students to place a sticky dot (but not to write!) on the magnetic pole.
 - Determine the latitude and longitude of the magnetic pole and record this in the chart on the STUDENT WORKSHEET.
 - Check the opposite side of the styro-planet, using the same method, to locate the geomagnetic South Pole, and record results.
 - Remove the sticky dots so the next group can locate the poles on their own.

Teacher's Note: If students handle the styro-planets with care, and do not write on them, they should last for many years.

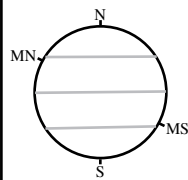
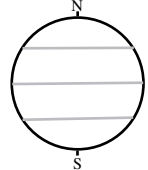
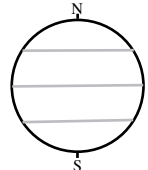
4. Ask students to divide the labor within their groups. One group member should use the compass, another should hold and move the styro-planet and another should record the data. Ask students to rotate from station to station recording answers and drawing diagrams. Each student should record information for at least two planets.
5. When all groups have completed the activity, ask them to share their results. Were they accurate? What might account for inaccuracies?

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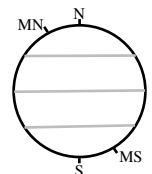
Directions: Please do not write on the planet!

Follow the steps to find and record the location of the magnetic North and South Poles of a styro-planet.

- Step 1: Set the compass on the edge of a table or other stable flat surface.
- Step 2: Hold the styro-planet in front of the compass (just out from the edge of the table), and turn it slowly along the lines of *latitude* until the compass needle points toward the center of the planet.
- Step 3: With the compass needle pointing toward the center of the planet, rotate the planet 90 degrees. Turn the planet slowly along the lines of *longitude* until the needle points to the center of the planet. This is the (geo)magnetic North Pole! Place a sticky dot on this spot.
- Step 4: Determine the latitude and longitude of the magnetic North Pole and record it in the chart below. In the "Sketch" column of the chart, make a small line at the location of the magnetic North Pole and label it MN (magnetic north).
- Step 5: Check the opposite side of the planet, using the same method, to locate the magnetic South Pole. Record your results in the chart. Use the abbreviation MS (magnetic south) to label the magnetic South Pole on the sketch in the chart.
- Step 6: Remove the sticky dots from the planet so the next group can find the poles on their own.

Name of Planet	Sketch	Magnetic North Pole		Magnetic South Pole	
		Latitude	Longitude	Latitude	Longitude
<i>Example</i>		40° N	160° W	40° S	20° E
					
					

1. What is the latitude of the magnetic North Pole on the planet sketched at right?
Latitude: _____



2. True or False: Earth's geographic and magnetic North Poles are in same location.

3. What two imaginary lines of measurement can be used to pinpoint the location of Earth's poles?

