

Magnificent Magnetospheres

Overview:

Students draw diagrams that compare and contrast the magnetospheres surrounding Earth and the sun.

Objectives:

The student will:

- develop a conceptual framework for Earth’s magnetosphere and understand that its shape is affected by the solar wind;
- identify the sun has a magnetosphere that also is affected by solar wind; and
- compare the shapes of the sun’s and Earth’s magnetospheres and learn the reasons for their differences.

Materials:

- Fold-out diagram of Earth’s magnetosphere
- Fold-out diagram of the sun’s magnetosphere
- VISUAL AID: “No Solar Wind”
- VISUAL AID: “Solar Wind”
- VISUAL AID: “Sun’s Magnetic Field”
- STUDENT WORKSHEET: “Magnificent Magnetospheres”

Activity Procedure:

Part 1: The Earth’s Magnetosphere

1. Hand out the STUDENT WORKSHEET: “Magnificent Magnetospheres.” Show VISUAL AID: “No Solar Wind.” Explain that if there were no solar wind in space, Earth’s magnetic field would look like the magnetic field surrounding a bar magnet. Ask students to draw the shape of Earth’s magnetic field around the Earth in Question #1 on their worksheets.
2. Ask students to think about how a tree looks on a day that has no wind. Then, ask students to think about the way the same tree looks on a day when the wind is blowing hard from one direction. Like wind blowing around a tree, the solar wind travels around Earth and stretches Earth’s magnetosphere.
3. Hand out the fold-out diagrams of Earth’s Magnetosphere and show VISUAL AID: “Solar Wind.” Demonstrate how to fold the diagram along the dotted lines so students can see how Earth’s magnetosphere looks when it is pulled by solar wind.

Magnificent Magnetospheres

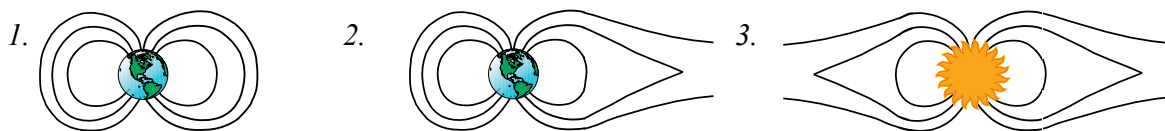
Activity Procedure (continued):

4. Explain that Earth's magnetic field is stretched out because solar wind is constantly traveling past all the planets in our solar system. Particles from the sun that reach Earth in the solar wind pull on Earth's magnetic field lines, causing the night side of Earth's magnetosphere (the side facing away from the sun) to look long and drawn out.
5. Ask students to use lines to draw the shape of Earth's magnetic field around Earth in Question #2 on their worksheets.

Part 2: The Sun's Magnetosphere

1. Explain the sun's surface is not solid like the surface of Earth. The surface of the sun is a fiery ball of gas that is constantly boiling and bursting with violent explosions. Each explosion can be more powerful than the force of one million hydrogen bombs.
2. These constant explosions create solar wind, which sends billions of solar particles past the nine planets in our solar system. The greatest concentration of solar wind blasts out from the sun's middle or equator. Because the sun rotates, this stream of solar wind shoots out from the middle of the sun in all directions, like a rotating light beam from a lighthouse or a stream of water shooting out from a rotating lawn sprinkler.
3. Show VISUAL AID: "Sun's Magnetic Field," and give each student a fold-out diagram of the sun's magnetosphere. Demonstrate how to fold the diagram along dotted lines so students can see how the sun's magnetosphere looks in the presence of solar wind, which is always blowing.
4. Ask students to use lines to draw the shape of the sun's magnetic field lines around the sun in Question #3 on their worksheets.

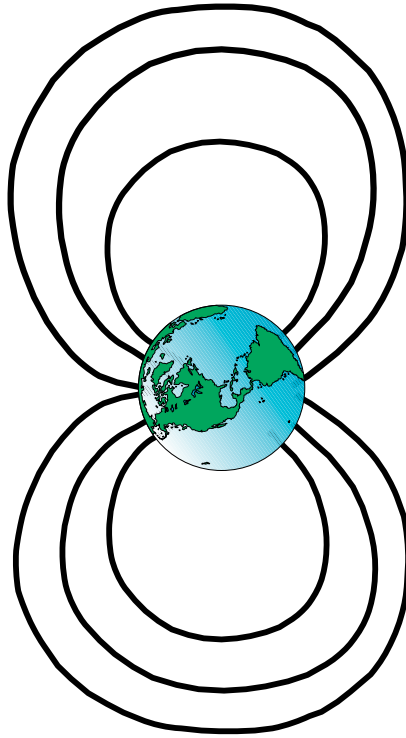
Answers to Student Worksheet:



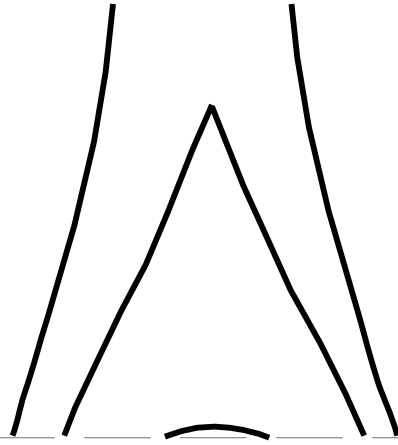
4. *A. solar particles blasting around Earth*
5. *B. particles streaming out from the surface of the sun*

Earth's Magnetosphere

Without
Solar Wind



With
Solar Wind



Fold Second (fold out)

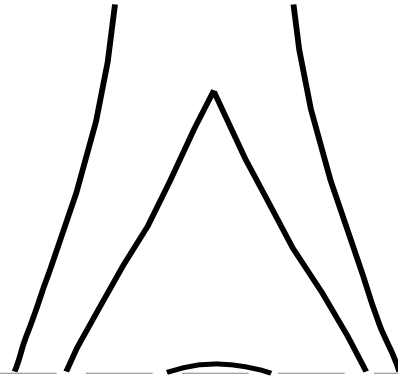
Fold First (fold in)

Fold First (fold in)

Fold Second (fold out)

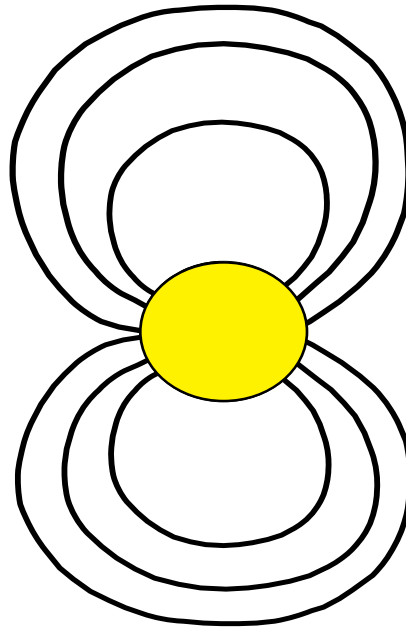
The Sun's Magnetosphere

With
Solar Wind



Fold Second (fold out)

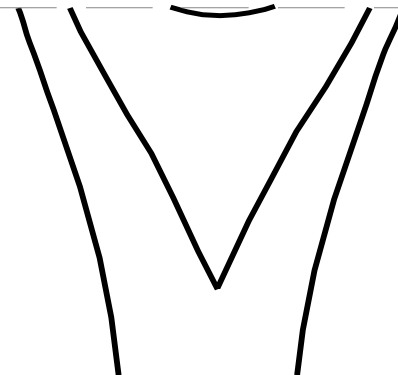
Without
Solar Wind



Fold First (fold in)

Fold First (fold in)

Fold Second (fold out)



Magnificent Magnetospheres

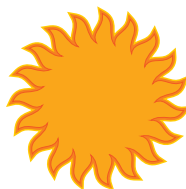
1. Use lines to draw the shape of Earth's magnetic field if it were not pulled by solar wind.



2. Use lines to draw the shape of Earth's magnetic field when it is pulled by solar wind, creating a magnetotail.



3. Use lines to draw the shape of the sun's magnetic field when it is pulled by solar wind.



4. Circle the words that most accurately complete the following sentence:

Earth's magnetosphere is stretched out by:

- A) solar particles blasting around Earth.
- B) the force of other planets.

5. Circle the words that most accurately complete the following sentence:

The sun's magnetosphere is stretched out by:

- A) the force of other planets.
- B) particles streaming out from the surface of the sun.