Aurora Ovals

Overview:

Students learn that aurora ovals surround Earth's open magnetic field lines and that aurora ovals can expand after a storm on the sun.

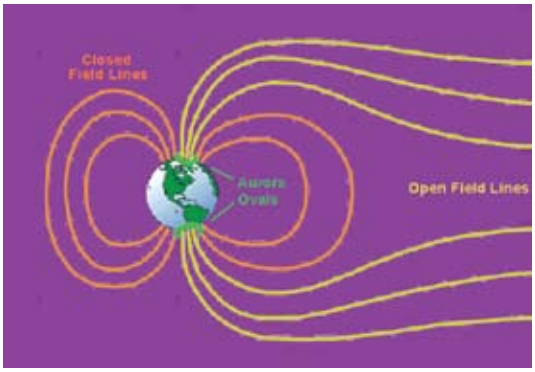
Objectives:

The student will:

- discover that the aurora oval stretches around Earth's open magnetic field lines and that the oval forms a boundary between Earth's open and closed magnetic field lines;
- determine that the aurora oval expands when a storm on the sun causes solar particles to bombard Earth's magnetic field. Earth reacts by creating more open magnetic field lines and the aurora oval stretches out to enclose these new open magnetic field lines;
- label open and closed magnetic field lines on a diagram;
- draw aurora ovals in the correct location on a diagram of Earth; and
- explain that Alaskans see the aurora when Earth rotates so that Alaska is under the aurora oval.

Materials:

- Globe
- Colored pencils
- Rubber bands
- VISUAL AID: "Magnetic Field Lines"
- VISUAL AID: "Open/Closed Field Lines
- VISUAL AID: "Viewing Auroras"
- STUDENT WORKSHEET: "Magnetic Field Lines"
- STUDENT WORKSHEET: "Aurora Ovals"



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Activity Procedure:

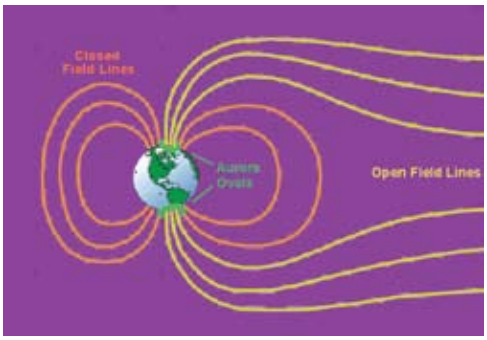
1. Use VISUAL AID: "Magnetic Field Lines" to explain that open magnetic field lines stretch out and are lost in space, while closed magnetic field lines loop back to Earth between the poles. Explain that aurora ovals make a circle around the open magnetic field lines near Earth's North and South Poles.
2. Distribute the STUDENT WORKSHEET: "Magnetic Field Lines." Ask students to label and color open magnetic field lines, closed magnetic field lines, and draw the aurora ovals (Question #2).
3. Show VISUAL AID: "Open/Closed Field Lines." Explain that aurora ovals form a boundary between the area covered by Earth's open magnetic field lines and Earth's closed magnetic field lines.
4. Ask students to color and label the area covered by open and closed magnetic field lines and the aurora oval, according to the instructions (Question #3). Ask students to answer Question #1.
5. Explain after a storm on the sun, solar particles bombard Earth's magnetic field. Solar storms can rip and break loose closed magnetic field lines and turn them into open magnetic field lines. Like a rubber band, the aurora oval stretches out to enclose these new open magnetic field lines.
6. Hold a handful of pencils near the north end of a globe. Explain that the pencils represent open magnetic field lines. Wrap a rubber band around the pencils and explain that the rubber band represents the aurora oval. Push more pencils inside the rubber band. Explain that as open magnetic field lines increase, the aurora oval stretches out to encompass them, just like a rubber band.
7. Show VISUAL AID: "Viewing Auroras." Explain Alaskans cannot see the aurora between noon and 2 p.m. in March because (1) Earth has rotated and Alaska is not under the oval; and (2) the daylight in Alaska is too bright to see the aurora. Explain Alaskans can see the aurora between midnight and 2 a.m. because Earth has rotated and Alaska is under the oval when the sky is dark and clear.
8. Distribute STUDENT WORKSHEET: "Aurora Ovals." Ask students to circle the image on the worksheet in which Alaskans can see the aurora and explain why.

Answers to Student Worksheets:

Magnetic Field Lines:

1. A. open magnetic field lines

2.



3.

Aurora Ovals:

1. C. an oval 2. B 3. Any two: Earth has rotated; Alaska is under the oval; clear night skies

Name:_____ **Student Worksheet**

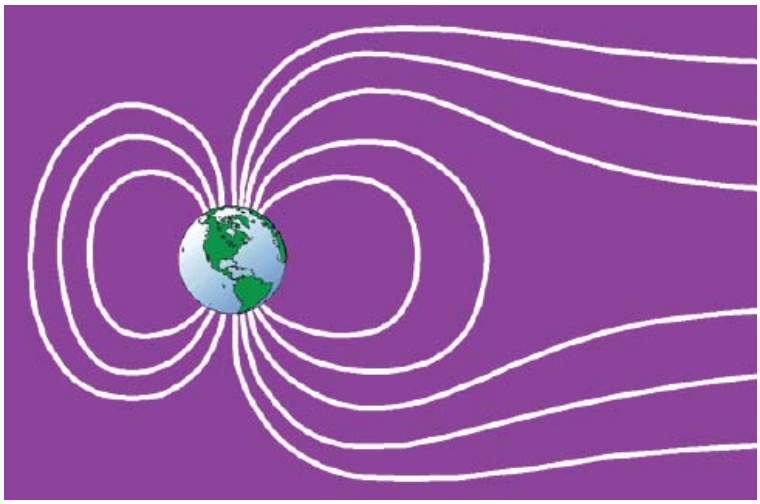
Magnetic Field Lines

1. The aurora oval stretches around what kind of magnetic field lines?

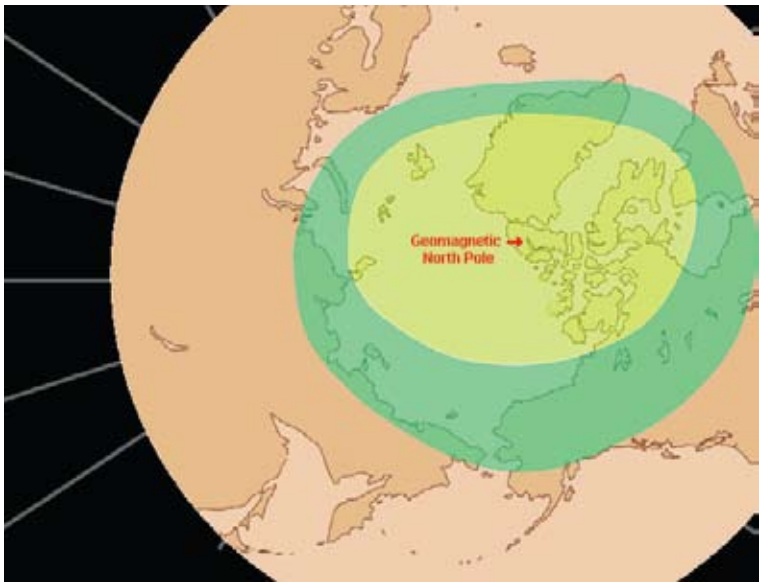
   A. open magnetic field lines

   B. closed magnetic field lines

2. Label and color Earth's open magnetic field lines with yellow and Earth's closed magnetic field lines with orange. Draw aurora ovals with green.



3. Fill-in the area covered by open magnetic field lines with yellow, the area covered by closed magnetic field lines with orange, and the aurora oval with green.

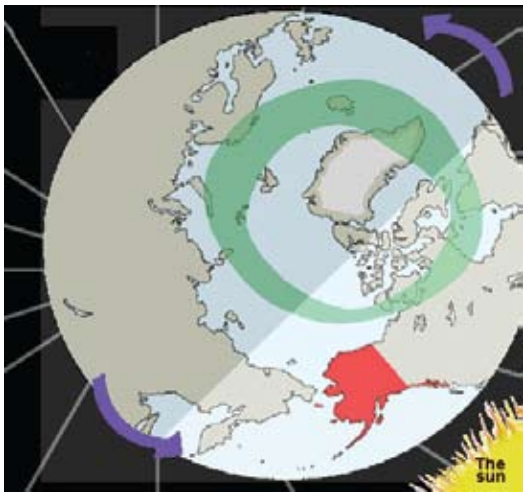


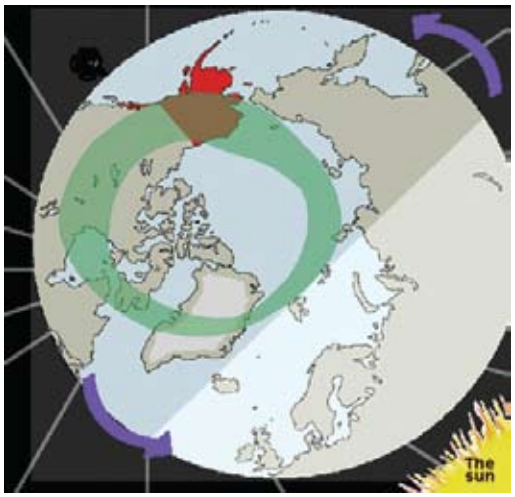
Name:_____ **Student Worksheet**

Aurora Ovals

1. The aurora forms what shape over Earth's geomagnetic poles?
   - A. a straight line
   - B. a zigzag line
   - C. an oval
   - D. a circle

2. Circle the image in which Alaskans can see the aurora.

A. 

B. 

3. Explain two reasons why Alaskans can see the aurora in the image you chose.

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