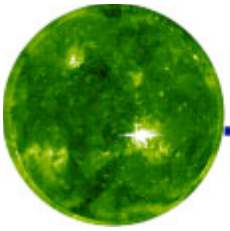


Where to See an Aurora

Middle School Grades

Lesson Summary
Students calculate and plot the locations from which aurora may be viewed.

Prior Knowledge & Skills
Understanding of:
- Basic characteristics of solar storms
- Aurora phenomena

Ability to:
- Read and interpret data tables
- Measure simple angles
- Plot points in terms of distance and angle

AAAS Science Benchmarks
The Nature of Mathematics
Mathematics, Science, and Technology
The Physical Setting
The Universe
Energy Transformations
Motion

NSES Science Standards
Science as Inquiry
Abilities to do Scientific Inquiry
Understandings of Scientific Inquiry
Physical Science
Transfer of Energy
Earth and Space Science
Earth in the Solar System
History and Nature of Science
Nature of Science

Mathematics Standards
Geometry
Measurement
Data Analysis & Probability
Problem Solving

Teaching Time: One 45-minute period

Materials per Student
- Ruler
- Colored pencils
- Atlas of the World
- Copy of student page
- ❖ *Protractor*
- ❖ *Enlarge map on the student page*
- ❖ *Pencil, standard*

Editor's recommendation

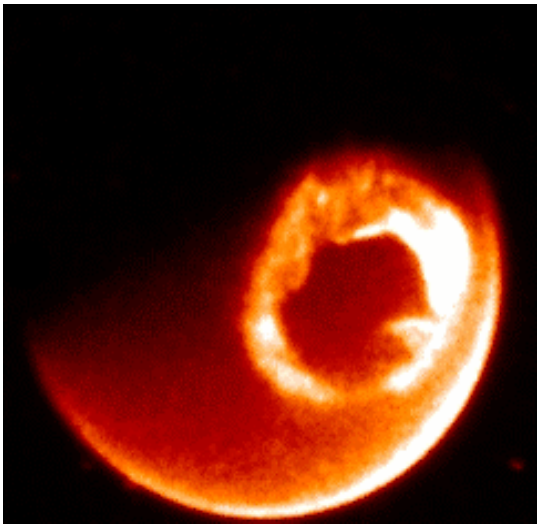
Advanced Planning
Preparation Time: 20 minutes
1. Review the lesson
2. Revise the student page to increase the size of the map
3. Practice plotting points

Editor's Note
Student ability to plot data used in this lesson would benefit from enlarging the map of the northern hemisphere.

The Northern Lights, pp. 8-9, NASA
EG-2000-XX-XXX-GSFC
http://image.gsfc.nasa.gov/poetry/activity/NLbook.html

LASP
LABORATORY FOR ATMOSPHERIC AND SPACE PHYSICS

Activity 2 Where to See an Aurora



As this image from the IMAGE satellite shows, from space, the aurora look like rings of light surrounding the North and South Poles. This activity has students plot the location and boundaries of a typical auroral 'oval' in the Arctic region. They will see its geographic extent, and determine its relationship to familiar continents and countries. They will also see that it is centered on the North Magnetic Pole and not on the North Geographic Pole. This is a clue that Aurora are related to Earth's magnetic field.

Math and Science Objectives:

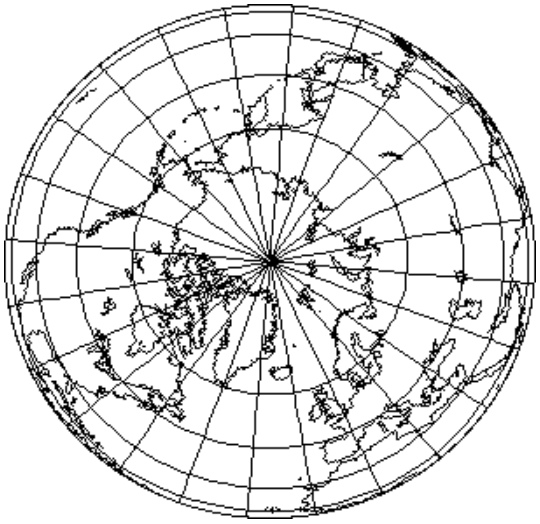
Find and describe locations on maps using geographic coordinates.
Graphs can be used to show a variety of possible relationships.
Graphs can be used to make predictions about the phenomena being graphed

Sample questions:

1...Where would you travel in North America to see aurora? **Answer: To Canada or Alaska**
2...About where is the center of the auroral oval located? **Answer : +78 North 104 West**
3...How far is the center of the auroral oval from the North Pole? **Answer: About 500 km.**
4...What is the range of widths of the auroral oval in kilometers? **Answer: From about 500 to 1500 km.**
5...If you were located at (100, 68) where would you look in the sky for the aurora? **Answer: Straight up!**
6...If you were located at (100,40) where would you see the aurora in the sky? **Answer: Northern horizon.**

Materials:

Ruler / Straight edge
Color pencils
Atlas



Student Name _____ Date _____

The Northern Lights are seen most dramatically in only certain places in North America.

Step 1) Plot the points in the satellite data table onto the geographic grid.
Step 2) Connect the points in the two rings which define the auroral oval boundaries.
Step 3) Color the resulting enclosed area with your favorite auroral colors!
Step 4) Identify the visible landforms.

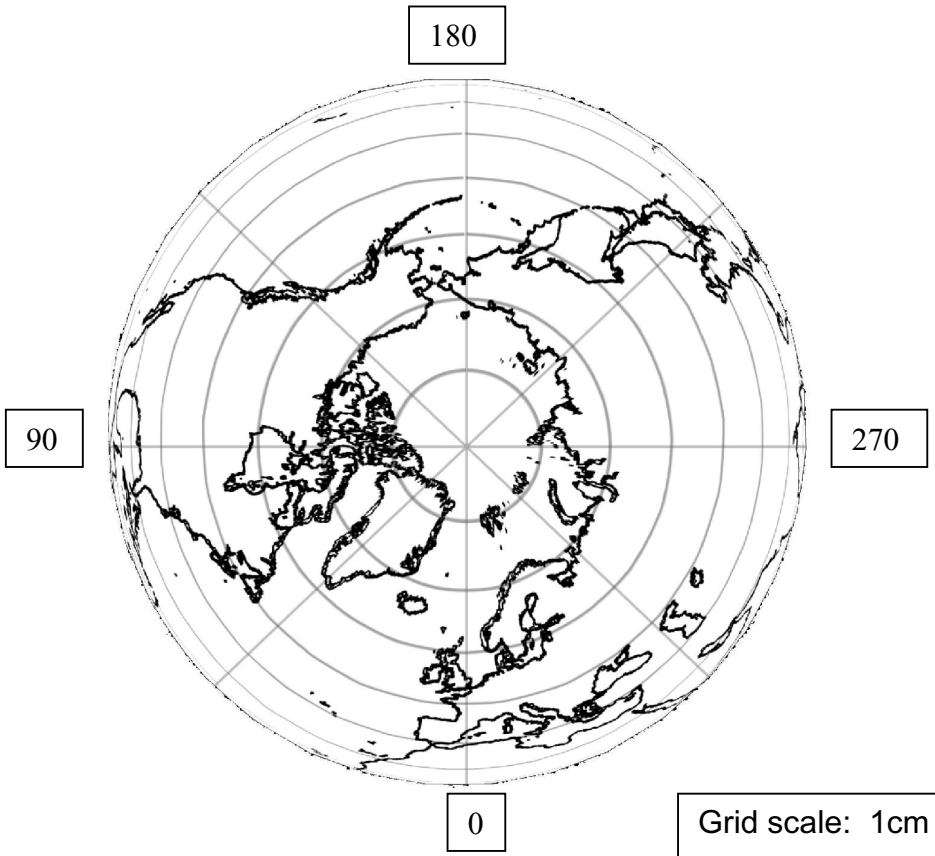
Note: The points are identified as ordered pairs: (Longitude,Latitude)

Outer Ring of Auroral Oval:

1...(270,65)	**2...(225,64)**	**3...(180,60)**	**4...(135,55)**	**5...(90,50)**	**6...(315,63)**
7...(0,60)	**8...(40,63)**	**9...(45,60)**	**10..(60,60)**	**11..(115,50)**	**12..(160,58)**

Inner Ring of Auroral Oval:

1...(270,78)	**2...(225,72)**	**3...(180,70)**	**4...(135,67)**	**5...(90,65)**	**6...(315,67)**
7...(0,75)	**8...(40,72)**	**9...(45,70)**	**10...(60,67)**	**11...(115,62)**	**12...(160,70)**



Grid scale: 1cm = 1400 km