

The Science of Auroras

Learning Activity – Celebrating Diversity from Space Association of Space Explorers

Developed by Meredith Swartzendruber



Description

In this lesson, students will explore how the Earth-Sun system creates the Northern Lights (Aurora Borealis). Through a hands-on activity, students will understand the interactions between solar wind, Earth's magnetic field, and atmospheric particles that lead to this spectacular phenomenon.

Grade Level

Middle School

Duration

Two class periods

Materials

- Flashlight (representing the Sun)
- Balloons (representing Earth)
- Iron filings (to visualize magnetic fields)
- Cardboard or heavy paper (to create the Earth model)
- Colored chalk or markers (to illustrate the auroras)
- Earth Music Theater-55 Minutes of Glorious Earth Video
- Safety goggles

- Post-it Notes (two per student)
- Comic template

Learning Goals

Students will be able to:

- Explain how solar wind interacts with Earth's magnetic field.
- Describe the role of atmospheric particles in creating the Northern Lights.
- Create a model to demonstrate the process of auroras.

NGSS Standard(s):

- MS-ESS1-3 - Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-ESS2-4 - Develop a model to describe the cycling of Earth's materials and the energy that drives this process.

Lesson Activities

ENGAGE

Students will be shown minutes 10:00-14:00 from the Earth Music Theater-55 Minutes of Glorious Earth video to capture their attention. While the video is playing, the teacher will divide the board into two halves. Label one half "What I know" and the other half "How I think they formed." During the video, students write on one post-it note what they know about Northern Lights. On the other post-it note, students will write how they think they are formed. Students will place their completed post-it notes on the board. Teacher will inform students that they will come back to their responses later in the lesson, and introduce students to some new words they may see in this lesson: solar wind, magnetic field, aurora, and atmosphere.

EXPLORE

Demonstrate:

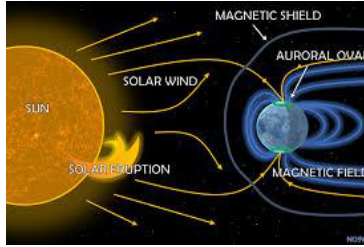
Teacher will dimly light the room, and use a flashlight to represent the Sun. Shine the light on the balloon, which represents Earth, while having students make observations on how the light interacts with the balloon. Teacher will sprinkle iron filings around the balloon to demonstrate how the magnetic field works. Have students observe how the filings align with the magnetic field around the balloon.

Discussion:

Teacher will lead a class discussion on how solar wind (light from the flashlight) interacts with the Earth's magnetic field (represented by the iron filings) and how the interaction leads to the formation of auroras. Explain that auroras form when charged particles collide with atmospheric gases.

EXPLAIN

Teacher will have a short whole group instruction about the science behind auroras. Explain to students that solar winds are made of charged particles that are released by the Sun. Using diagrams to provide a visual for students, demonstrate how the particles are deflected by Earth's magnetic field and cause them to collide with particles in Earth's atmosphere. This results in colorful displays, known as auroras!! Students will draw a version of this diagram on a sheet of paper, and label all the parts. This will be submitted with the hands-on activity at the end of class as a formative assessment.



ELABORATE

In small groups, students will create a model of the Sun-Earth system using balloons, colored chalk, and cardboard. Students will

- inflate a balloon to represent Earth
- Use cardboard to create a base that represents the Sun and Earth's atmosphere. On the cardboard, they can draw the diagram they had made on paper during the class instruction.
- To represent the auroras, students will use the colored chalk to create colorful displays around the poles of the Earth.

Following the construction of the models, each group will present their model to the class, and explain how the Northern Lights are created based on their understanding of the Sun-Earth system.

EVALUATE

After the student presentations, the teacher will bring the group back to whole class and return to the post-it notes from the beginning of class. Select a few of the notes from the board, and determine if what they knew was true and how their understanding has changed from the lesson. Teacher will encourage students to provide feedback to their peers after their presentations.

Students will then use a comic template to explain how auroras form step by step. They can use visuals or words to demonstrate their knowledge in each box of the template. The completed comic will be submitted as a summative grade.