Particle Collision

Overview:

This activity reinforces the idea that the aurora is created when particles from the sun collide with gas particles in Earth's atmosphere about 60 to 600 miles high. The lesson focuses on the auroral colors: green, purple, and red. The greenish-glow is produced by oxygen in Earth's atmosphere; the purplish glow is produced by nitrogen; and the rare red aurora is produced by high-altitude oxygen in Earth's atmosphere.

Objectives:

The student will:

- discover the aurora is created when particles from the sun collide with gas particles in Earth's atmosphere about 60 to 600 miles high;
- determine when the sun's particles collide with oxygen in Earth's atmosphere, a greenish glow is produced;
- observe when the sun's particles collide with nitrogen in Earth's atmosphere, a purplish glow is produced;
- determine when the sun's particles collide with high-altitude oxygen in Earth's atmosphere, a reddish glow is produced; and
- conclude particles in the atmosphere are more dense at lower elevations and less dense at higher elevations.

Materials:

- An open space in which students can move around
- Flashlights labeled "oxygen" and covered with green cellophane
- Flashlights labeled "nitrogen" and covered with purple cellophane
- Small number of flashlights labeled "high-altitude oxygen" and covered with red cellophane
- VISUAL AID: "Earth's Atmosphere"
- VISUAL AID: "Glowing Gases"
- VISUAL AID: "Bright Aurora Particles"
- VISUAL AID: "Bright Aurora Colors"
- STUDENT WORKSHEET: "Particle Collision"

Particle Collision

Classroom Discussion:

1. Show VISUAL AID: "Earth's Atmosphere." Explain the aurora occurs in Earth's upper atmosphere and is created when particles from the sun collide with gas particles in Earth's atmosphere about 60 to 600 miles high.

2. Show VISUAL AID: "Glowing Gases." Explain different colors are produced when the sun's particles crash into different gases in Earth's atmosphere. Review that red auroras created by high-altitude oxygen are rare. Most of the auroras we see are created when particles from the sun crash into oxygen and nitrogen about 60 miles above Earth.

3. Show VISUAL AID: "Bright Aurora Particles." Demonstrate that particles in the atmosphere are more dense at lower elevations and less dense at higher elevations. Show them that a thick soup of oxygen and nitrogen exists at lower elevations (about 60 miles above Earth), and that a thin soup of high-altitude oxygen exists at higher elevations (about 600 miles above Earth).

4. Overlay VISUAL AID: "Bright Aurora Colors" on top of VISUAL AID: "Bright Aurora Particles" to show students how glowing gas particles make up the bright aurora they are familiar with seeing.

5. Ask students to help create two signs for the classroom. On one sign write "60 miles (100 kilometers) above Earth." On the second sign write "600 miles (965 kilometers) above Earth."

Particle Collision

Activity Procedure:

1. Ask students to act out the process that occurs in Earth's atmosphere to create the aurora. It may be a good idea to ask students to move their desks to the wall, or move to an open area.

2. Show VISUAL AID: "Earth's Atmosphere" again. Instruct students to recreate Earth's upper atmosphere between 60 and 600 miles high with this activity.

3. Ask students to place the "60 miles (100 kilometers) above Earth" sign on one wall and the "600 miles (965 kilometers) above Earth" sign on the opposing wall.

4. Ask two students to represent particles from the sun.

5. Ask a few students to represent high-altitude oxygen particles in the upper atmosphere. Give each of these students a flashlight with a red bulb. Explain that because they represent rare high-altitude oxygen particles, they are confined to a small area high in the atmosphere. Because of that, throughout this activity, these students must stand within one arm's length of the wall on which the "600 miles (965 kilometers) above Earth" sign is hanging.

6. Divide the majority of the students into two groups. Give each student in the oxygen group a flashlight with green cellophane attached. Give each student in the nitrogen group a flashlight with purple cellophane attached. Explain because they represent oxygen and nitrogen in the atmosphere, they must start out the activity close to the wall with the "60 miles (100 kilometers) above Earth" sign on it, but they may walk freely between it and the center of the room. However, they cannot venture close to the opposing wall on which the "600 miles (965 kilometers) above Earth" sign is hanging.

7. Turn off the classroom lights.

8. Ask the students acting as the sun's particles to travel to any person and tap their shoulder. When that person is tapped, they must stop walking and turn their flashlight on and off. Soon, all students will turn their flashlights on and off to simulate the colors and motion of the aurora.

9. Turn the classroom lights back on. Hand out the STUDENT WORKSHEET: "Particle Collision," and ask students to complete it.

Answers to Student Worksheet:

1. oxygen 2. nitrogen 3. red 4. C. between 60 and 600 miles

Name:_____ **Student Worksheet**

Particle Collision

1. Name the gas that creates the green color of the aurora.

2. Name the gas that creates the purple color of the aurora.

3. When solar particles crash into high-altitude oxygen, what color is created?

4. The aurora is located how high above Earth?

   A. between 10 and 20 miles high

   B. between 40 and 60 miles high

   C. between 60 and 600 miles high

   D. between 1000 and 2000 miles high

