COMPLETE THE CIRCUIT *(MODIFIED FOR YFSD)*

INSTRUCTIONS

Overview:

Students compare the components of a generator to the dynamics of the aurora.

Objectives:

The student will:
- identify components of the aurora phenomenon; and
- compare components of generator to the aurora.

Targeted Alaska Grade Level Expectations:

Science

[5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

[7] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by recognizing that electric currents and magnets can exert a force on each other.

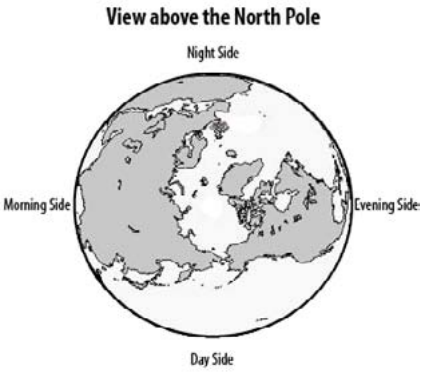
[10] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by explaining that different kinds of materials respond to electric and magnetic forces (i.e., conductors, insulators, magnetic, and non-magnetic materials).

[11] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by conducting an experiment to explore the relationships between magnetic forces and electric forces to show that they can be thought of as different aspects of a single electromagnetic force (e.g., generators and motors).

[9] SD3.2 The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by explaining the phenomena of the aurora.

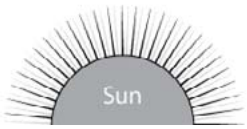
Materials:

- Flashlight
- Wire
- Scissors
- Globe
- File folders
- Fine-grit sandpaper
- Glue or tape
- Continuity testers
- STUDENT WORKSHEET: "Complete the Circuit"



Activity Preparation:

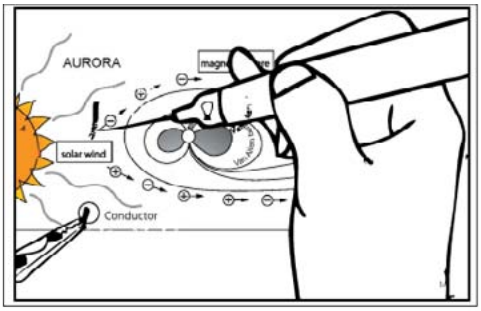
1. Make a model of an electroboard using the directions on the STUDENT WORKSHEETS: "Complete the Circuit." If wire is not available, strips of aluminum foil secured with masking tape also will work.



Activity Procedure:

1. Write the following terms on the board: day side, night side, morning side and evening side. These terms will be helpful in understanding parts of the aurora generator. To illustrate these terms, turn off the lights in the classroom and shine a flashlight at the globe. Explain that the flashlight and the globe are models of the sun's light shining towards Earth. Ask the students to guess which sides are the day side and night side, then the morning side and evening side.

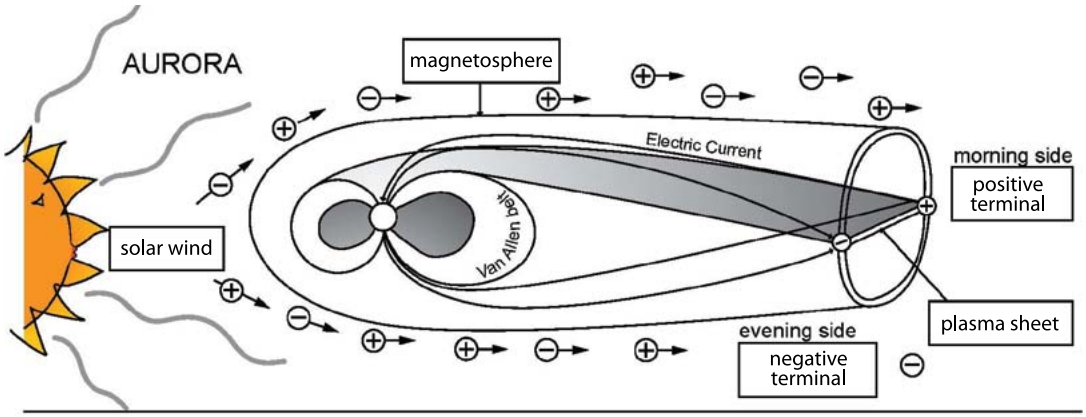
2. Distribute STUDENT WORKSHEETS: "Complete the Circuit." Guide students through the reading passage and the diagram, then have the students continue on with Part 1 and Part 2. Keep the model electroboard available for reference.



Answers:

STUDENT Worksheet: "Complete the Circuit"

1.



2. When connected to "conductor," the continuity tester should light up when the other end is connected to the solar wind on the aurora or the wire on the simple generator. When connected to "magnetic field," the continuity tester should light up when the other end is connected to the magnetosphere on the aurora or the magnet on the simple generator.

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COMPLETE THE CIRCUIT

Directions: Read the following passage, referring to the diagram on the following page.

In creating a generator, certain components are necessary. What are those parts and how are they present in making the aurora? To generate electricity, a conductor and a magnetic field must move across each other. In the simple generator, the wire is the conductor. For the aurora, the plasma of the solar wind is the conductor. It contains high speed positively charged particles (ions) and negatively charged particles (electrons).

The magnetic field in the aurora system is the magnetosphere. The magnetic field in the simple generator is the magnet.

A generator must have a positive and negative terminal. In the simple generator, the terminals are the positive and negative sides of the magnet. The doughnut shape created by magnetic field lines around Earth is called the Van Allen belt. On the night side, the Van Allen belt stretches out inside the magnetotail to form a sheet called the plasma sheet. In the magnetosphere, the positive terminal is on the morning side of the plasma sheet and the negative terminal is on the evening side of the plasma sheet.

The magnetic field lines act as invisible wires, sending electric current from the morning side terminal to Earth's ionosphere. Then the current heads back out to the negative terminal on the evening side of the plasma sheet.

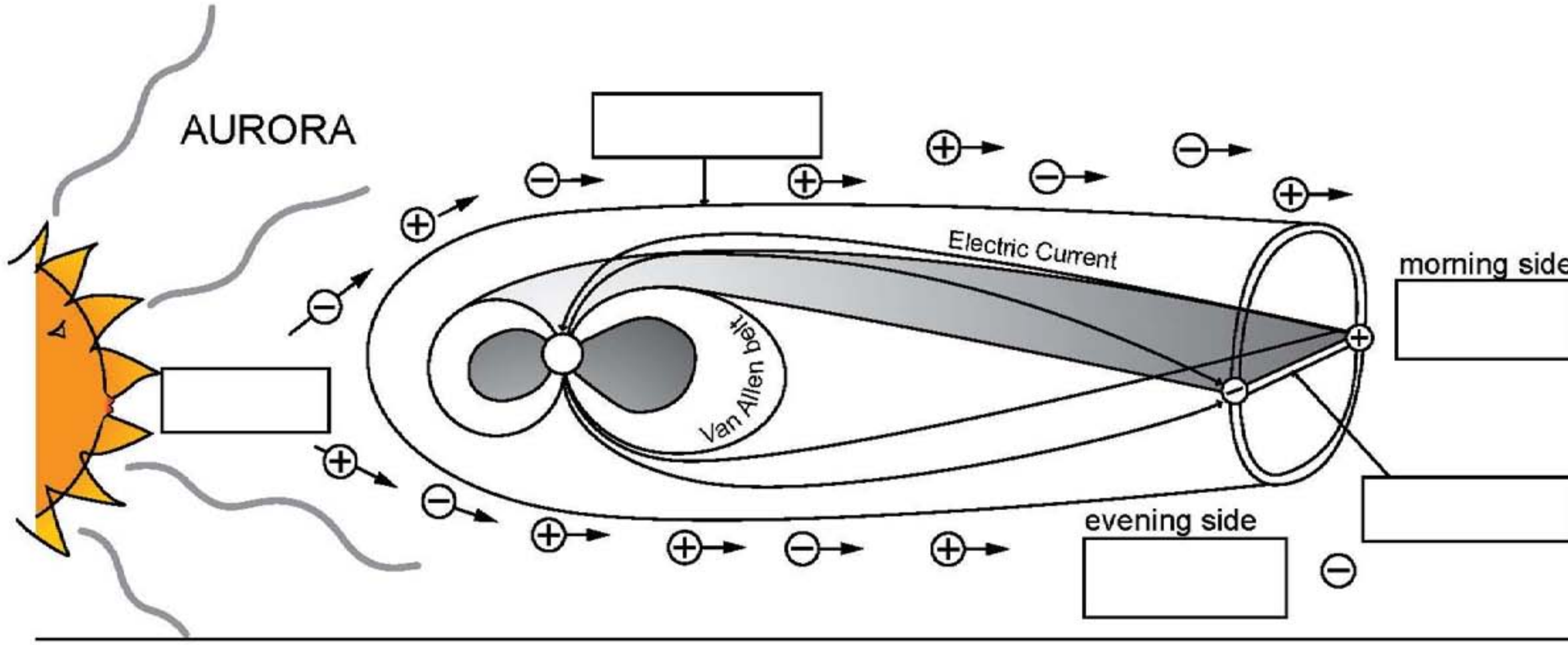
This system can generate an electric current of about one million amperes along an auroral curtain. Sometimes, during major geomagnetic storms, this auroral activity will generate current in long conductors on Earth. Long conductors on Earth include power lines and pipe lines.

Part 1:

Using the information above, correctly fill in empty boxes on the following diagram with words from the word bank.

WORD BANK

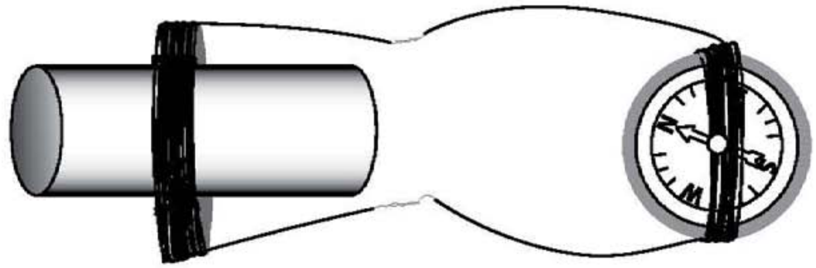
plasma sheet
positive terminal
negative terminal
solar wind
magnetosphere



○ conductor

○ magnetic field

Simple Generator



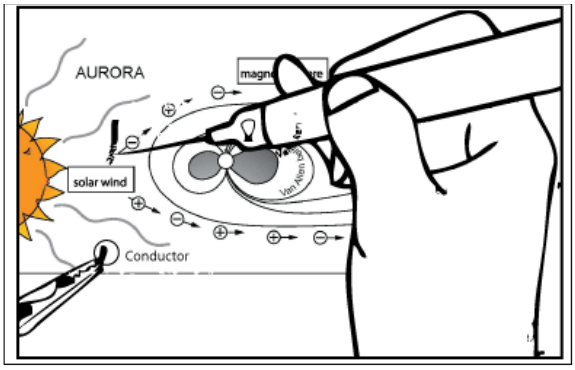
Directions: Connect one end of the continuity tester to the wire by "conductor" or "magnetic field". Place the other end on the corresponding wire for the Aurora or the simple generator. If you have it on the correct part, the continuity tester will light up.

NAME: _____

COMPLETE THE CIRCUIT

Part 2:

Make an electroboard that shows the relationship of the aurora to a generator. An electroboard works by connecting corresponding parts with wire. When corresponding parts are connected with the continuity tester, it should light up.



Materials:

- File Folder
- Glue or tape
- Wire
- Scissors
- Fine-grit sandpaper
- Continuity tester

Activity Procedure:

1. Glue or tape page 2 (of this worksheet) to the top of the file folder.
2. Open up the folder and poke a hole through the circle by "conductor" and poke small holes in the corresponding parts in the diagram of the aurora and the simple generator.
3. Cut piece of wire that will connect the corresponding parts together. Poke the ends through the holes from the inside of the folder to the outside and remove the insulation with the sandpaper. Then fold over the exposed wires on the outside to keep them from going back through the hole.
4. Repeat steps 2 and 3 for "magnetic field."
5. Close the folder to cover up the wires and tape it shut.
6. Use the continuity tester to test the circuits. If the electroboard was made correctly, the directions on the front of the diagram should work.