



How Solar Cells Work

Grades: Middle School

Subjects: Science, Language Arts

Time: 60 minutes



***Standards:** Students will...

Science Standard 9: Understand the sources and properties of energy.

Benchmark # 1: Know that energy is a property of many substances (e.g., heat energy is in the disorderly motion of molecules and in radiation; electrical energy is in the attraction or repulsion between charges).

Benchmark # 4: Know how the Sun acts as a major source of energy for changes on the Earth's surface (i.e., the Sun loses energy by emitting light; some of this light is transferred to the Earth in a range of wavelengths including visible light, infrared radiation, and ultraviolet radiation).

Benchmark # 11: Understand the origins and environmental impacts of renewable (e.g., solar energy) and non-renewable resources, including energy sources like fossil fuels.

Technology Standard 6: Understand the nature and uses of different forms of technology.

Benchmark # 3: Know that most technological systems require an input of energy, which is an important consideration both in designing an object or a system and in conserving energy (e.g., so many things require energy that alternative sources to fossil fuels should be used when possible).

Geography Standard 14: Understand how human actions modify the physical environment.

Benchmark # 3: Understand the ways in which technology influences the human capacity to modify the physical environment (e.g., the effects of the introduction of electricity, combustion engine vehicles, chemicals and fertilizers).

Objectives: Students will be able to...

- Describe energy as the ability to cause motion or create change.
- Describe how the parts of a photovoltaic cell work and how photovoltaic cells can convert the Sun's rays into electricity.
- Generate a graphic representation of a photovoltaic cell to demonstrate knowledge and understanding of its parts and processes.

[Please click here to view both the creative artwork for this great lesson and the downloadable PDF.](#)

Materials:

- A paved area
- Chalk
- Bell
- 40-Foot Rope
- "Solar Cells Materials and Diagram" worksheet included below

Overview: Photovoltaic or solar cells turn energy from the sun into electricity. These cells are made of materials known as semiconductors such as silicon. Energy is created when a photon of light from the sun strikes a solar cell and is absorbed within the semiconductor material. This excites the cell's electrons, causes the electrons to flow, and creates a usable electric current. The energy created is delivered to a loader, such as a calculator or home appliance. Individual cells, ranging in size from a half inch to four inches across, are combined to form solar panels. One cell only produces one or two watts which isn't much power for most uses. In order to increase power, photovoltaic or solar cells are



bundled together in a package called a module. The attached worksheet shows the basic process photovoltaic cells use to convert sunlight into electrical power.

Kid's Speak: Photovoltaic cells turn the sunlight into electricity. Energy is created by photons from the Sun hitting electrons in the cells. The electricity is then delivered to a loader. Cells are combined to form solar panels, which can supply almost anything with electricity – even space shuttles.

Eco-Fact: The impact of photovoltaic systems on the environment is minimal, requiring no water for system cooling and generating no by-products.

Procedures:

Before Experiment:

- Explain to students what photovoltaic cells are and how they work.
- Explain to the class that photovoltaic cells are combined to form solar panels.
- Show students images of photovoltaic cells and solar panels.
- Tell the class that they are going to create a photovoltaic cell model and that students will be working parts of the model.
- Read through the experiment instructions with the class.
- Bring the class outdoors to conduct the experiment.

Experiment Instructions:

1. Draw an outline of a 10 foot by 10 foot box with a piece of chalk. Explain to students the box represents a photovoltaic cell.
2. Draw an outline of a circle 15 feet in diameter, and explain to students that it represent the Sun.
3. Make 10 knots in the rope, two feet apart, and tie the ends of the rope together; place the rope over the photovoltaic cell chalk outline.
4. Have ten students each grab onto a knot around the cell. These students represent electrons.
5. Have the remaining students stand in the circle to represent the sun's photons.
6. Place a bell outside the cell and tell students it represents a loader. Have the student holding the last knot on the rope stand next to the bell.

One of the students who represent the Sun's photons will walk over to the first student electron and hold that student's hand. Explain to the class that the photon is energy and creates motion. Have the two joined students walk inside the cell to the cell's next electron and tag it. The tagged electron will move to the next electron and tag it. Continue this chain of movement until the energy reaches the last student holding a knot. The last student activates the circuits load by ringing the bell.

7. After the bell rings, have the electron circle around the rope and grab the first knot. Then, have another photon leave the Sun and continue the process. Continue until all the photons leave the Sun. Explain to the class that, unlike the demonstration, the Sun never runs out of photons.

After Experiment:

- After the demonstration is complete, have students create a diagram of the model. Have students label the parts of their diagrams with appropriate scientific terms used in the lesson and arrows that show movement.

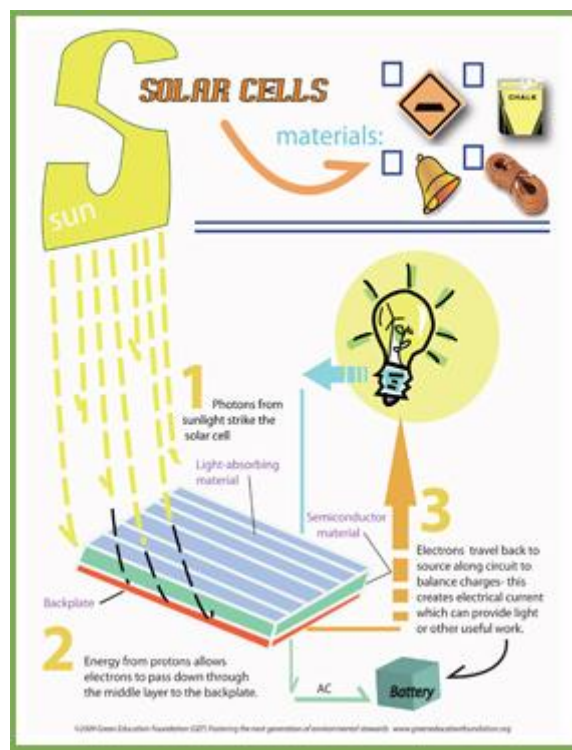
Adaptations: Diagrams may be done as part of a homework assignment and shared in class the following day.



Extensions:

- As a follow up lesson or for homework, have students write an explanation to accompany their diagrams.
- Take a field trip to a site that uses solar panels.
- Have a contractor that installs solar panels speak to the class.

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- To view full-size lesson plan and print, follow these directions:
1. Click on the image above
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For technical assistance with printing any of the GEF lessons, please contact:
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