



Solar Boats

Lesson 4: How do Solar Panels Work?

AUTHOR: Carol Patrick

DESCRIPTION: Students will learn the basics of how a solar cell generates electricity and observe the effects on a small electrical load attached to a solar module under a variety of conditions. They will build upon knowledge gained in previous lessons dealing with energy transformations in order to build an understanding of how the sun's energy can be converted into kinetic electrical energy within a photovoltaic cell. Students will additionally be given the opportunity to explore the interaction between current flow and operation of a load through their own exploration of different DC-powered devices.

GRADE LEVEL(S): 4, 5, 6

SUBJECT AREA(S): Science, energy, solar energy, photovoltaic effect, solar thermal, electromagnetic radiation, greenhouse effect, absorption, reflection, conductivity, energy transfer, photons, electrons,

ACTIVITY LENGTH: 1 hour

LEARNING GOAL(S): Students will be able to describe, in basic terms, the way that electricity is generated from a solar cell. Students will be able to determine that energy from the sun is being converted directly into electricity. Students will understand that this electrical energy that is produced in this energy transfer is able to perform the work required within a small load.

NEXT GENERATION SCIENCE STANDARDS:

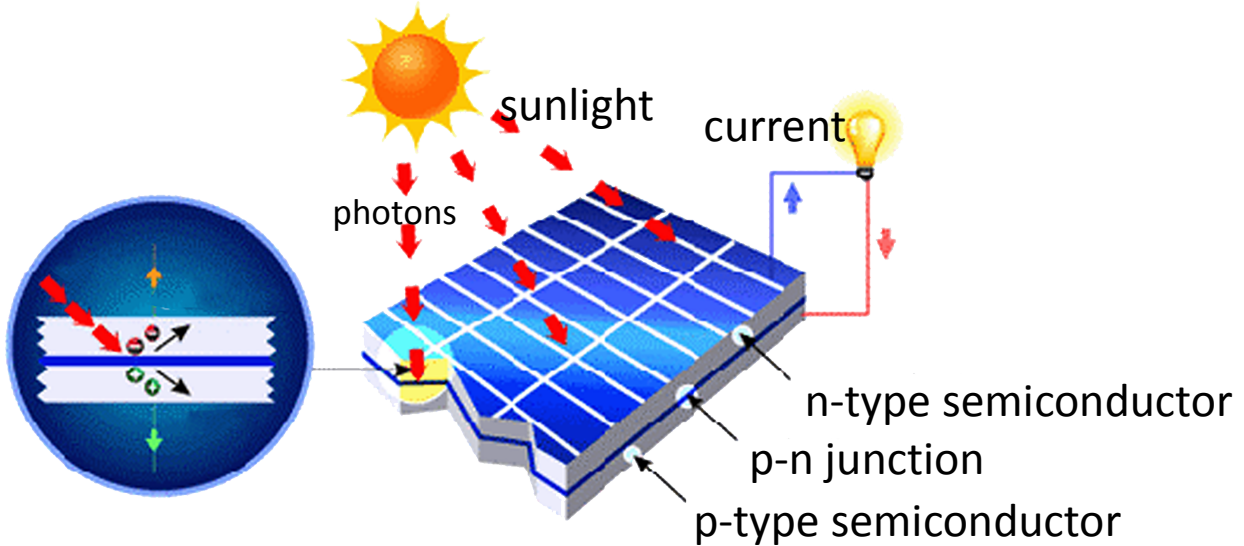
- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

STUDENT BACKGROUND:

Students have a basic understanding of energy, but little to no understanding of solar power or electricity/circuits. They will understand that energy cannot be created or destroyed, only transformed from one form to another, based on observations they have made in previous lessons demonstrating energy transfer.

EDUCATOR BACKGROUND:

- Basics of the photovoltaic effect
- Information from Basics of Solar presentation, by Joe Rand from KidWind (<http://www.kidwind.org/>)



Materials List (per student group)

- (1) small solar module
 - (1) DC motor with a propeller attached
 - Sunlight or another light source (shop lights will work)
-

Lesson Details

Activity – Basics of Solar

- Present KidWind Slideshow, “Basics of Solar”. Use this piece primarily as a way to provide images to your students that they may be familiar with or can provide them new references as they move forward in their development of knowledge regarding photovoltaics. You may consider printing off some of these images for students to reference as they are observing a photovoltaic cell generating electricity.
- Demonstrate a solar circuit by attaching a solar module to a DC motor with propeller attached. Note: We used a 0.5-5 V DC motor that would work with a small 0.5 V motor only in direct sunlight (or close to shop light). A larger module (at least ~10in² is recommended, such as a SunWind Solar 1.5 V or 2 V solar panel).
- Have students make observations about the speed of the motor – how can they get it to change (faster, slower, stop)? Note: this is to begin preparing students to think about the

Solar 4R Schools™ is a program of BEF.

BONNEVILLE ENVIRONMENTAL FOUNDATION : 240 SW 1st Avenue
: Portland OR 97204
: 503-248-1905
: www.b-e-f.org

angle of the solar module for the next activity, but they may also discover some aspects of shading a solar panel and that covering one cell of the module will stop the fan, even though they can cover a much larger area. Even if you are not familiar with the reasons for this, encourage this inquiry and exploration, and do not be afraid to say you don't know the answer!

- Throughout this process of exploration, have students “play” with as many loads as they can. Electronics that generate sound, such as radios and old battery-powered toys, are some of the best tools to use as a demonstration of current flow, as they will generate different types of sound depending on the amount of current they are receiving. Students may, however, need assistance determining where to place the leads from their modules on the toys, however, remind them that photovoltaic cells act similarly to batteries and that they can use the same location where they would place those.

References

- KidWind PowerPoint and website www.KidWind.org

Solar 4R Schools™ is a program of BEF.

BONNEVILLE : 240 SW 1st Avenue
ENVIRONMENTAL : Portland OR 97204
FOUNDATION : 503-248-1905
: www.b-e-f.org