



*Drexel-SDP GK-12 ACTIVITY*

# **Lumens & Solar Energy Voltage**

**Subject Area(s)** Earth & Space

**Associated Unit**

**Associated Lesson**

**Activity Title** Discover The Relationship Between Lumens and Solar Generated Voltage

**Grade Level** 5 (4 - 6)

**Time Required** 1.5 hrs

## **Summary**

This activity allows students to discover the relationship between the amount of light available and the amount of solar energy produced via a solar cell. Students use handheld Explorer devices to measure light, in lumens, and electricity, in volts.

## **Engineering Connection**

Engineers investigate solar energy as a source of renewable energy. Scientists investigate methods of capitalizing on the sun as a power source. There is a relationship between the amount of sunlight present and the amount of electricity that can be produced from this energy. In this activity students will explore this relationship.

## **Keywords**

Solar Energy, Solar Cell, Voltage, Lumens

## **PA Educational Standards**

- Science & Technology:
  - 3.4 Physical Science, Chemistry, and Physics
  - 3.6 Technology Education
  - 3.7 Technology Devices

- Math:
  - 2.3 Measurement and Estimation
  - 2.4 Mathematical Reasoning and Connections
  - 2.5 Mathematical Problem Solving and Communication
  - 2.6 Statistics and Data Analysis

**Pre-Requisite Knowledge**

- 1) Review the definition of solar energy. Discuss what students know about the sun and solar energy.
- 2) Introduce students to the concept of lumens, the unit of measure for light, and voltage, the unit of measure for electricity.

**Learning Objectives**

After this lesson, students should be able to:

- Understand the relationship between the amount of light available and the amount of energy produced by a solar cell.

**Materials List**

Solar Cell

Device capable of measuring lumens

Digital Multi-meter

**Introduction / Motivation**

Renewable energy is energy generated from natural sources such as sun, wind, and rain. Engineers and scientists are interested in developing methods of using these resources to generate energy suitable for human use. Wind turbines (commonly called windmills) are one method of using the wind to generate electricity. Water can also be used to generate electricity by turning water turbines. Likewise, the sun can be used as a source of energy as well. One tool used to harness the sun's energy is a solar cell. Solar cells convert solar energy into electricity. In turn, this electricity can be used as needed by people.

In this lab you will explore the relationship between the amount of sunlight present and the amount of electricity generated by a solar cell. Engineers strive to develop solar cells that maximize the amount of energy produced from the cell.

**Vocabulary / Definitions**

Word	Definition
Lumens	Unit of measure for light
Voltage	Unit of measure for electricity
Solar Energy	Energy from the sun

## **Procedure**

- 1) Ask students to hypothesize about the relationship between lumens and voltage and write their hypothesis on the attached worksheet.
- 2) Using the unlabeled table on the worksheet allow students to correctly label the table with lumens and voltage.
- 3) Choose five or six locations where the students will take their measurements. Select locations with varied levels of light, near a window, a dark corner, under a desk, etc. Record the locations on the worksheet table.
- 4) Allow students to measure and record the voltage generated from the solar cell using the digital multi-meter.
- 5) From the same location, allow students to measure and record the amount of light, in lumens using the light meter.

## **Attachments**

Solar Energy Worksheet

## **Troubleshooting Tips**

If students are unable to measure voltage from the solar cell you can:

- Make sure the leads of the voltage meter are properly connected to the solar cell. Students should be able to maintain the connection with their fingers long enough to make a measurement. If not, they may need assistance.
- Make sure that there is enough light in the area for the solar cell to work. Be sure to choose at least 1 sunny location to show a contrast in measurements.

## **Assessment**

Post-Activity Assessment

Have the students create a lab report. Using the worksheet as a start the report should be completed on a separate sheet of paper. The report should begin by stating the problem and the hypothesis the student recorded in Step 1. The materials and procedure sections should follow with enough detail for someone to replicate the experiment exactly. The measurements should be listed in a copy of the table from the worksheet. The table should contain the proper labels and title. In addition to the table the students should create a graph of the data. The horizontal axis, x, should be labeled as Lumens and the vertical, y, axis is the voltage. The final part of the report is the conclusion in which students write about whether their hypothesis was correct or not. The student must also include why they believe their hypothesis was correct or incorrect. Students should correctly determine that there is a direct relationship between the lumens and voltage. Meaning, as the amount of lumens increases the amount of voltage generated increases.

## **Owner**

Drexel University GK-12 Program

## **Contributors**

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# Solar Energy Worksheet

Name \_\_\_\_\_

Date \_\_\_\_\_

Question: Is there a relationship between the amount of lumens measured and the amount of voltage generated by a solar cell.

Hypothesis:

Data Table:
