



# Skill Badge Requirements: Solar

Created by Adam Kemp



<https://learn.adafruit.com/skill-badge-requirements-solar>

Last updated on 2023-08-29 02:11:52 PM EDT

# Table of Contents

Overview	3
Section 1: Concept of Operation	4
Section 2: Making Measurements	5
Section 3: Demonstration	6
Certificate of Completion	7

---

# Overview

Solar cells, or photovoltaics, are made out of photosensitive semiconductors that convert light energy into electricity in a process known as the photoelectric effect. This process describes the interaction between light energy and the materials that make up the individual cell. Depending on how the cell is configured, conversion efficiencies can exceed 30%!



Instructions for completion:

Record the section, item number and requirement before each response on your notepaper. This will assist your instructor when evaluating the completion of the requirements.

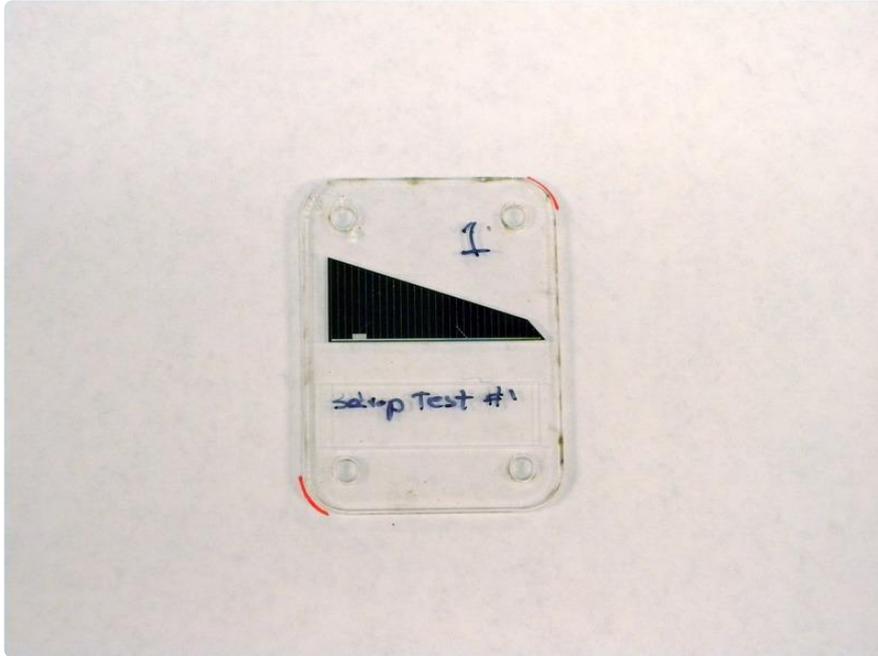
Example:

2.1 Measure and calculate the surface area ( $A_{eff}$ ) of the solar cell supplied by your instructor.

- I calculated the surface area ( $A_{eff}$ ) of my solar cell to be 2 square inches, with the dimensions of 2in x 1in.

---

# Section 1: Concept of Operation



The following section focuses on investigating the different concepts that govern the operation of a solar cell.

Do EACH of the following and submit to your instructor:

1. Identify and describe the photoelectric effect.
2. Identify and describe three different types of solar cells, their advantages and disadvantages.
3. Identify and describe the layers that make up a typical cell.
4. Identify and describe the following terminology:
  1. Effective surface area ( $A_{eff}$ )
  2. Open circuit voltage ( $V_{oc}$ )
  3. Short circuit current ( $I_{sc}$ )
  4. Power output ( $P_{sa}$ )
  5. Input power density ( $P_{in}$ )
  6. Efficiency ( $\eta$ )
7. Identify and describe the hardware that makes up a panel.
8. Identify and describe how individual cells are connected to make a panel.
9. Describe why solar technology might be cost prohibitive.
  1. What can be done to lower the cost?
2. Identify the equipment and describe the method in which solar panels are connected to the electrical grid.

3. Identify and describe two methods for storing the electrical energy produced by your solar cell.

---

## Section 2: Making Measurements



This section focuses measuring the power produced by a solar cell.

Materials Needed:

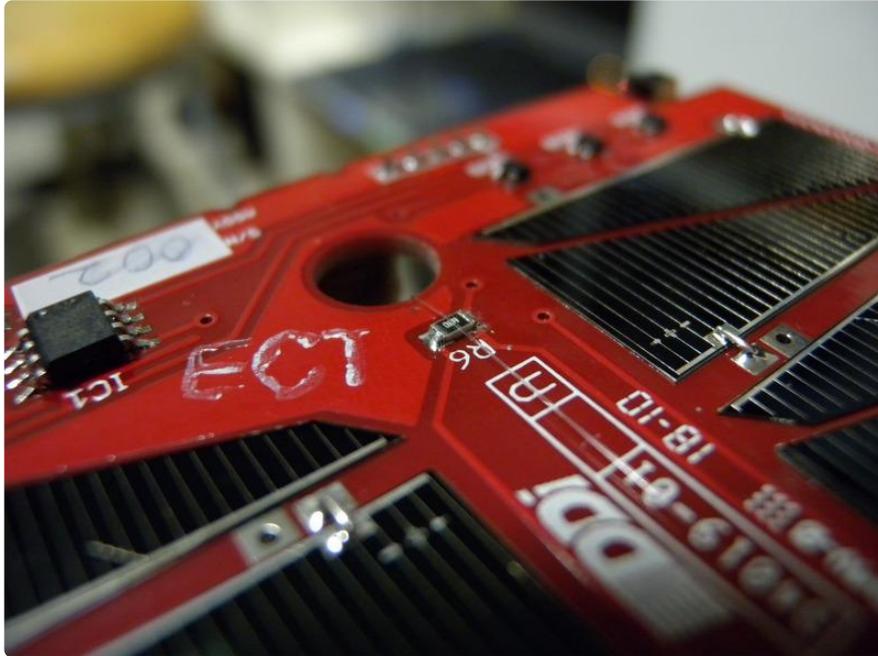
- Solar cell with terminals exposed
- Ruler or Caliper
- Multimeter
- Notepaper

Do EACH of the following and submit to your instructor:

1. Measure and calculate the surface area ( $A_{eff}$ ) of the solar cell supplied by your instructor.
2. Configure and use a multimeter to measure your cell's  $V_{oc}$  in direct sunlight. Record your results.
3. Configure and use a multimeter to measure your cell's  $I_{sc}$  in direct sunlight. Record your results.
4. Calculate your cell's approximate  $P_{sa}$ . Record your results.

5. Calculate your cell's approximate efficiency based on a  $P_{in}$  of  $1000W/m^2$ .
  6. Record your results.  $\eta = P_{sa} / (P_{in} \times A_{eff})$
- 

## Section 3: Demonstration



This section focuses on the demonstration of a device that utilizes solar technology.

Do ONE of the following and submit to your instructor:

1. Design and construct a simple circuit that powers an LED using the electrical energy produced by your solar cell.
2. Design and construct a model car that uses materials provided by your instructor to run on the electrical energy produced by your solar cells.
3. Design and construct a method for tracking the sun, improving your cells power output over time.

---

# Certificate of Completion



*This certificate is awarded to*

---

*For successful completion of  
requirements to earn the*

**Solar Skill Badge**

*Issued by:* \_\_\_\_\_ *Date:* \_\_\_\_\_

