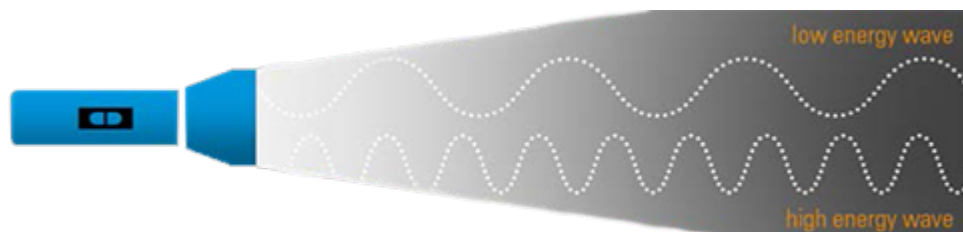


Lab 18 Light and Solar Panels

Name: _____ Lab Partner(s): _____

Driving Question

How does light power and distance affect solar panel output? If you could zoom in on a beam of light, you would see countless tiny particles called photons, moving in a wave-like pattern.



Photons carry electromagnetic energy from one place to another. When a photon has enough energy, it can knock electrons free from atoms in a solar cell. These free electrons can then be collected to create an electric current, which can either be used immediately to power devices or stored in batteries for later use.

The power of a device is a measure of how quickly it does work or transfers energy. Power is measured in watts (W). If a certain amount of energy is transferred slowly, the power is low. If the same energy is transferred quickly, the power is high. In this lab, we will explore how the intensity of light and the distance from the light source affect the power output of a solar panel.

Materials

- Voltage sensor with red and black banana plug leads
- Solar panel with toothpicks taped behind center line
- Meter stick
- Pencil
- Tape
- Flash light
- Solar panel holder from previous activity
- Adjustable lamp with bulb of any wattage (At least two different wattage bulbs must be available for student use. Bulbs must be the same type; either use all CFL or all incandescent bulbs)

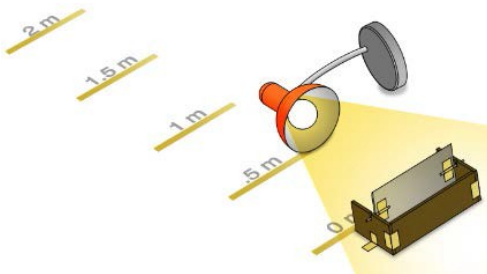
Consider

1. Predict the change in voltage produced when a light source moves farther away from the panel:
 - A. Voltage will increase
 - B. Voltage will decrease
 - C. Voltage will not change

2. Which allows the highest number of photons to reach you?
 - A. A walk in a forest
 - B. A day at the movies
 - C. A day in a museum
 - D. A nap on a sunny beach
3. Predict the relationship between light power (bulb wattage) and the voltage produced by a solar panel:
 - A. Higher light power produces higher panel voltage
 - B. Higher light power produces lower panel voltage
 - C. Light power has no effect on panel voltage

Investigate

1. Open *SPARKvue* and build a page with a graph.
2. Connect the voltage sensor.
3. Work in a minimum 3×3 m space.
4. Mark the following distances in a straight line: 0 m, 0.5 m, 1 m, 1.5 m, 2 m.
5. Place the solar panel in the holder you built in a previous activity. Rotate the cell to 90° . Line up the cell at 0 m as shown.



6. Place the lamp at 0.5 m, shining towards the panel as shown.
7. Insert banana plug leads into the sensor if necessary. Use red for (+) and black for (-). Use the alligator clips to attach the solar panel wires to the voltage sensor. Match colors.
8. Enter the bulb wattage for Run 1 in Table 1.

Table 1: Bulb Power	
Run #	Bulb Power (W)
1	
2	

9. Turn on the lamp. Turn off all classroom lights, close doors, and cover windows if possible. Let the lamp warm up for 1 minute.
10. Start collecting data. Measure voltage at each distance for Run 1. Record results in Table 2. Avoid touching the hot bulb.

Table 2: Voltage at Increasing Light Distance		
Distance (m)	Voltage (V), Run 1	Voltage (V), Run 2
0.5		
1.0		
1.5		
2.0		

11. Stop collecting data after recording voltage at 2 m. Turn off the lamp and let it cool for a few minutes.
12. Trade your lamp with a group that used a different bulb wattage. Enter wattage for Run 2 in Table 1.
13. Turn on the new lamp. Let it warm up for 1 minute.
14. Start collecting data. Measure voltage at each distance for Run 2. Record results in Table 2.
15. Stop collecting data.

Analyze

1. How does light distance affect voltage produced? Does this match your prediction? Support your answer with data.

2. How does bulb wattage affect voltage produced? Does this match your prediction? Support your answer with data.

3. What happens to the number of photons that land on the solar panel as you move the light farther away from the solar panel?

4. Why is it important to maximize the number of photons that land on a solar panel?

Extend

1. The sun is on average 1.5×10^{11} meters from Earth. To give you an idea of how big that number is, you would need to eat over 450 pieces of candy every second of every day for over 10 years to eat a total of 1.5×10^{11} pieces of candy! Write a testable question to determine if changing solar panel distance from the sun has an impact on voltage produced. Design and conduct an experiment to answer your testable question.