

Photoelectric Effect, Photovoltaic Effect and Alternative Energy

In photoelectric effect light, in the form of photons, causes electrons to be ejected from a substance. A hallmark of this effect is a dependence on the frequency of the light but not on the intensity of the light.

In the photovoltaic effect light causes a voltage to form across the junction between two materials. The maximum voltage attainable is set by the band gap between the materials.

Properties of electricity

Voltage, V , measured in volts and is measured across a device.

Current, I , measured in amps and is measured through a device.

Power, P , measured in watts

One can calculate power from the current and the voltage via:

$$P=IV.$$

Light bulbs:

We will first measure the power used by a light bulb powered by the power supply (do not exceed 10V). Connect the light bulb to the power supply so it lights. Use data studio to measure the voltage and a multimeter to measure the current used by the lightbulb. (make sure that the computer is hooked up as a voltmeter and the multimeter as an ammeter).

Reverse the light bulb's connection to the power supply and measure the power consumed by the light bulb again.

Describe the approximate brightness of the light in the two cases.

Light emitting diodes (LEDs):

Turn down the power supply voltage to 1.5V and connect it across the red LED and resistor.

Slowly turn up the voltage to 10V.

Measure the power consumed **by the red LED**.

Reverse the LED and measure the power consumed by the LED.

Describe the brightness of the light in the two cases.

Repeat the above with the power supply across the resistor and yellow LED.

Using LEDs to collect power:

While the area of the LED is much too small to collect a significant amount of power, it still shows that the process can be reversed, shining light on the LED converts light energy to electrical energy. Measure the voltage produced across a lone LED when placed under a bright lamp. Note that since the LED is not connected to a load, current cannot flow and so no power consumed.

Bigger LEDs—Solar cells:

Build a solar racer from the kit provided. What plays the role of the source, what plays the role of the load? Measure the power consumed by the motor when the car's wheels are not touching the table.

Westminster's alternative energy installation at the field station.

What are the key differences between what you used in the lab and the installation at the field station?