

Light Source Efficiency

Name: _____

Since the Children's Museum needs your solar mobile to be displayed inside, you will need to do some testing of how the photovoltaic (PV) panels perform indoors with various light sources as compared to outside in the sun. You will need to test the efficiency of the PV panels in watts per square meter (W/m^2) using a Pyranometer. Along with natural Sunlight, you will need to collect data using light sources we commonly use in an indoor environment. You will test a spectrum of artificial lights (incandescent, fluorescent, halogen, and light-emitting diodes).

A Pyranometer will be used to measure the power of electromagnetic radiation and is sensitive to near infrared, visible, and UV radiation, where 90% of solar energy is concentrated. Measuring the sun will be a start, then you will compare your various light source results to having your mobile set out in the sun.



Photo from Vernier.com

After data collection, you will need to make a recommendation to the Children's Museum director as to the lighting necessary for the Solar Mobile display.

OBJECTIVES

In this experiment, you will

- Use a Vernier Pyranometer to measure electromagnetic radiation in watts per square meter.
- Compare Sunlight irradiance with various indoor lighting options.
- Make a recommendation as to the optimum indoor lighting for powering solar panels

MATERIALS

LabQuest2	2 Volt Solar Panel
LabQuest App	2 wire leads with clips
Vernier Pyranometer	Materials to test variables (fluorescent light, halogen light, light-emitting, diodes)

PRE LAB QUESTIONS

1. What are some variables that might affect the outcome of your Watts per Square Meter (W/m^2) readings?
2. What are some variables that will need to be kept constant in this experiment?
3. If a comparison is being made between other light sources and natural light what is the range of your Sunlight reading?

PROCEDURE

1. Create a plan to collect data for testing various light sources. You will need to test 4-6 lights.
2. Set up the equipment.
 - a. Connect the Vernier Pyranometer Sensor to the LabQuest2.
 - b. Choose New from the File menu.
 - c. Change the settings by tapping
 - "Mode:" and choosing Time Based,
 - "Rate" to 1 sample/s,
 - "Interval" to 1 s/sample
 - "Duration" to 5 min.
 - d. Set the Pyranometer in your test location making sure that the Pyranometer is 30 cm from the light source.
 - e. When you are ready, turn on the light source and press the green "record" arrow on the LabQuest2.
3. When the data collection is complete, go to "graph view" and tap "Analyze" and find the average Irradiance (W/m^2)
4. Repeat data collection until you have collected all the data that you need to test your variable.

DATA TABLE

Variable (Type of Light Source)	Irradiance Average (Watts/M ²)
Sunlight	
Sunlight through a skylight	

DATA REPORTING

Create a graph of your collected data.

ANALYSIS

1. Which light source had the irradiance closest to the natural sunlight?
2. Based on your results, what is your recommendation to the Children's Technology Museum director as to the best indoor lighting?