LAB REPORT

Lab Session:

Name 1: SID:

Name 2: SID:

1. Laboratory Power Supply

Set the laboratory supply for 5V output and 20mA maximum current and load it with resistor R_1=1kΩ (Figure 1). Use the 0 … 25V output.

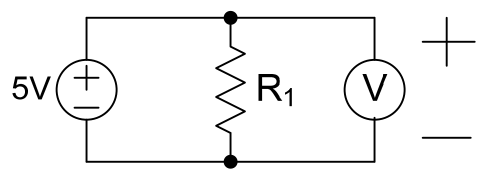


Figure 1 Power supply with resistive load and voltmeter.

a) Verify the output voltage with the voltmeter. (Use the multimeter for all these measurements. The meter that is built into the supply is not as accurate).

Predicted value: _____ V ___ of 1 **P**

Measured Value: _____ V ___ of 1 **M**

b) Disconnect the voltmeter. What is the current flowing through resistor R_1?

Predicted value: _____ A ___ of 1 **P**

Design a circuit for measuring the current flowing through R_1. Your diagram should include the supply, resistor, and the ampere meter.

___ of 3 **P**

Measured Value: _____ A ___ of 1 **M**

Explain discrepancies: ___ of 2 **M**

c) Replace R_1 with a 100Ω resistor. What are the voltage across and current flowing through the resistor?

Predicted values: _____ V _____ A ___ of 2 **P**

Measured values: _____ V _____ A ___ of 1 **M**

Explain discrepancies: ___ of 2 **M**

d) Calculate the smallest value of R_1 for which the supply output remains at 5V.

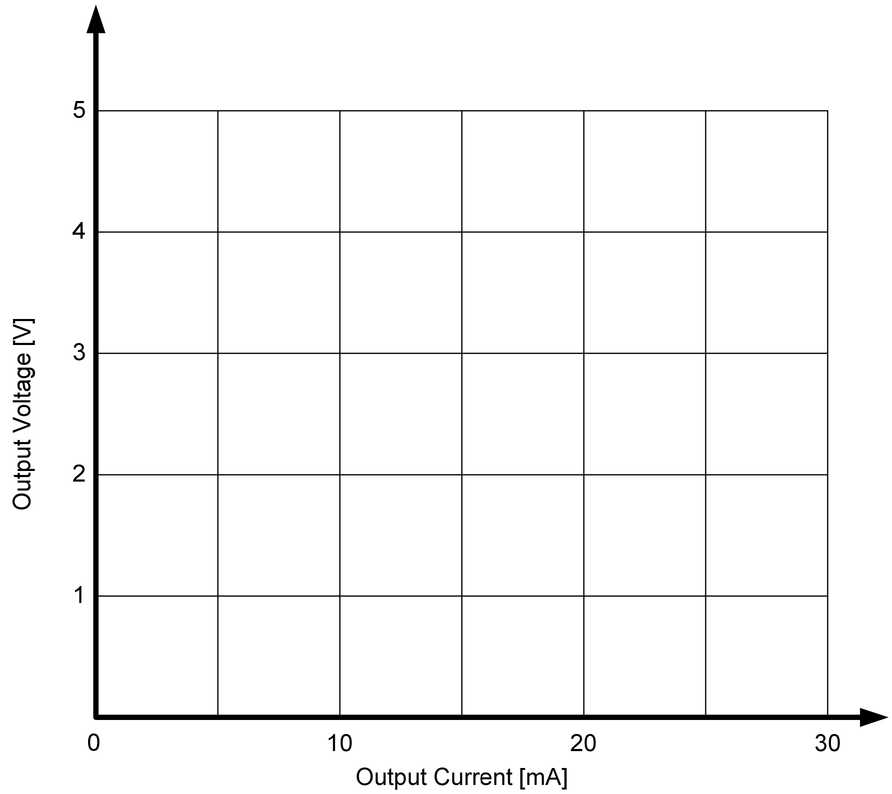
Calculated value of R_1 _____ Ω ___ of 2 **P**

Measured voltage and current (note that the resistor gets warm or hot if you increase the voltage)

_____ V _____ A ___ of 2 **M**

Explain discrepancies: ___ of 2 **M**

e) Measure the IV characteristic of the supply with the settings from part (a), using different values of R_1 to get sufficient data points. Also transfer the measured data points from parts (b), (c), and (d) to the graph. Please draw neatly and use a ruler!



___ of 3 **P**

___ of 3 **M**

2. Solar Cell

A solar cell is another form of an electrical supply that does not draw its energy from burning coal or chemical reactions, but from the sun (or other light source). We will characterize a small solar cell and assess its suitability as an alternative energy source.

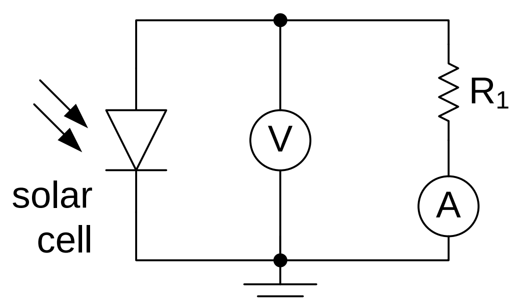


Figure 2 Solar cell test circuit.

a) Load the solar cell with a 1kΩ resistor and measure the voltage across and the current though the resistor (Figure 2). Experiment with different light exposures and try to maximize the power delivered by the solar cell to the resistor (P = IV). Record the maximum power (along with the corresponding values for voltage and current) and the distance between the solar cell and the lamp.

_____ V _____ A _____ mW _____ cm ___ of 4 **M**

b) Calculate the "power per area" of the solar cell. For comparison, high efficiency solar cells in direct sunlight generate about 120W/m^2. Try using a solar cell outside on a sunny day to see if you can match this result (play with R_1 to maximize the power).

Power per area _____ W/m^2 ___ of 1 **M**

c) What area solar cell is required to power a 25W fluorescent bulb?

High efficiency solar cell _____ m^2 ___ of 1 **P**

Laboratory solar cell _____ m^2 ___ of 1 **M**

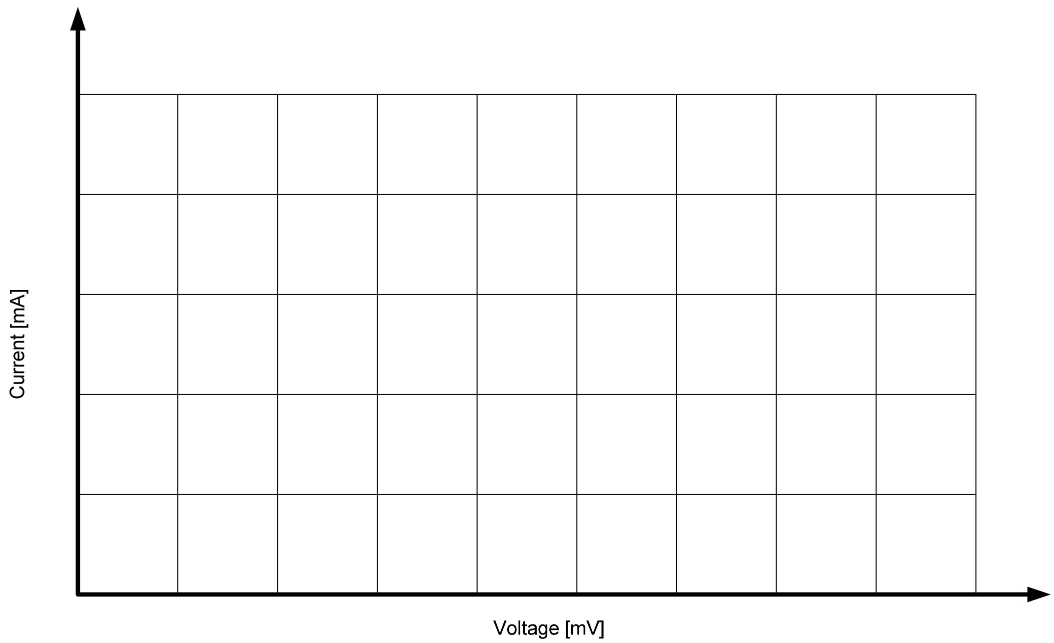
d) Using (as best as possible) the same light expose that yielded the maximum output power in part (a), measure the IV characteristic of the solar cell by connecting different valued resistors to it. Be sure to test resistance values from 10 Ω to 1 kΩ. Collect your results in the table below and plot them in the current and voltage graphs below. Choose different resistors (including parallel and series combinations of available resistors) to get a sufficient number of points so that you can accurately interpolate in the graphs between measurements and accurately determine the peak power available from the solar cell.
You may notice some variation in the measured current. This may be due to varying illumination or heating of the solar cell: the efficiency of solar cells drops with increasing temperature, a problem for solar farms installed in warm climates.

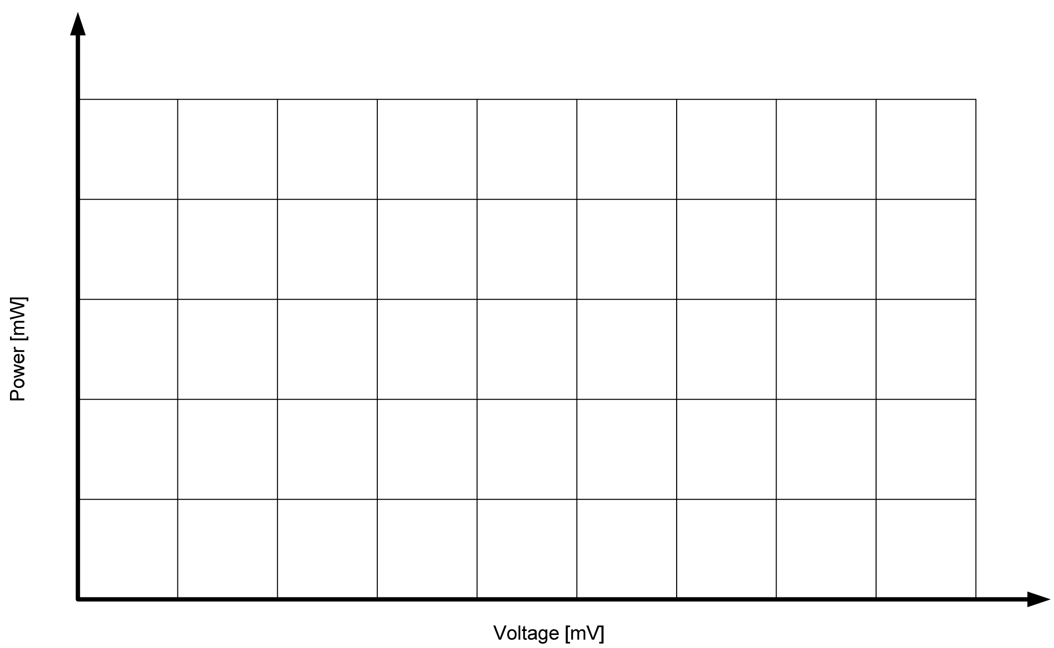
R_1	V	I	P = I x V

Peak power delivered by solar cell _____ mW ___ of 1 **M**

Voltage at peak power _____ V ___ of 1 **M**

Load resistance at peak power _____ Ω ___ of 1 **M**





___ of 10 **M**

SUGGESTIONS AND FEEDBACK

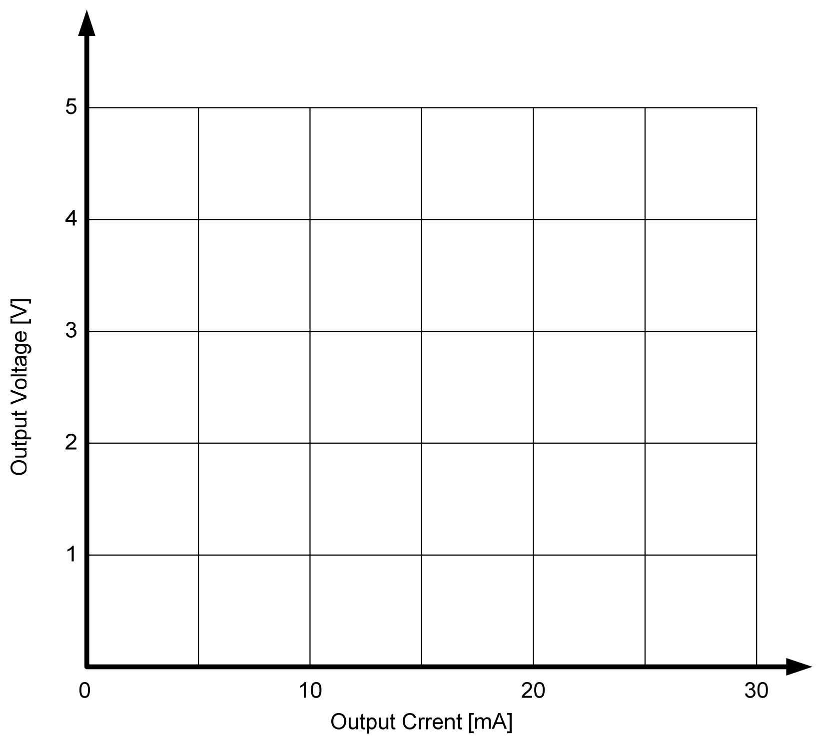
Time for completing prelab:

Time for completing lab:

Please explain difficulties you had and suggestions for improving this laboratory. Be specific, e.g. refer to paragraphs or figures in the write-up. Explain what experiments should be added, modified (how?), or dropped.

PRELAB SUMMARY

Summarize your prelab (P) results here and turn this in at the beginning of the lab session.

Problem	Result
1a	V
1b	A
1b	
1c	V A
1d	Ω
1e	
2c	m^2