

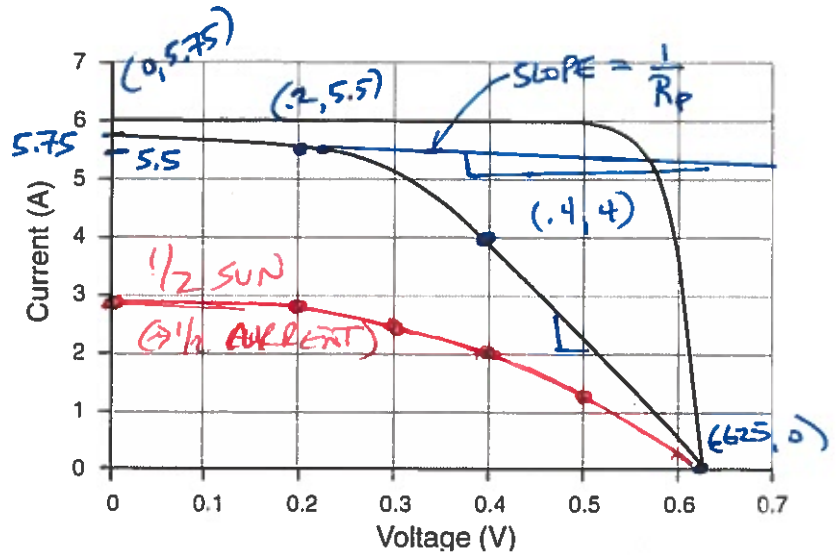
LAST NAME SOLUTION Alphabetic # _____

FIRST NAME _____

Quiz 5

1. The diagram depicts the I-V characteristic curves of a photovoltaic cell at 1 sun insolation.

- The upper curve is the I-V characteristic of the simplest equivalent circuit.
- The lower curve is the I-V characteristic of the equivalent circuit including parallel and series resistors.



a. (2 pts) For the simpler equivalent circuit, what are the values for R_p and R_s ?

$$R_p = \infty$$

$$R_s = 0$$

b. (3 pts) For the more complex circuit, what are the values for R_p and R_s ? Show your work.

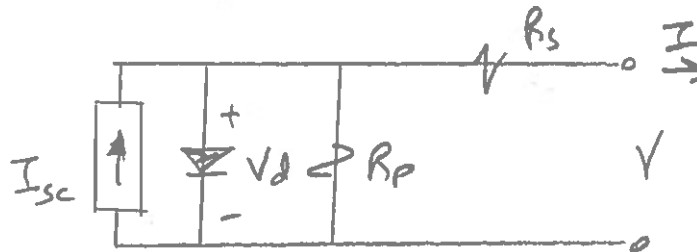
$$\frac{1}{R_p} \approx \frac{5.75 - 5.5}{0.2} = \frac{0.25}{0.2} \approx 1.25 \Rightarrow R_p \approx \underline{\underline{0.8 \Omega \text{ ANS}}}$$

$$R_s \approx \frac{0.625 - 0.4}{4 - 0} \approx \frac{0.225}{4} \approx \underline{\underline{0.056 \Omega \text{ ANS}}}$$

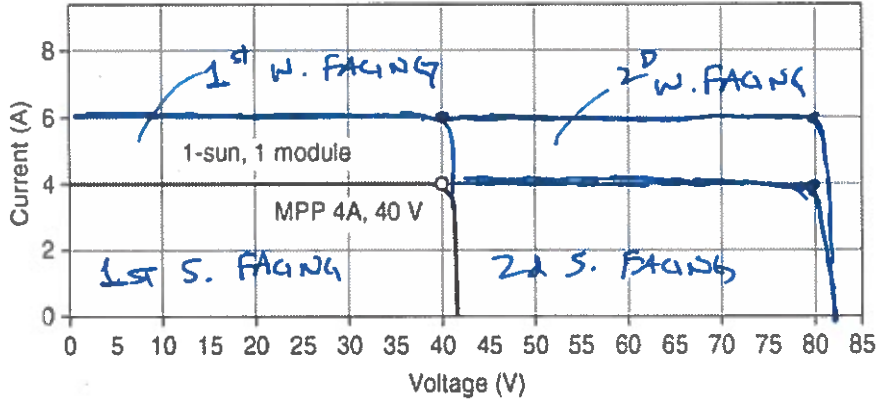
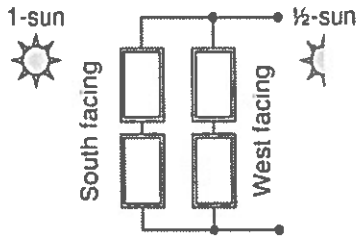
c. (2 pts) Sketch the $\frac{1}{2}$ sun I-V characteristic of the more complex cell equivalent circuit on the figure.

1/2 SUN CORRESPONDS TO 1/2 CURRENT @ EACH VALUE OF V.

d. (3 pts) Draw and label the more complex equivalent circuit model using accepted variable names.



NAME SOLUTION



2. A 4-module array has two south-facing modules in series exposed to 1000 W/m² of insolation, and two west-facing modules exposed to 500 W/m². The 1-sun I-V curve for one module (MPP at 4A, 40 V) is shown.

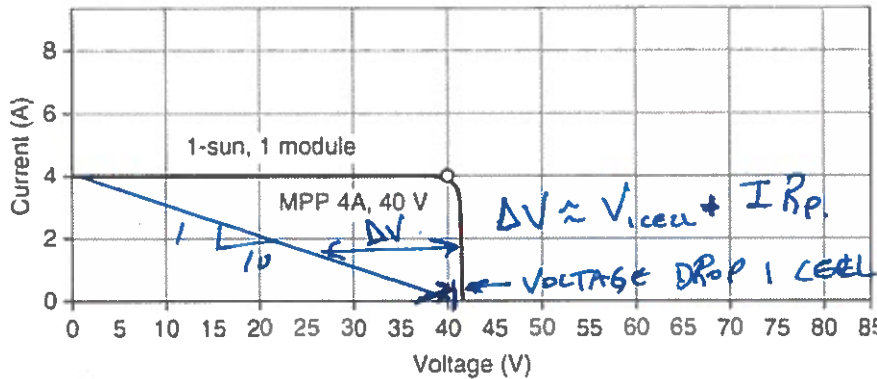
a. (3 pts) Draw the I-V curve for the 4-module array under these conditions on the figure.

SEE FIGURE

b. (3 pts) What is the output power (W) at the array's maximum power point?

$$P_{MPP} \approx 6A \cdot 80V = \underline{480W} \text{ ANS.}$$

c. (4 pts) Suppose that one identical module is used at a different site. Under 1-sun illumination, one cell is shaded. Assume that the shaded cell has an equivalent parallel resistance of 10 Ω. Draw the new I-V curve on the figure over the original curve.



Bonus 1: (1 pt) What was Willoughby Smith's contribution to photo voltaics?

PRACTICING ELECT ENGR 1870'S ENGLAND WORKING FOR GUTTA PERCHA CO. OBSERVED AND REPORTED "SQ" PHOTOELECTRIC PROPERTIES WHILE TESTING TELEGRAPH

Bonus 2: (1 pt) What is "gutta percha" CABLE DURING INSTALLATION. A MALAYSIAN TREE WHOSE SAP IS A NATURAL ELASTIC POLYMER → USED AS AN ELECTRICAL INSULATOR

Bonus 3: (1 pt) What was Albert Einstein's contribution to photo voltaics?

WROTE 1905 PAPER ADVANCING THEORY OF LIGHT'S DUAL NATURE AS PARTICLE AND WAVE. UNDERPINNED MODERN PHOTOELECTRIC SCIENCE.

EINSTEIN WON NOBEL PRIZE FOR THE WORK.