EE4226 - EXPERIMENT #2

RENEWABLE ENERGY CHARACTERISTICS

Lab Section: L02

Name: Jacob Cox

Date: 1/31/2018

Lab Partners: Mitch Morford

Solar Panel - 1500Ω

Data Attached (see spreadsheet)

Angle	Current
0°	
10°	
20°	
30°	
40°	
50°	
60°	
70°	
80°	
90°	

Hydrogen Fuel Cell Measurements

60mL

Characteristic Curve Measurements

Resistance	Voltage	Current
O.C.	1.983	0
100	1.792	.017
50	1.736	.035
20	0.85	.036
10	0.17	.011
5	.07	.004
3		
2	.052	.012
1	.056	.013
0.5	.051	.014
0.3	.047	.013

Efficiency Measurements

Current	.007
Voltage	.05
Time	150
Vol H_2	5mL

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RENEWABLE ENERGY CHARACTERISTICS

Lab Section: L02 Name: Jacob Cok

Date: 1/31/2018 Lab Partners: Mitch Manford

Data Attached (see spread sheet)

120V

Resistance	Voltage	Current
O.C.		
50000		
25000		
10000		
7500		
5000		
4000		
3000		
2500		
2000		
1500		
1300		
1200		
1100		
1000		
750		
600		
500		
400		
300		
250		
100		
50		
S.C.		

_____ W/M^2

100V

Resistance	Voltage	Current
O.C.		
50000		
25000		
10000		
7500		
5000		
4000		
3000		
2500		
2000		
1500		
1300		
1200		
1100		
1000		
750		
600		
500		
400		
300		
250		
100		
50		
S.C.		

_____ W/M^2

80V

Resistance	Voltage	Current
O.C.		
50000		
25000		
10000		
7500		
5000		
4000		
3000		
2500		
2000		
1500		
1300		
1200		
1100		
1000		
750		
600		
500		
400		
300		
250		
100		
50		
S.C.		

_____ W/M^2

Post Lab Questions:

1. On a single graph, plot the three voltage/current curves with the voltage on the x axis. On another graph, plot the output power of the panel at each voltage level. Use a spread sheet program (such as Excel) to plot the data, **hand drawn curves are unacceptable.**

   See attached graphs (attached 1)

2. Find the peak power point and fill factor for each curve.

   120V = 0.103W 100V = 0.0748W 80V = 0.0388W

   FF = 0.6999 FF = 0.6862 FF = 0.5071

3. Using your irradiance measurements and peak power points, calculate the maximum efficiency of your PV panel for each lighting level.

   $120V = \left(\frac{P_{max}}{Area}\right) / Irradiance = .0259$ 100V = .0255 80V = .0174

4. Plot the current of your solar cell versus the angle (in degrees with the angle on the x axis). On another graph, plot the current of the panel versus the cosine of your angle (in degrees with the angle on the x axis). Use a spread sheet program to plot the data, **hand drawn curves are unacceptable.** Describe the relationship shown by your graphs.

   The more indirect the light is, the less current is produced.

   (See attached graphs 4)

5. Plot the voltage/current curve of the fuel cell with the current on the x axis. On another graph, plot the output power of the fuel cell with current on the x axis. Use a spread sheet program (such as Excel) to plot the data, **hand drawn curves are unacceptable.**

6. Determine the efficiency of the fuel cell.

$$\eta = \frac{\text{Electrical Energy}}{\text{Energy Content of Hydrogen}} = \frac{V * I * t}{H_{OH2} * Vol_{H2}} = \_\_\_\_\_$$

H_{OH2} = Energy Density of Hydrogen = 11920 kJ/m^3

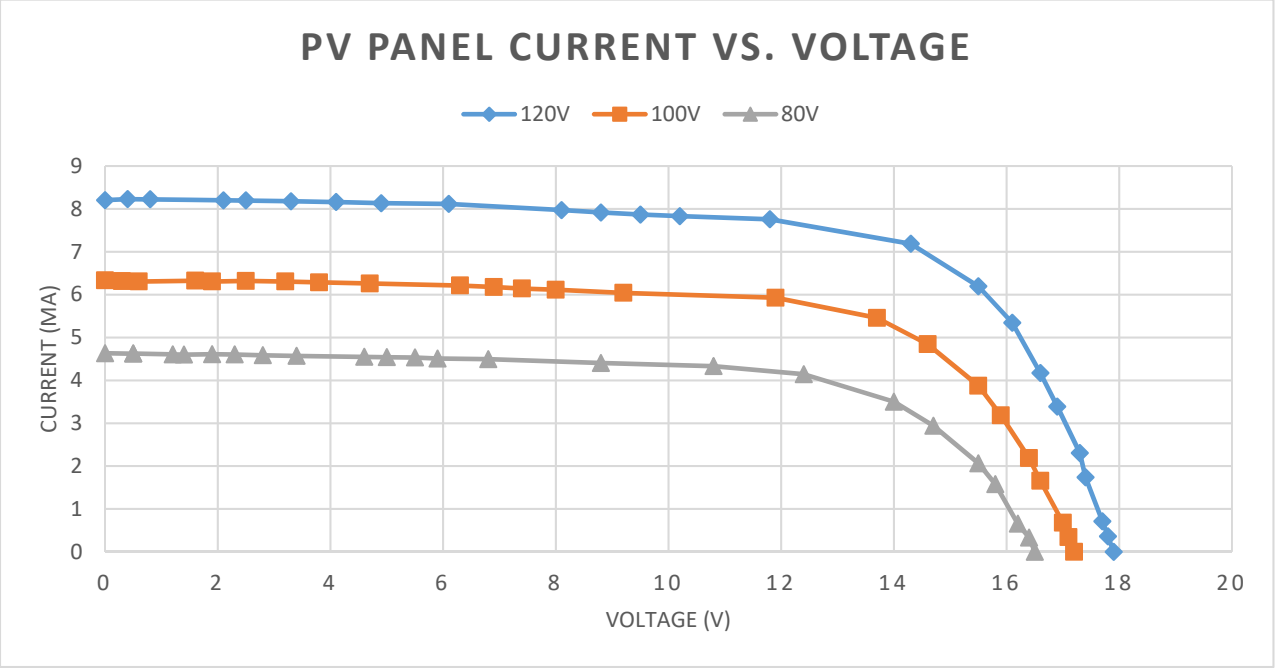
To get efficiency in percent, you will need to cancel units. Hint:

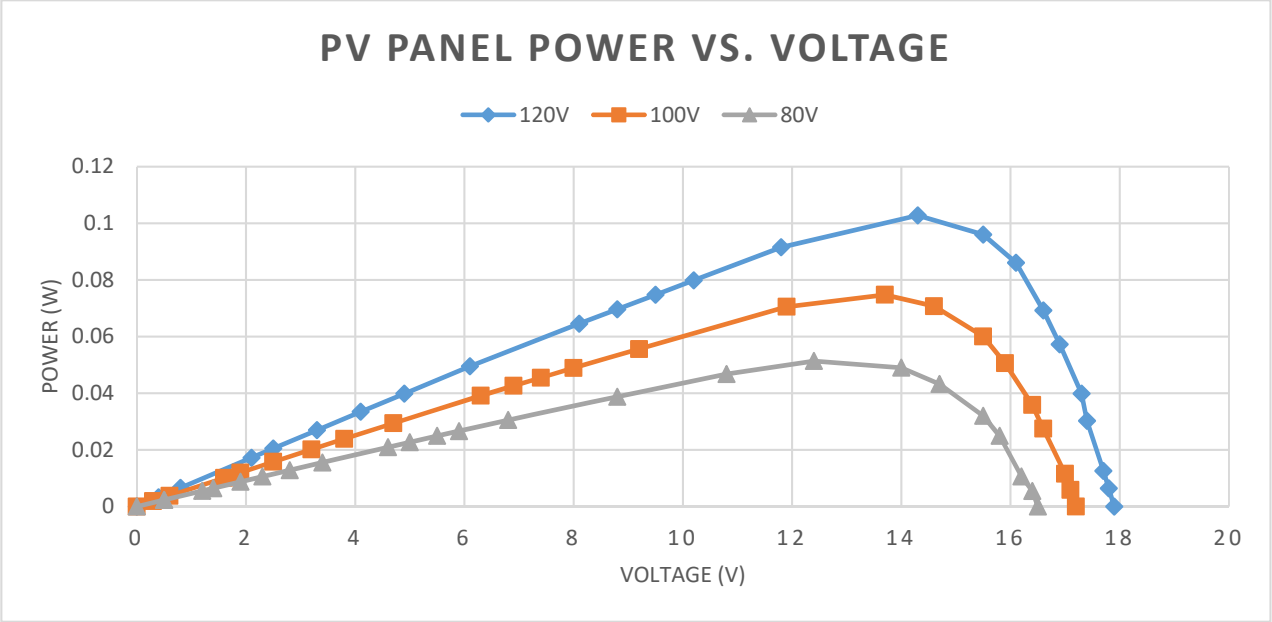
1 V*A*sec = 1 J 1 m^3 = 10^6 mL

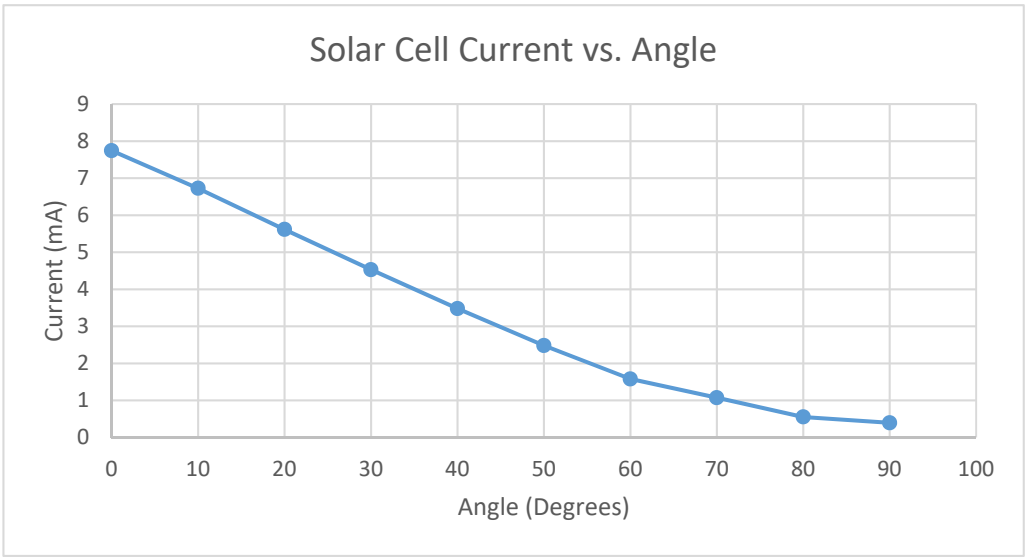
	120V		100V		80V	
Resistance	Voltage	Current (mA)	Voltage	Current	Voltage	Current
O.C.	17.9	0	17.2	0	16.5	0
50000	17.8	0.36	17.1	0.342	16.4	0.332
25000	17.7	0.712	17	0.68	16.2	0.656
10000	17.4	1.74	16.6	1.655	15.8	1.578
7500	17.3	2.305	16.4	2.186	15.5	2.064
5000	16.9	3.389	15.9	3.182	14.7	2.941
4000	16.6	4.173	15.5	3.874	14	3.501
3000	16.1	5.346	14.6	4.844	12.4	4.144
2500	15.5	6.194	13.7	5.457	10.8	4.331
2000	14.3	7.188	11.9	5.928	8.8	4.405
1500	11.8	7.758	9.2	6.041	6.8	4.494
1300	10.2	7.832	8	6.114	5.9	4.509
1200	9.5	7.869	7.4	6.142	5.5	4.533
1100	8.8	7.917	6.9	6.177	5	4.54
1000	8.1	7.973	6.3	6.213	4.6	4.549
750	6.1	8.116	4.7	6.259	3.4	4.57
600	4.9	8.134	3.8	6.286	2.8	4.585
500	4.1	8.163	3.2	6.306	2.3	4.605
400	3.3	8.177	2.5	6.319	1.9	4.609
300	2.5	8.199	1.9	6.306	1.4	4.601
250	2.1	8.199	1.6	6.325	1.2	4.606
100	0.8	8.226	0.6	6.306	0.5	4.626
50	0.4	8.228	0.3	6.314	0.5	4.622
S.C.	0	8.205	0	6.334	0	4.633

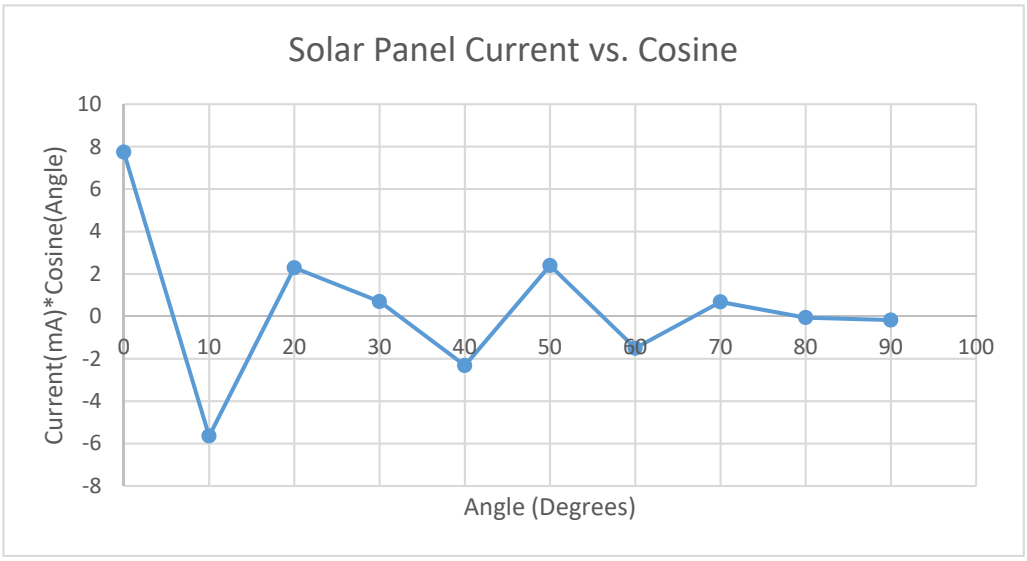
Irradiance	114	W/m^2	84	W/m^2	64	W/m^2

Solar Panel - 1500 Ohms	
Angle	Current
0	7.743
10	6.725
20	5.615
30	4.529
40	3.479
50	2.482
60	1.58
70	1.075
80	0.554
90	0.395


PV PANEL CURRENT VS. VOLTAGE
120V
100V
80V
CURRENT (MA)
VOLTAGE (V)
0
1
2
3
4
5
6
7
8
9
0
2
4
6
8
10
12
14
16
18
20


PV PANEL POWER VS. VOLTAGE
120V
100V
80V
POWER (W)
VOLTAGE (V)
0
0.02
0.04
0.06
0.08
0.1
0.12
0
2
4
6
8
10
12
14
16
18
20


Solar Cell Current vs. Angle
Current (mA)
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80
90
100
Angle (Degrees)


Solar Panel Current vs. Cosine
Current(mA)*Cosine(Angle)
10
8
6
4
2
0
-2
-4
-6
-8
0
10
20
30
40
50
60
70
80
90
100
Angle (Degrees)