Name ____________________ Date__________

Ice, Ice PV!

Investigation Worksheet

Data Collection

Record the measurements from the experiment in the tables, below. Measure the voltage and current under ambient conditions before the ice bath. Calculate the power at each time after the experiment is completed using the electrical power equation. Use the current measured at ambient conditions to calculate power for all times.

Ambient Conditions	
Temperature, T (^oC)	
Current, I (A)	
Voltage, V (V)	
Power, P (W)	

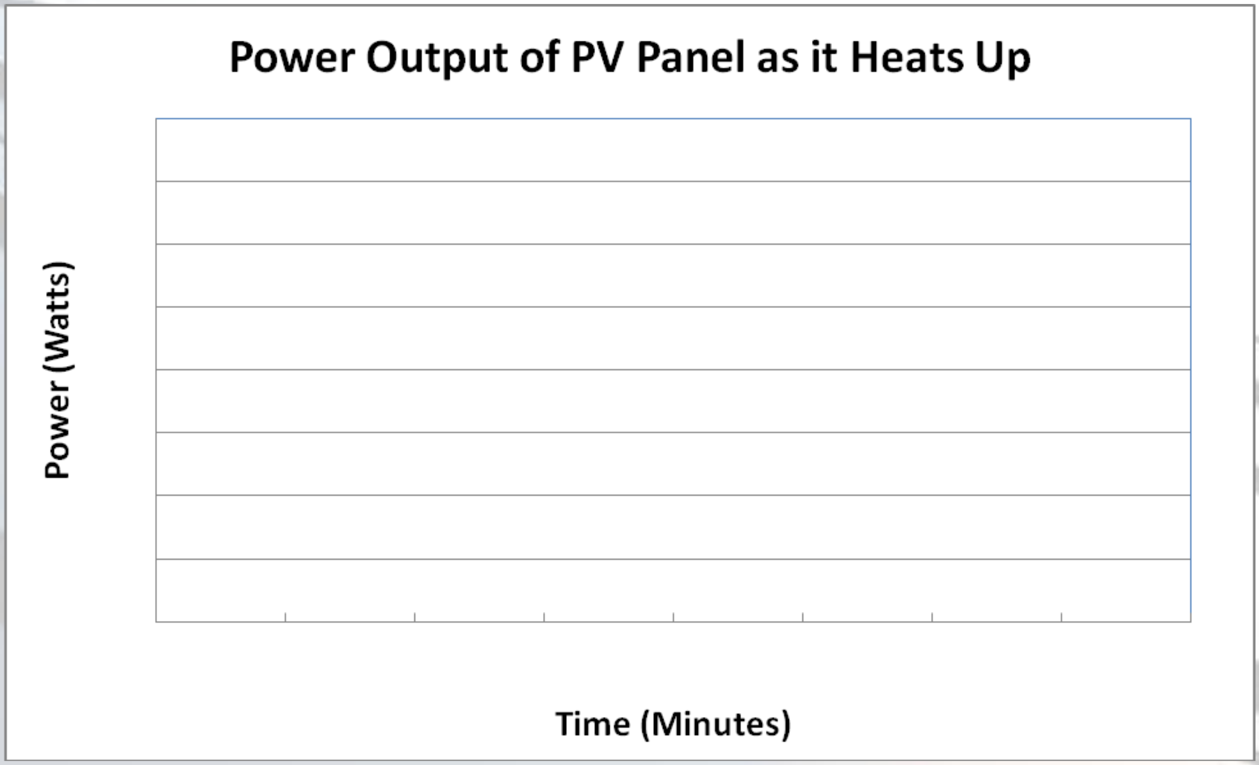
Time (min)	Voltage (V)	Power (W)
0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		

Time (min)	Voltage (V)	Power (W)
8.0		
8.5		
9.0		
9.5		
10.0		
10.5		
11.0		
11.5		
12.0		
12.5		
13.0		
13.5		
14.0		
14.5		
15.0		
15.5		

Name ____ Date___________________

Graphing

Plot the power with respect to time in the graph below.



Equations

1. $P = I * V$ **Electrical Power Equation**

   P = power, I = current, V = voltage

2. $TC = \frac{(V_{ice} - V_{Ambient})}{(T_{Ambient}[°C] - T_{ice}[°C])}$ **Temperature Coefficient**

   TC = temperature coefficient, V = voltage, T = temperature

3. $°F = \left(\frac{9}{5}\right)°C + 32$ **Temperature Conversion**

   ºC = degrees Celsius, ºF = degrees Fahrenheit

Name ____ Date___________________

Investigating Questions

1. Is the panel more efficient when it is colder or hotter?

2. Predict the power output of the panel if left in these experimental conditions indefinitely.

3. Describe the shape of the curve in the graph and why it looks this way.

Calculations

1. Using Equation 2, find the temperature coefficient (TC) of the panel. Use the initial voltage measured when the lamp is turned on as $V_{Ambient}$ and the first reading after the ice bath as V_{ice}. $T_{Ambient}$ = the room temperature (°C), T_{ice} = 0 °C

$$TC = \frac{(V_{ice} - V_{Ambient})}{(T_{Ambient}[°C] - T_{ice}[°C])}$$

2. What are the units of the temperature coefficient?

3. Using Equations 2 and 3, calculate the temperature of the panel at the time when you recorded the last voltage reading. Your answer should be in °F.

   Manipulating Equation 2 gives : $T_{Last}[°C] = \frac{(V_{ice} - V_{Last})}{TC} + T_{ice}[°C]$

Name ____ Date___________________

4. Explain what the temperature coefficient means and how it can be used to predict the power output of the panel at any temperature?

5. What would the power output of the panel be at the following temperatures? Using Equation 2, replace the ambient temperature with the temperature listed below and solve for the new voltage. Use Equation 1 to calculate the power output.

Description	T (°C)	Voltage	P (W)
Brrrrrr!	**-100**	10.78	1.164
Fargo, ND	**-28.9**	7.936	0.857
Water freezes	**0**	6.78	0.732
Las Vegas, NV	**41**	5.14	0.555
Water boils	**100**	2.78	0.300

6. Calculate the difference in the power output of the panel for the temperatures in Las Vegas and Fargo? What would be the difference in power output if there were a solar PV power plant with 10,000 of these panels installed?