MAE221 Thermodynamics Lab – Lab 1.2 ***(25 points)***

Name:

Lab Day:

If you are working with a group because you have not received kit 1, please note the names of people you are working with:

***Instructions:*** Complete this worksheet as you work through the lab. Once completed, submit it through Canvas before the start of your next lab. Each person should submit a worksheet.

**Exercise 1: Temperature Measurements (15pts)**

Fill out the following table as you proceed through your temperature measurements (12pts). The “Average Photon Voltage” should be the voltage that is directly measured from the active and cold junctions, so make sure you compensate for the gain.

You can find the link to the thermocouple table [here](https://www.thermocoupleinfo.com/pdf/type-t-thermocouple-reference-table.pdf).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Temperature Case | Average Photon Voltage (V) | Temperature according to calibration curve (°C) | Temperature according to thermocouple table (°C) | Temperature according to gauge (°C) |
| Room Temperature |  |  |  |  |
| Ice Bath |  |  |  |  |
| Boiling/Hot Water |  |  |  |  |

Question 1: Do you think the Photon or the dial thermometer is more accurate at measuring temperature? (1.5pts)

Question 2: The voltage generated by a type T thermocouple at room temperature is only 0.8mV. Does your multimeter have the ability to read such a small signal? How about the Photon? (1.5pts)

**Exercise 2: Comparisons with Calibration Curve (10pts)**

Create a plot that will compare your Photon temperature measurements from using the table to the calibration curve itself. This plot can be used to compare the two calibration methods. Some guidelines:

1. Voltage plotted on the x axis and temperature plotted on the y axis
2. Table calibrated data should be plotted as points and the calibration curve should be plotted as a line. **They must be plotted on the same plot.**
3. Include the error window for the thermocouple T wire in your plot
   1. Use the [standard accuracy of the thermocouple type-T wire](https://www.thermocoupleinfo.com/type-t-thermocouple.htm) (+/-1.0C or +/- 0.75%, whichever one is greater)
   2. You can plot two lines with one that is above and one that is below the line that was plotted using the calibration curve equation
4. Include a legend, axis labels with proper units, and a title
5. **Plot is worth 8pts**

Open Discussion: Discuss how your table-calibrated data compares with the calibration curve and the standard accuracy of the thermocouple type-T wire. You are essentially comparing the voltages calibrated using the table and using the calibration curve. Discuss how they compare and consequences of using either method. Discuss sources of error and how you might improve the experiment (2pts)