# Physics 114: Re-Evaluation Lab 9

Due on time designated by phylabs

*Daniel Lum Lab*

**Student's Name:**

## Problem 1

During the superconductivity portion of this lab, you were expected to plot the temperature vs. resistance of the ceramic. From principles alone, sketch the anticipated plot. Be sure to mark the superconductivity transition temperature in your sketch. How did you observe this critical temperature in the experiment?

## Problem 2

During the electronic circuits portion of this lab, unusual values were reported without much thought as to their reasonableness. This is an approximation question to establish reasonable vs. unreasobable reported values. To a reasonable order of magnitude (micro, milli, centi, deci, killo, mega...), give the expected current and dissipated power through a 1,000 ohm resistor when powered by a standard battery (like the one used in lab). Assume the resistor is ohmic.

# Problem 3

The folling is analogous to the the light bulb data collected in lab. Consider the following data:

| Current (mA) | Voltage (V) |
|---|---|
| 0 | 1 |
| 1 | 1.35 |
| 2 | 1.82 |
| 3 | 2.46 |
| 4 | 3.32 |
| 5 | 4.48 |
| 6 | 6.05 |
| 7 | 8.17 |
| 8 | 11.02 |
| 9 | 14.88 |
| 10 | 20.09 |
| 11 | 27.11 |
| 12 | 36.60 |
| 13 | 49.40 |

It may be helpful to plot the data to answer the following.
Is the plot linear?
This is an I-V (Current vs. Voltage) plot. Does the circuit that formed this plot obey Ohm's Law?
What would the plot look like if it did obey Ohm's law?
By answering the above, explain how to find the voltage anywhere.
Finally, fit an exponential function to this curve and find the resistance at 1 volt and at 15 volts. This is not a misprint. Even though you do not have data for 15 volts, you can still find it by the following. To properly answer this, you must first fit an exponential to the plot. You are trying to find an equation of the form:

$$y = e^{mx} \tag{1}$$

Where x represents your voltage and y respresents your current.
The best method to finding m is to take the natural logarighm of both sides yielding the equation:

$$ln(y) = m * x \tag{2}$$

The equation is now linear and by either fitting the data to a line in Excel or by hand (best done in Microsoft Excel), find the m value in this equation. Once the m value has been obtained, derive an analytical expression for the resistivity and give the resistivity values at both 1 volt and 15 volts. (Hint: Remember how a derivative was approximated in class? Here a true derivative will need to be taken to yield an analytical expression.)