Lab Report #2

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Measured Values:

Vin = 5.18 V

Resistor: 1 k**Ω**

Volume of Coffee 1: 95 mL

Volume of Coffee 2: 92 mL

Equations:

Rearranged from R(T) equation on the lab handout:

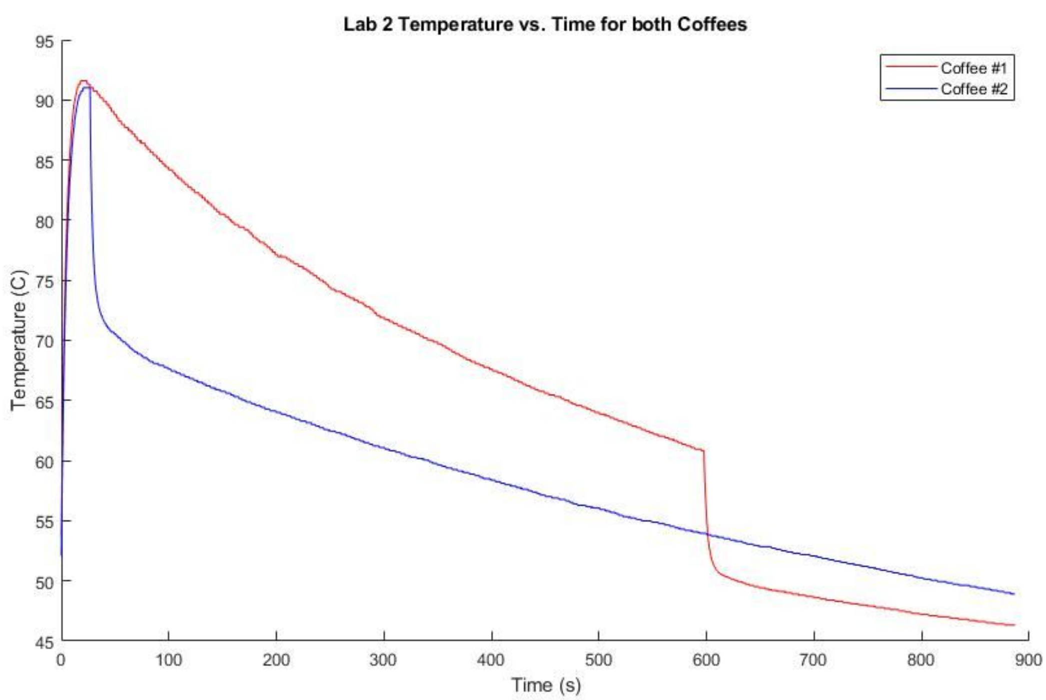
$T(R) = 3528 / (4.93 + \ln(R)) - 273.15$ [C]

Calculated using Ohm's law and a circuit diagram:

$R(V_{out}) = V_{out} * R1 / (V_{in} - V_{out})$ [**Ω**]

T(R(Vout)) was used to convert the voltage measured into a usable temperature in units of Celsius.

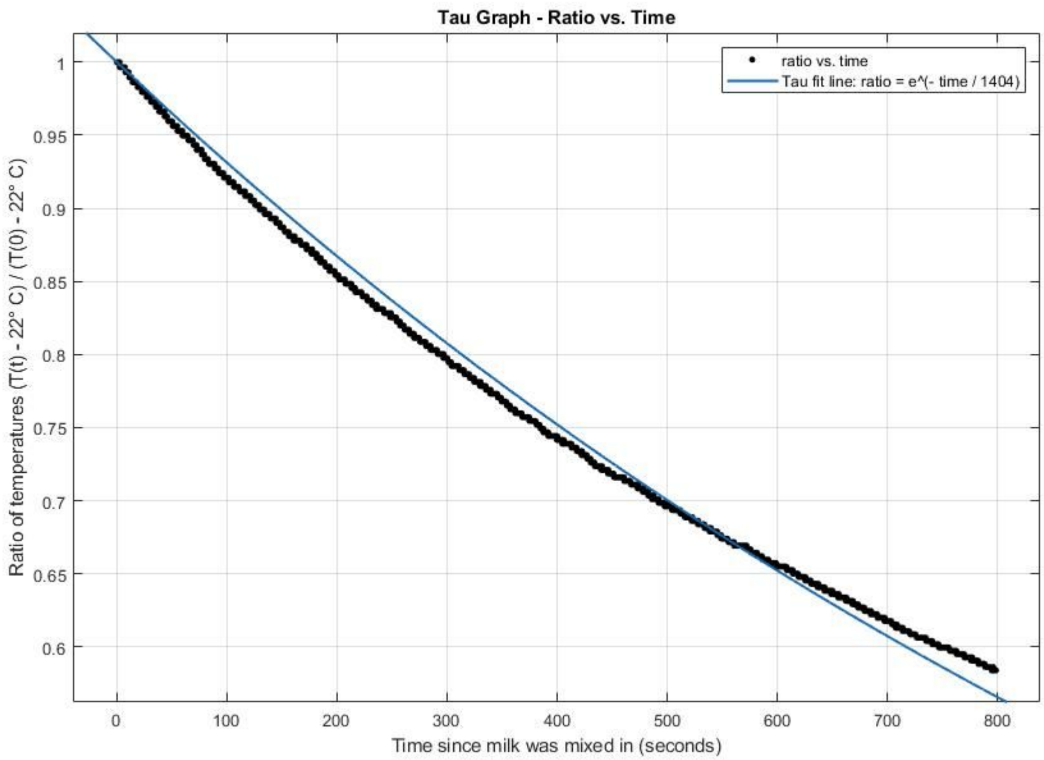
Temperature Graph:



Temperature Results:

The temperature graph shows the temperature of each coffee over time. The measurement of which coffee ends up hotter is taken at the first point of drinking the coffee, assumed to be after the milk is added. Coffee #2 ended at a higher temperature than Coffee #1 by approximately five degrees Celsius once the milk had mixed in, making it the clear winner.This was the coffee in which the milk was added at the coffee shop rather than at the office. The cooling rate of this coffee was slower than the other, which I hypothesize is due to the increased volume that the milk has added to it while travelling to work. Overall, this experiment proves that to keep your coffee hotter, you should add your milk sooner rather than later to prevent increased heat loss.

Tau graph:



Tau results:
This was created by truncating the dataset used to disinclude anything prior to the milk being mixed in, dividing the temperature difference between the room and the coffee over time by the initial temperature difference, and then using an exponential curve fit equation in the matlab Curve Fitting app using the equation e^(-x/T).

This is done to follow the initial formula, Newton's law of cooling, which is:

$$T(t) = T(env) + (T(t = 0) - T(env)) * e^{(-x / T)}$$

Which can also be rearranged as:

$$\Delta T(t) - \Delta T(0) = (T(t) - T(env)) / (T(t = 0) - T(env)) = e^{(-x/T)}$$

The best fit line calculated from this data ended up producing a value of $\tau = 1404$.