Charlie Nitschelm

ME 646

**Section 1 - Part 1: Solving the Thermistor Equation**

Using the original thermistor equation:

And the table of values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
| 273 | 373 | 27200 | 1020 | 298 | 3343 | 9736 |

Using the initial conditions above including and, solve for by rearranging the thermistor equation to

Once we have a solution for , we can then use the second data set at boiling to make a second thermistor equation. can be substituted into this equation to produce

Then to simplify by separating the exponential and dividing like terms:

Moreover, find an equation for ,

And with , an equation for can be solved as

**Section 1 - Part 2: Ice Bath Statistics**

The temperature of the ice bath during the test was approximately 273.15K. Below is a table that details the voltage measurements obtained in the ice bath 10 separate times.

Recorded Ice Bath Data in mV:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 34.7 | 38.3 | 36.2 | 31.4 | 36.6 | 37.2 | 33.7 | 31.8 | 33.9 | 35.5 |

The actual temperatures measured by the thermocouple during the test can be approximated by a linear approximation, meaning a line of best fit can take a linear form. This form, calibrated from data from multiple water temperature baths, can be applied to convert the voltage measurements to temperature measurements.

The calculated temperatures of the ice bath, in Celsius, are detailed below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0.050 | 0.411 | 0.201 | -0.308 | 0.214 | 0.274 | -0.077 | -0.268 | -0.057 | 0.104 |

With a resolution of only the maximum decimal places that could be accurately measured are two after the decimal.

The mean of the sample, , can be calculated by the equation:

Where is the number of samples taken, which from above is equal to 10.

0.0463

The standard deviation of the data, , is calculated with the equation:

, which can be found within a table, is picked depending on the number of samples taken and the confidence level desired. This value can then be used to calculate the population mean interval where 95% of the population would lie. With N=10 and a desired 95% confidence, we find:

The standard deviation of the mean can then be calculated using the equation below.

This quantity is then used for a final calculation that determines the bounds in which the population would lie between with 95% confidence.

**Section 2 – Part 5**

BIB = Bare Ice Boil

BBI = Bare Boil Ice

AIB = Aluminum Ice Boil

ABI = Aluminum Boil Ice

SIB = Steel Ice Boil

SBI = Steel Boil Ice

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of Constant and Bounds | BIB | BBI | AIB | ABI | SIB | SBI |
| Tau Constant – Gamma = 0:1 (s) | 0.171 | 0.128 | 5.187 | 7.022 | 2.782 | 7.763 |
| Tau Constant – Gamma = 0.2:0.7 (s) | 0.129 | 0.125 | 5.956 | 6.597 | 3.142 | 6.126 |
| Constant – Gamma = 0:1 (K) | 1.678 | 2.178 | 2.356 | 1.151 | 1.239 | 3.609 |
| Constant – Gamma = 0.2:0.7 (K) | 0.561 | 2.177 | 1.371 | 1.367 | 0.744 | 2.503 |