Part 1: Solving the equation thermistor equation,

,

for and .

Original Equation:

Table of Values:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | 854 | 273.15 | 373.15 | 298.15 | 3601 | 9915 |

Using initial conditions of solve the equation for :

Rearrange to find:

Rewrite equation for second conditions :

Substitute with the first equation:

Simplify:

Final equation for

Now that is known the equation for , can be solved for a value:

Part 2: Statistics of Ice Bath

Table of Ice Bath Data (Measurements are in mV):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15.35 | 27.17 | 28.56 | 28.54 | 28.03 | 28.05 | 27.67 | 29.39 | 30.26 | 27.86 |

Temperature of ice bath is approximately 273K.

0mV corresponds to .

By reading the chart given by the amplifiers manufacturer the actual temperatures measured by the thermocouple can be approximated by a linear interpolation.

The measured temperatures of the ice bath, in Celsius, was found to be:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1.251 | 2.459 | 2.601 | 2.599 | 2.547 | 2.549 | 2.510 | 2.685 | 2.774 | 2.529 |

With a resolution of only the maximum decimal places that could be accurately measured are 2.

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

Where is the number of samples taken and is equal to .

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

Determine t value from table

Determine standard deviation of the mean:

­­Determine population mean:

Final Values for Time Constants( and Deviation of the Best Fit Lines (Syx):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Bare Wire Boil to Ice | Bare Wire Ice to Boil | Embedded Stainless Boil to Ice | Embedded Stainless Boil to Ice | Embedded Aluminum Boil to Ice | Embedded Aluminum Ice to Boil |
| Tau: 5 Standard Deviations and Gamma Method (s) | 0.199 | 0.084 | 7.830 | 5.170 | 2.560 | 6.210 |
| Tau: Max Slope and Gamma Method (s) | 0.191 | 0.058 | 7.480 | 5.010 | 2.460 | 6.550 |
| Tau: 5 Standard Deviations and .632 Method (s) | 0.745 | 0.300 | 11.600 | 7.790 | 4.750 | 3.360 |
| Tau: Max Slope and .632 Method (s) | 0.046 | 0.052 | 10.400 | 6.090 | 4.290 | 2.970 |
| Syx: 5 Standard Deviations and Gamma Method (°C) | 19.400 | 15.200 | 7.570 | 7.790 | 7.680 | 9.580 |
| Syx: Max Slope and Gamma Method (°C) | 5.570 | 0.564 | 4.610 | 2.460 | 5.850 | 9.620 |
| Syx: 5 Standard Deviations and .632 Method (°C) | 14.100 | 8.900 | 6.710 | 7.790 | 4.050 | 4.040 |
| Syx: Max Slope and .632 Method (°C) | 0.432 | 0.352 | 1.310 | 0.659 | 2.420 | 1.090 |