Homework 8: Part 1a

Look at the following results for a Thermistor calibration

Temperature, °F	Resistance, kΩ
82	3.16
80	3.23
72.5	3.89
65	4.47
61	4.76
58	5.31
54	5.77
50.5	6.37
47.5	6.80

CALIBRATED TEMPERATURE-RESISTANCE PAIR For Thermistor

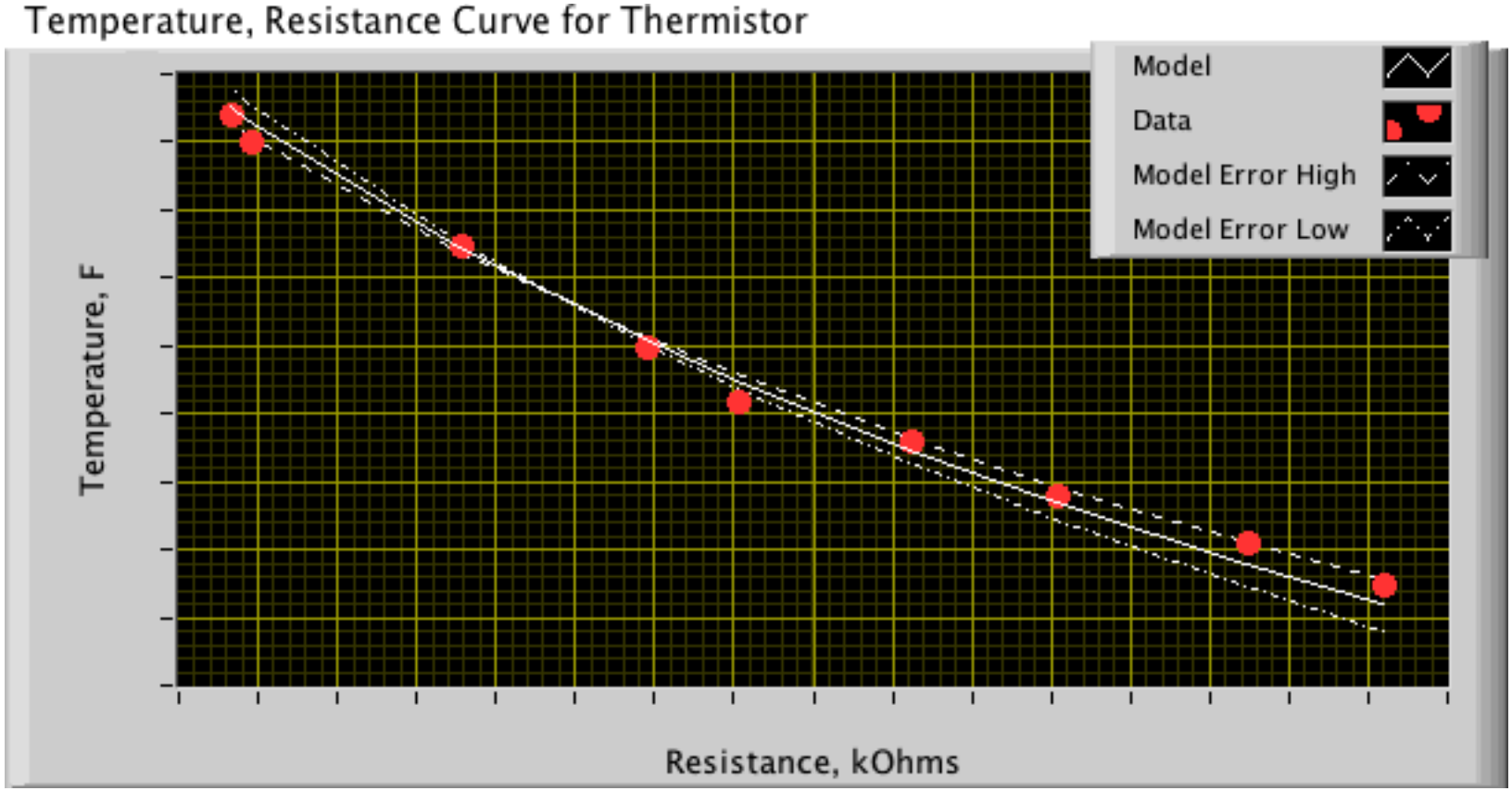
$T_0 = 20\ ^oC$

$R_0 = 4.24\ k\Omega$

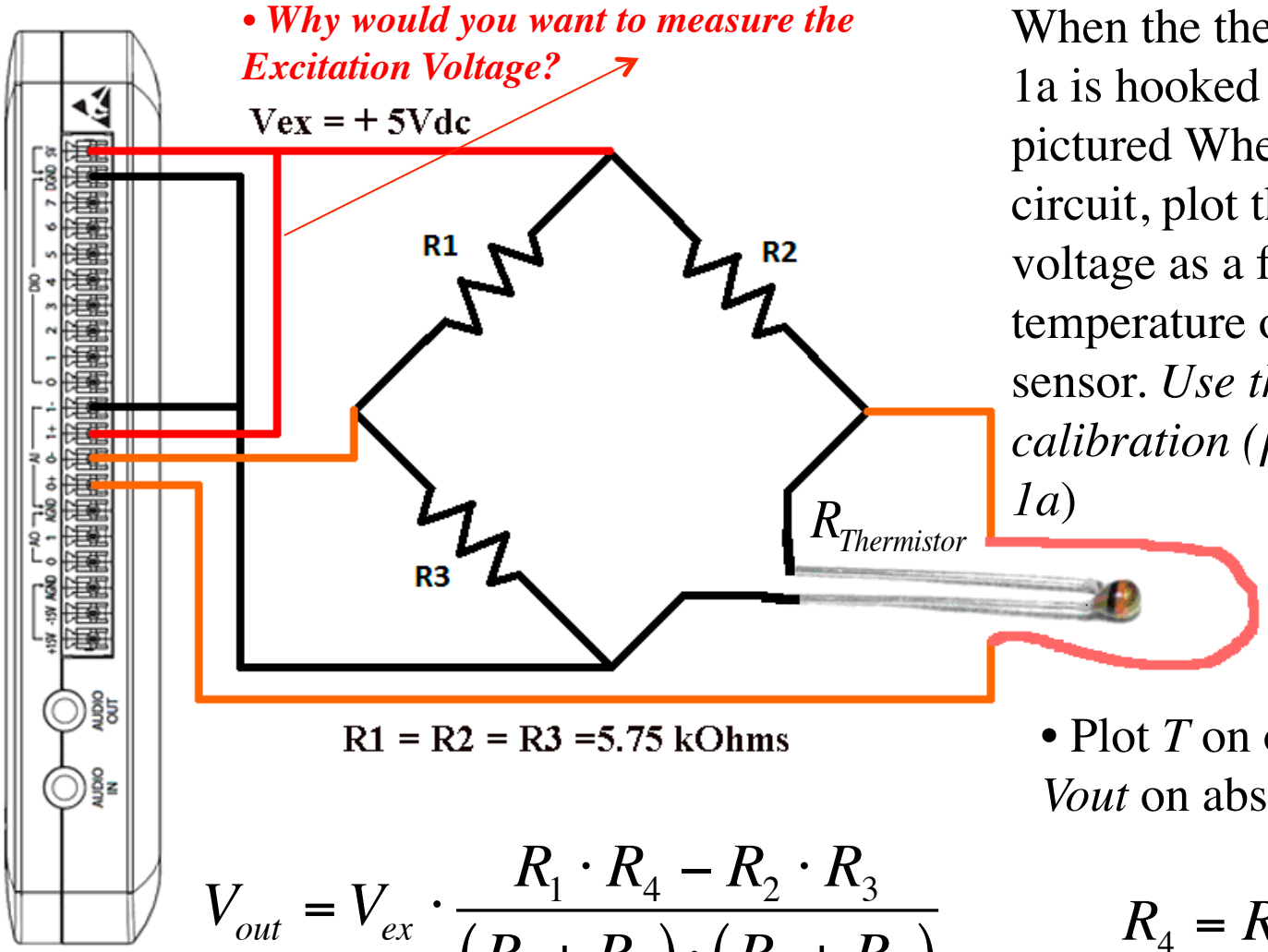
- Using the Steinhart-Hart equation, calculate the mean value for "β" and assess the confidence interval for this mean estimate at the 95% confidence level. (assume student-t distribution). ***Be careful about your units for temperature! Use Absolute Units***
- Compare your model based on your average β against calibration data by Plotting *T vs. R* curve on same plot with calibration data. Plot *R* on ordinate-axis, *T* on abscissa.
- Use your ***"high"*** and ***"low"*** confidence interval estimates for β to plot error bounds for the temperature model on this plot … how do these boundaries agree with your data?

Homework 8: Part 1a (2)

- Hint .. Your comparison plot should look something like …



Homework 8: Part 1b



When the thermistor from part 1a is hooked up as a part of the pictured Wheatstone bridge circuit, plot the expected output voltage as a function of temperature on the thermistor sensor. *Use thermistor calibration (β) model from part 1a*)

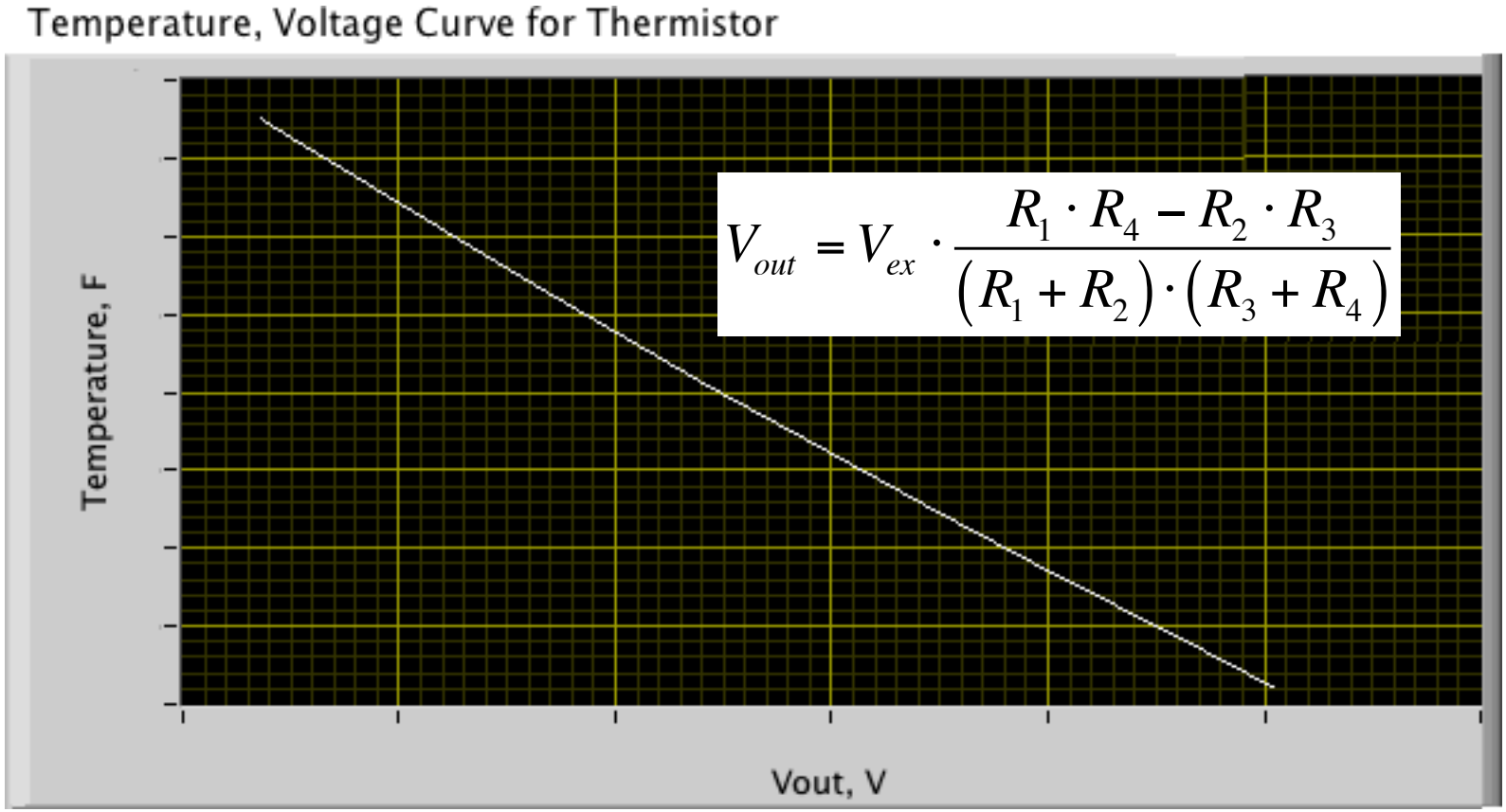
- Plot *T* on ordinate-axis, *Vout* on abscissa.

$$V_{out} = V_{ex} \cdot \frac{R_1 \cdot R_4 - R_2 \cdot R_3}{(R_1 + R_2) \cdot (R_3 + R_4)}$$

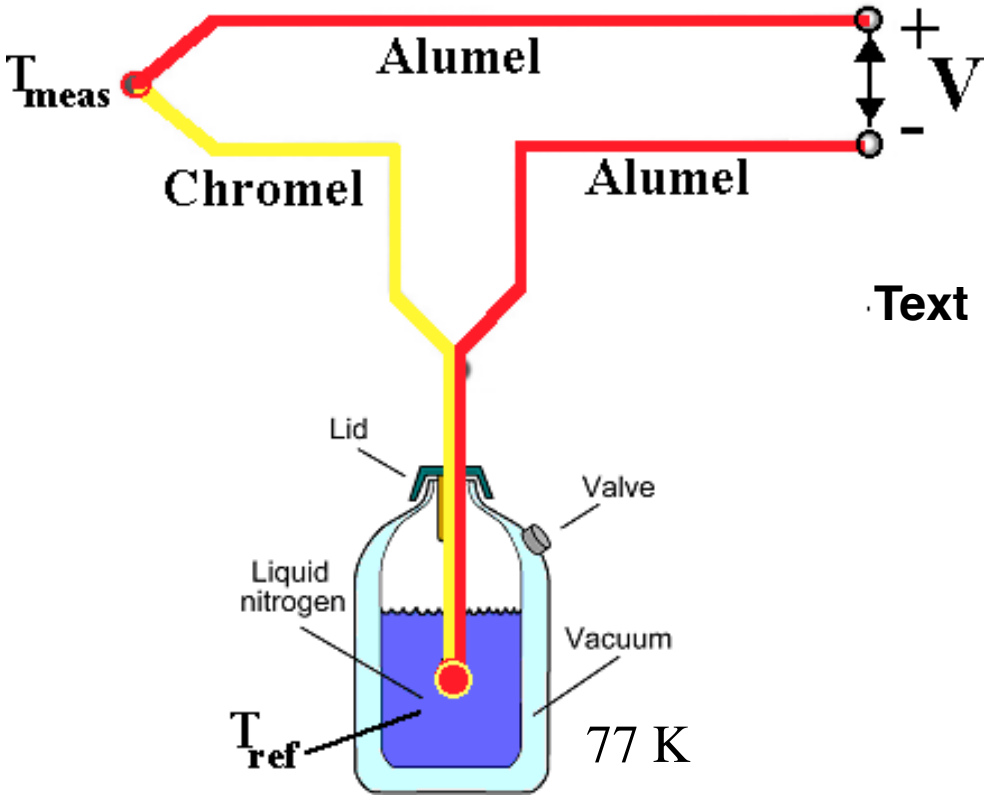
$$R_4 = R_{Thermistor}$$

Homework 8: Part 1a (2)

- Hint .. Your Voltage/Temperature plot should look something like …



Homework 8: Part 2a



a) A type-K thermocouple has its reference junction submersed in liquid nitrogen at 77 K.

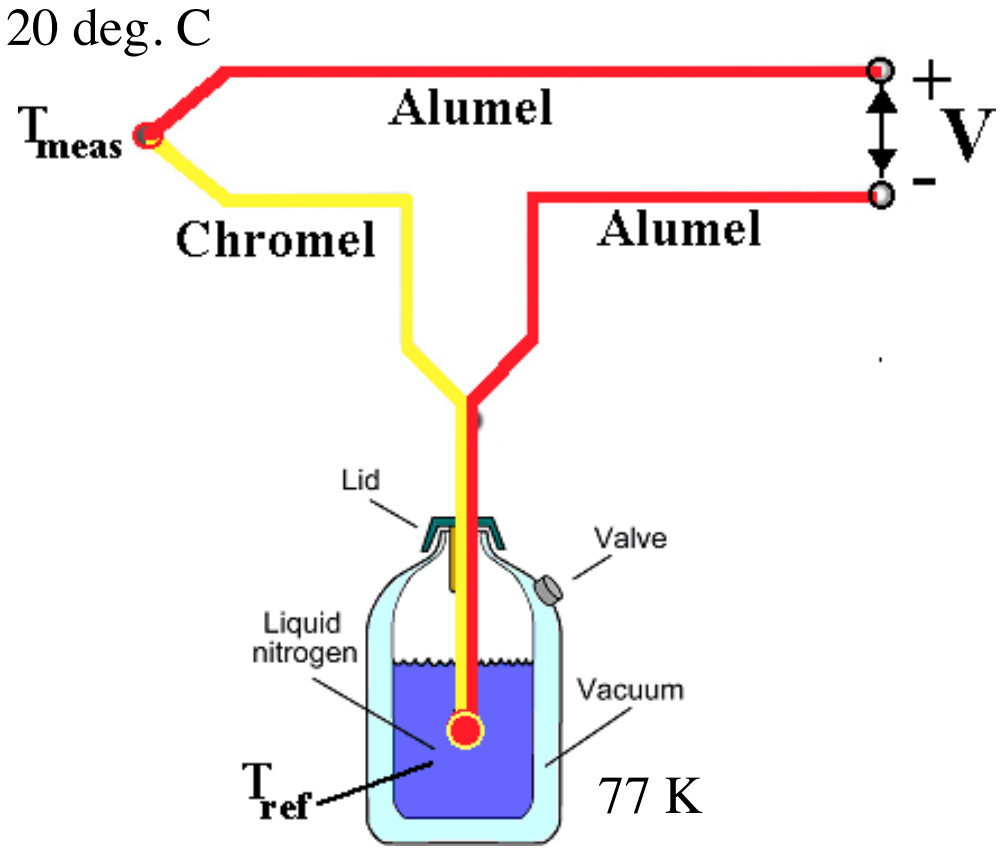
-- The measured output voltage is 1.340 mV

-- What is the temperature of the measurement junction?

Hint:—> Use the Type K TC vi posted to the web page for lab 8 !~

http://www.neng.usu.edu/classes/mae/3340/Lab8/lab_8_VI%20Folder.zip

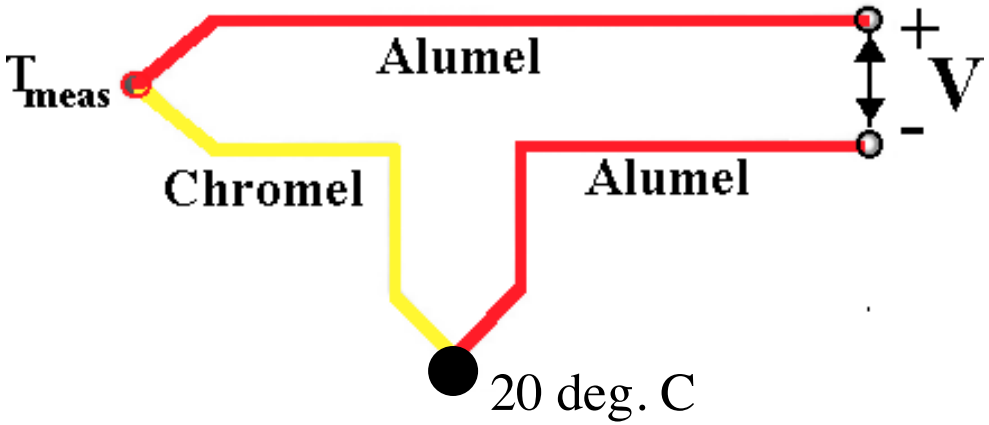
Homework 8: Part 2b



b) What is the output voltage when the temperature of the measurement junction is 20 deg. C

-- Assume that the reference junction is still immersed in the liquid N_2.

Homework 8: Part 2c



c) What is the output voltage when the reference junction is removed from the liquid nitrogen bath and warmed to 20 deg. C

-- Assume that the temperature at the measurement junction is the same as for part 2a.