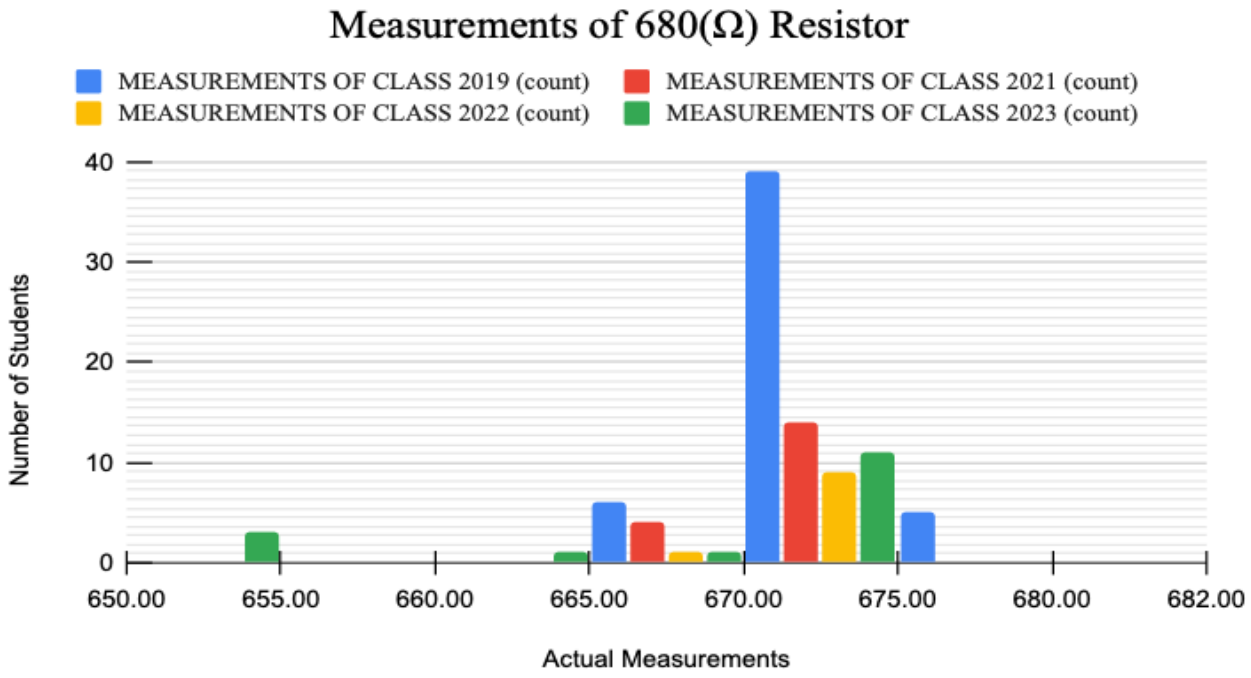
Objective:
To gain experience using digital equipment like the multimeter and the infrared thermometer. Learn how to measure resistance, characterize the operation of a thermistor over temperature (and view the linear relationship with temperature), and the possible variations for the resistors around their nominal values.

Resistor Measurements and Values				
Component	Component Marking	Decoded Value	Measured Resistance	% Difference
680 Ω	blue, violet, brown, gold	670 Ω	652.4 Ω	2.63%
680 Ω	blue, violet, brown, gold	670 Ω	653.38 Ω	2.48%
680 Ω	blue, violet, brown, gold	670 Ω	651.09 Ω	2.82%
680 Ω	blue, violet, brown, gold	670 Ω	652.2 Ω	2.66%
1 kΩ	brown, black, red, gold	1 kΩ	.971 k Ω	1.3%
47 kΩ	yellow, blue, orange, gold	46 kΩ	47.8 kΩ	-3.91%

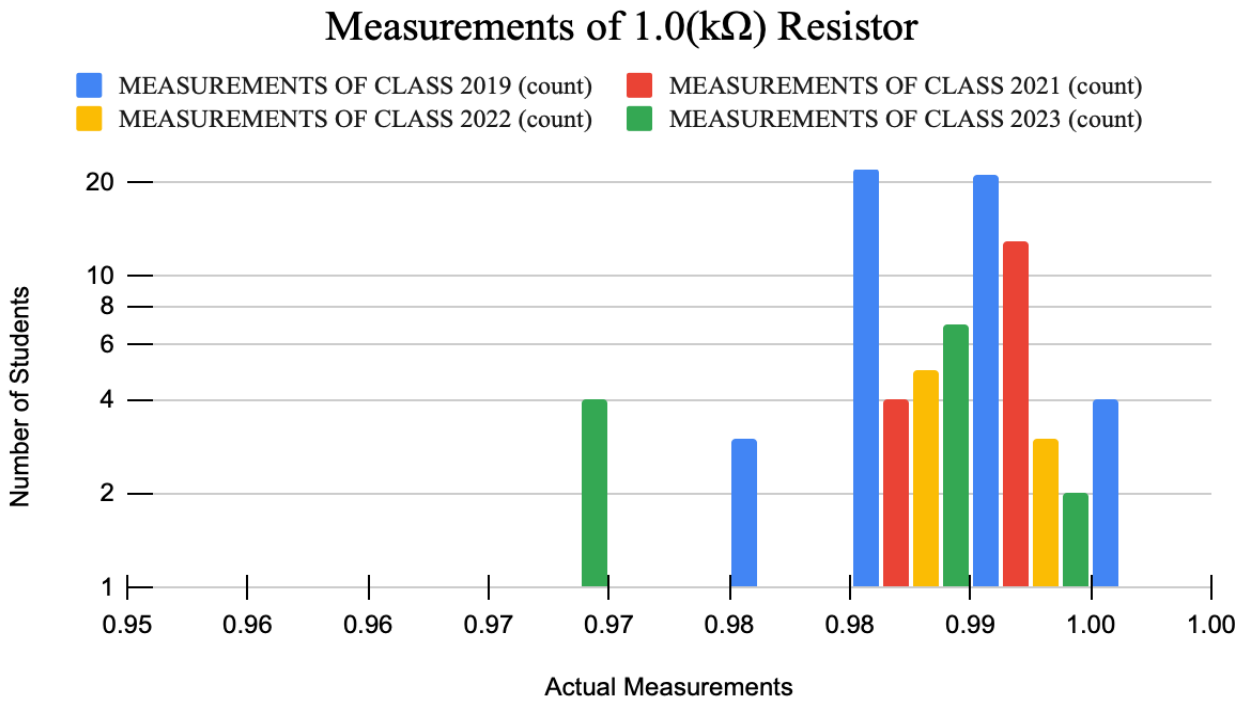
(Table 1 Above)

Thermistor Resistance Measurements at Different Temperatures				
Measurement	Temperature	Measured Resistance	Expected Resistance (Using Eq 3)	% Difference
Room Temperature	75.8 ºF	9.730 kΩ / 97300 Ω	9.696 kΩ / 9696.37 Ω	.35 %
Cold	73.6 ºF	12.3 kΩ / 12300 Ω	9.161 kΩ / 9160.57Ω	29.2 %
Hot	77.2 ºF	10.20 kΩ / 10200 Ω	10.051 kΩ / 10051.35 Ω	1.47 %

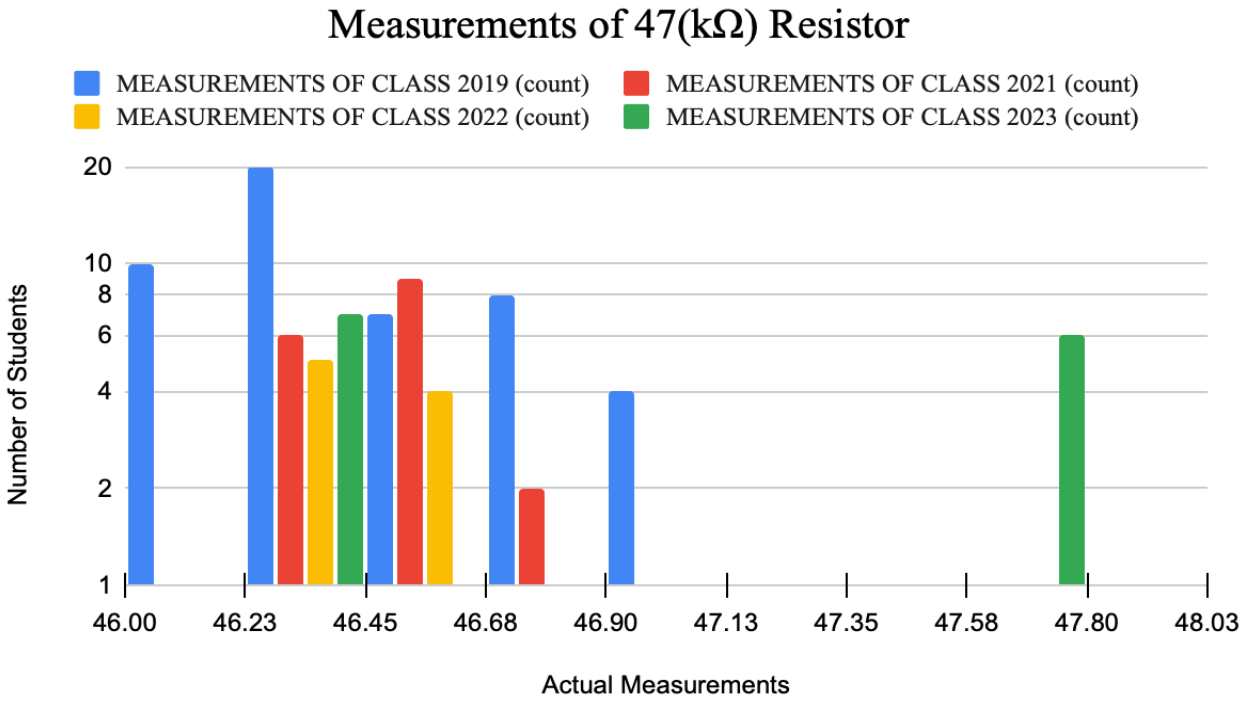
(Table 2 Above)



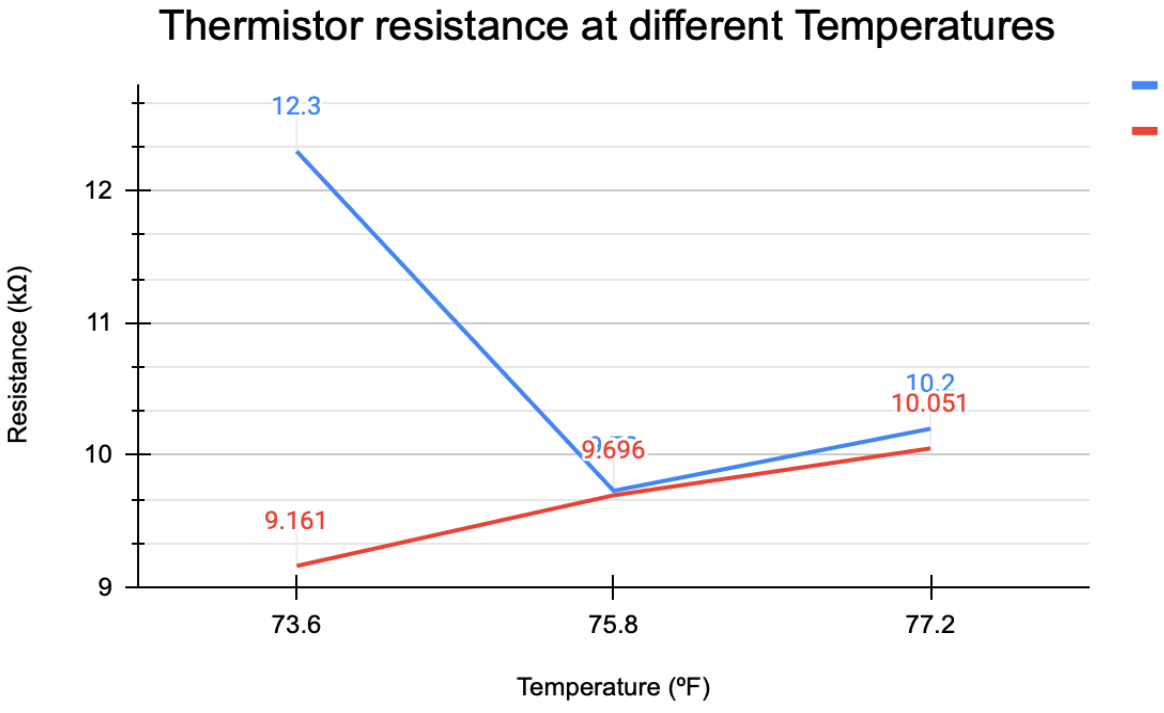
(1)



(2)


Measurements of 47(kΩ) Resistor
MEASUREMENTS OF CLASS 2019 (count)
MEASUREMENTS OF CLASS 2021 (count)
MEASUREMENTS OF CLASS 2022 (count)
MEASUREMENTS OF CLASS 2023 (count)
Number of Students
20
10
8
6
4
2
1
46.00
46.23
46.45
46.68
46.90
47.13
47.35
47.58
47.80
48.03
Actual Measurements

(3)


Thermistor resistance at different Temperatures
Resistance (kΩ)
12
11
10
9
12.3
10.2
10.051
9.696
9.161
73.6
75.8
77.2
Temperature (°F)

(4)

1. Provide an appropriate discussion of the measurements, plots, and tables (using cross-references) including equations used in calculations. Note: only complex equations (like the thermistor equation) need to be formatted on a separate line with an equation number.
    a.
2. Discuss the histograms of the three resistors in terms of the nominal expected value and the tolerance.
    a. The measured resistance of the 680 Ω resistor had the most variety of measurements (Fig. 1) while still maintaining the ±5% threshold for the resistor. Although many measurements remained below the nominal value. This is also true for the 47 kΩ measurements as well (Fig. 3). As for the 1kΩ resistor measurements (Fig. 3) some measurements remained precise to the nominal value while many remained in the lower portion of the ±5% threshold.
3. Discuss the classes measured values for the thermistor compared to the theoretical curve.
    a. From Figure 4 and Table 2 it is evidenced that the theoretical curve is a lot more linear compared to the actual measurements. The theoretical values supposed that at a lower temperature the resistance would be lower than expected but when measured in lab the results proved that at a colder temperature the resistance was greater than that at the hotter temperature. The Hot and Room Temperature measurements were more precise to the theoretical values compared to the theoretical values of the cold temperature and its measured result.

Conclusion:

From the data gathered during the laboratory experiment the results show the reaction of temperature correlates with the resistance measured. When measuring the resistance of the thermistor in colder temperatures the resistance measured increases compared to the resistance measured when the thermistor is at a higher temperature as seen in table 2. As for the resistance measured on each resistor is varied based upon the nominal values. Each resistor measured is within bounds of ±5% of the nominal value expected as evidenced from Table 1 and Figures 1, 2 and 3. While typically the values varied to the lower portion of that threshold each resistor's value is within its tolerance scope.