CPE 1140

Circuits / DC Circuit Fundamentals Lab

Fall 2021

Laboratory Report
Lab:1

Lab: Resistance, Voltage and Current Measurements and Ohms Law

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Laboratory Date: 9/9/2021

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Part A:

Resistor	Band 1	Band 2	Band 3 (Multiplier)	Band 4 (Tolerance)	Lower – Upper Values (ohm)
R1: 510Ω	Green	Brown	Brown	Gold	484.500 – 535.500
R2: 1000Ω	Brown	Black	Red	Gold	950.000 -1050.000
R3: 2000Ω	Red	Black	Red	Gold	1900.000 – 2100.000
R4: 4700Ω	Yellow	Purple	Red	Gold	4465.000 – 4935.000
R5: 10,000Ω	Brown	Black	Orange	Gold	9500.000 – 10500.000

Resistor	Measured Resistance (Ω)
R1	503.23
R2	985.670
R3	1.975 kΩ
R4	4.7667kΩ
R5	10.029kΩ

Part a of this lab was to see if the given resistors are correct and are within expected ranges. As shown in the tables above the given resistors are within manufacturing tolerances.

I would like to obtain a measurement at 20^{o} C since that is the measurement of the definition in a material engineering textbook, I was reading over the summer break.

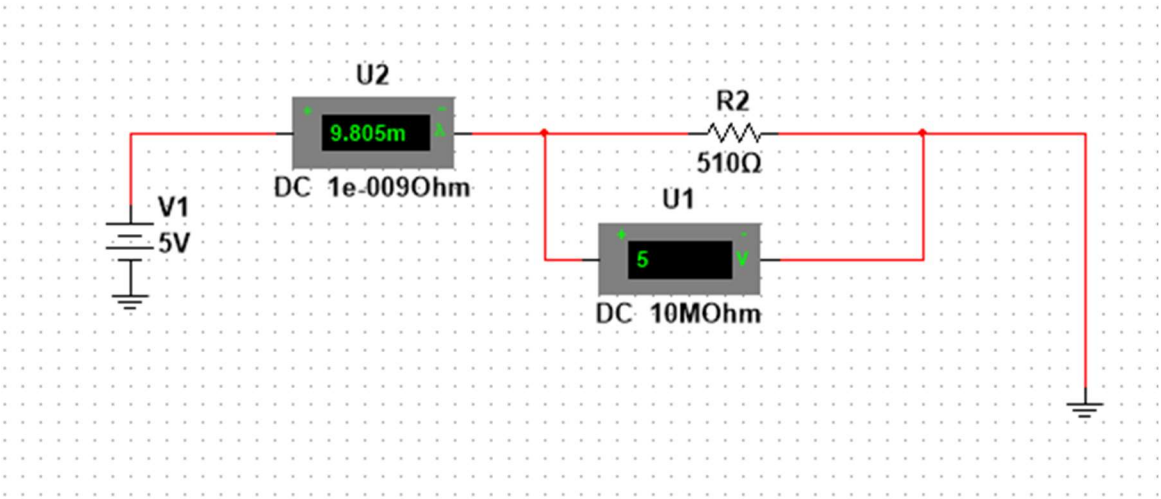
Part B:

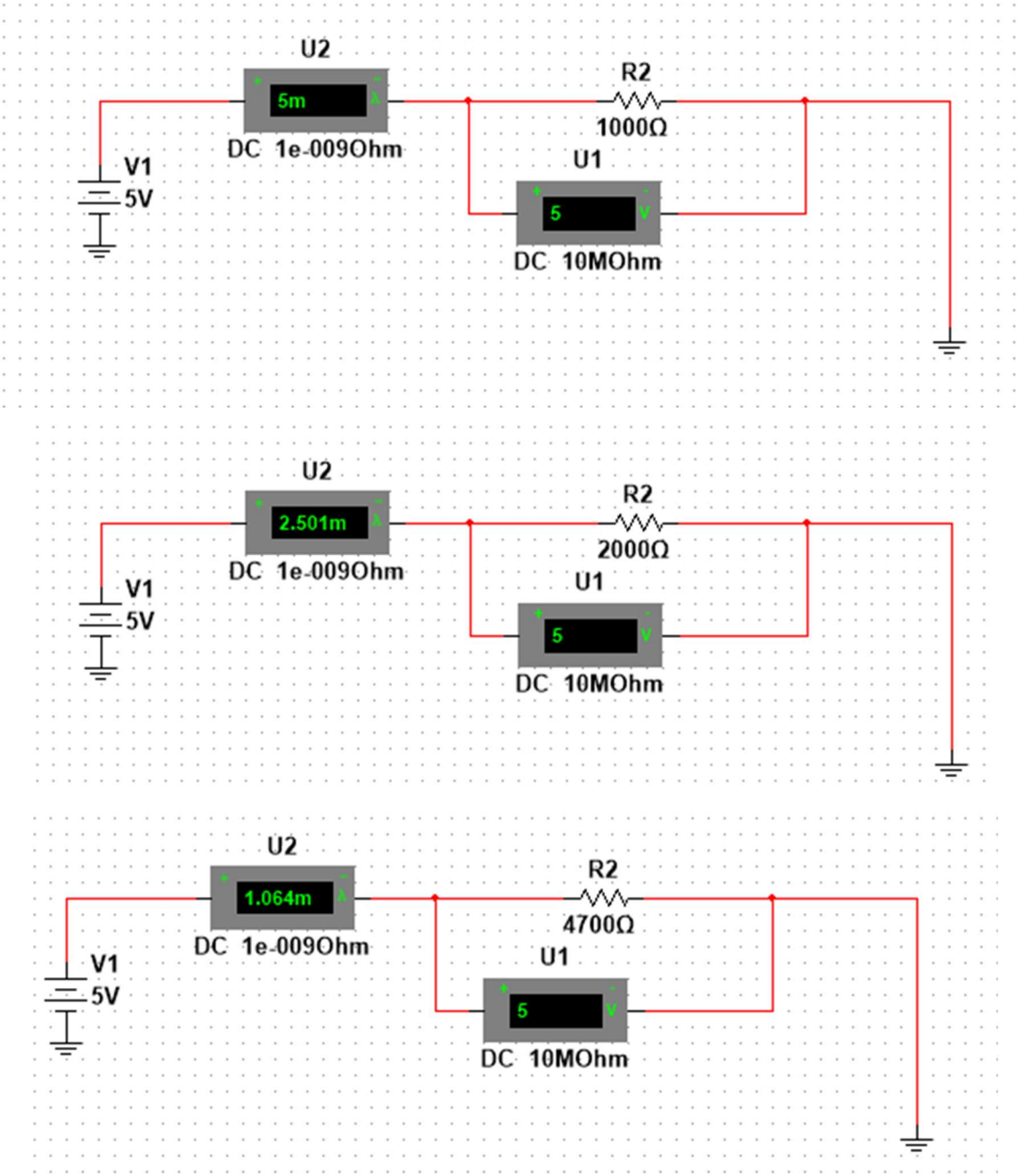
Predicted results

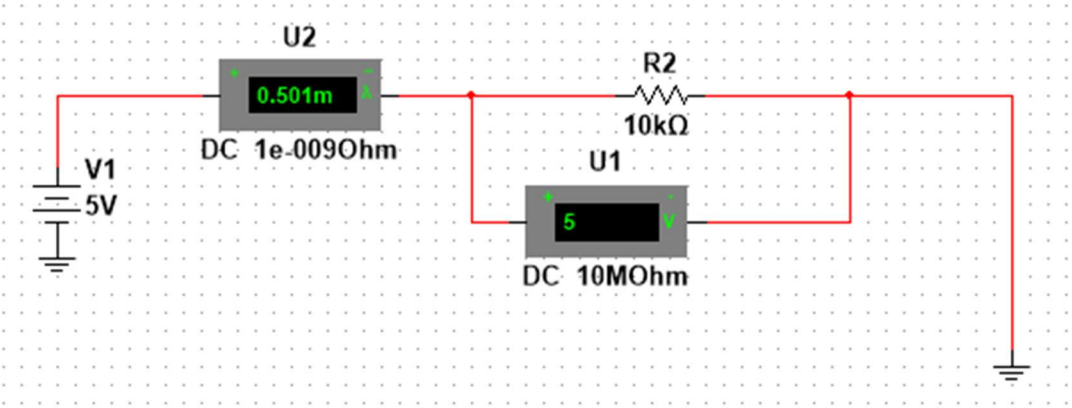
E = 5.0V

Resistor	Current (mA)
R1	9.804
R2	5.000
R3	2.500
R4	1.064
R5	0.500

Simulated results




U2
5m
DC 1e-009Ohm
R2
1000Ω
U1
5
DC 10MOhm
V1
5V
U2
2.501m
DC 1e-009Ohm
R2
2000Ω
U1
5
DC 10MOhm
V1
5V
U2
1.064m
DC 1e-009Ohm
R2
4700Ω
U1
5
DC 10MOhm
V1
5V



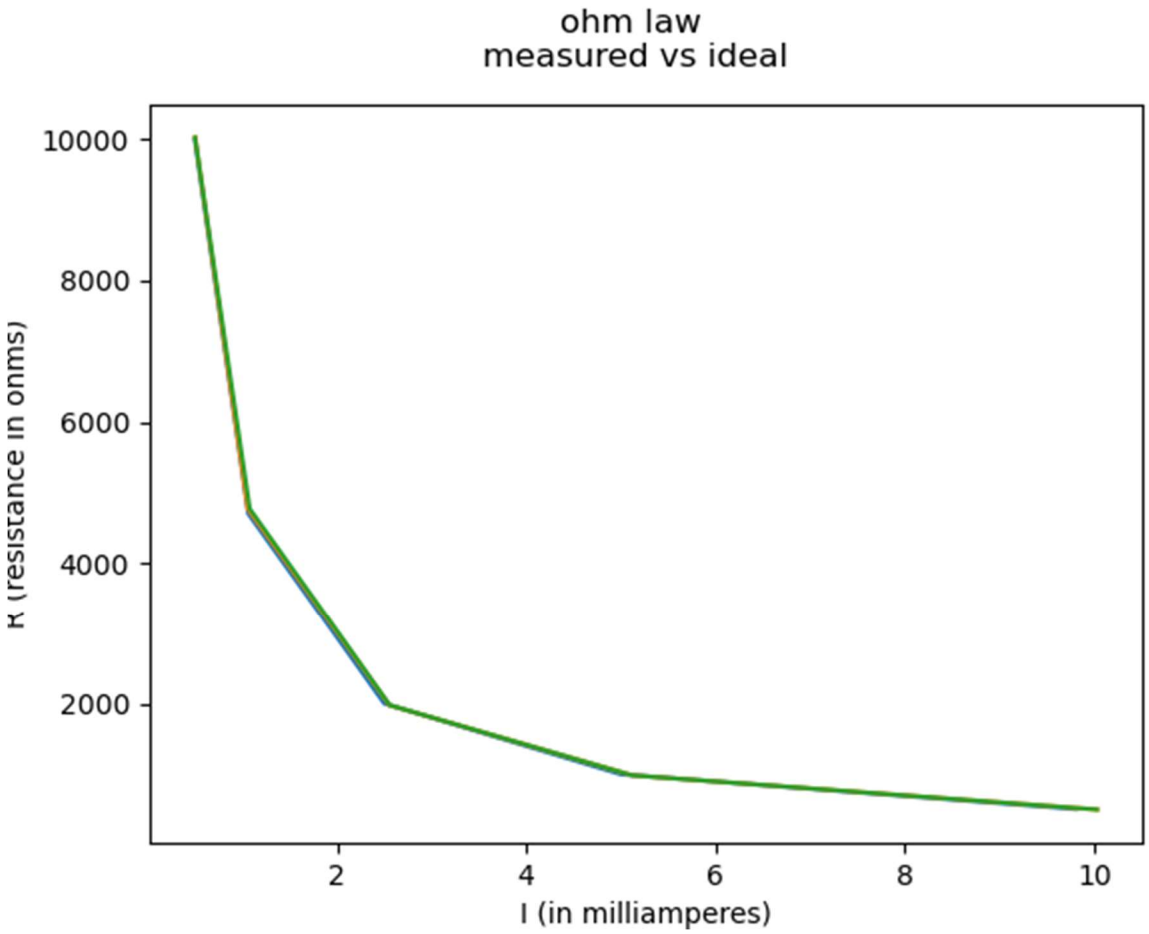
Measured results

E = 5.047V

Resistor	Source Current I (mA)
R1	10.029
R2	5.121
R3	2.560
R4	1.081
R5	0.503

The input voltage was slightly higher than the ideal case and the resistance of all the resistors were slightly lower than the ideal.

The relationship between voltage and current appears to be the positive part of $\frac{1}{x}$.



Graphed with matplotlib in python

It seems that the difference in results is negligible. Or close enough the lines are of measured, measured calculated, and ideal calculated.

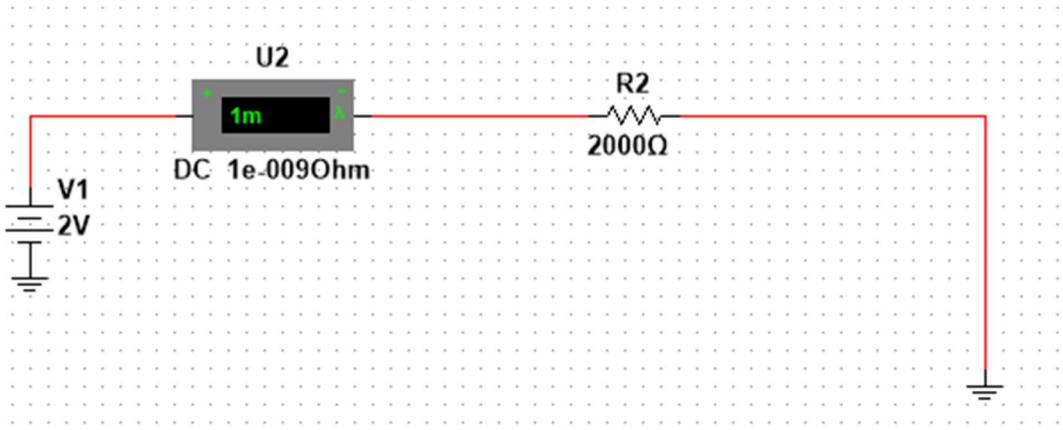
$\frac{V}{R} = I$ is the formula used for the graph above. V or Voltage is held as a constant and R resistance is the changing variable for this experiment.

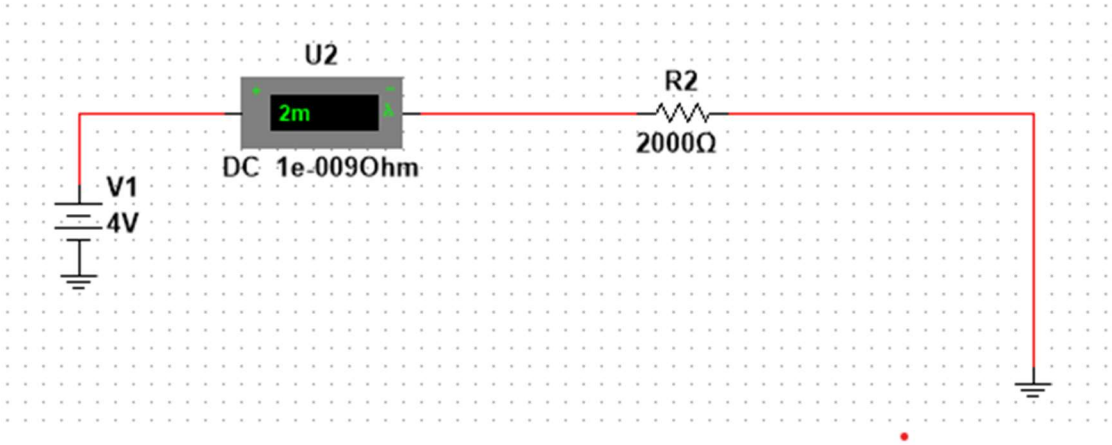
Part C:

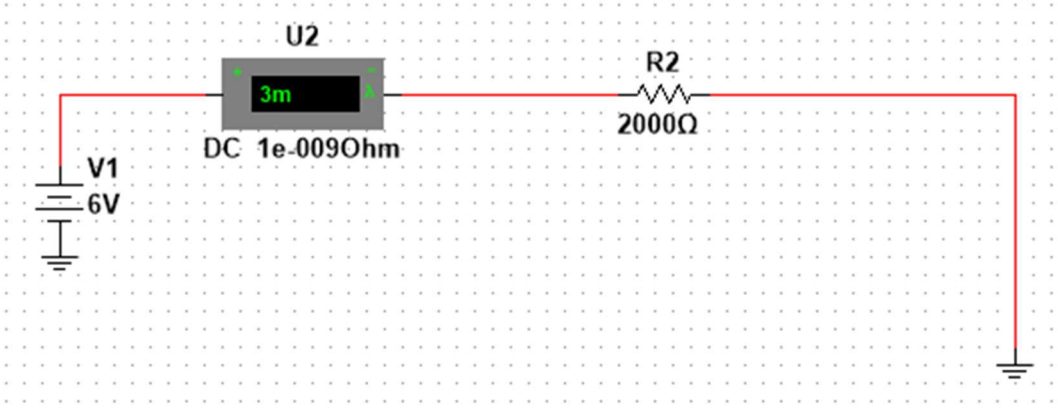
Predicted results

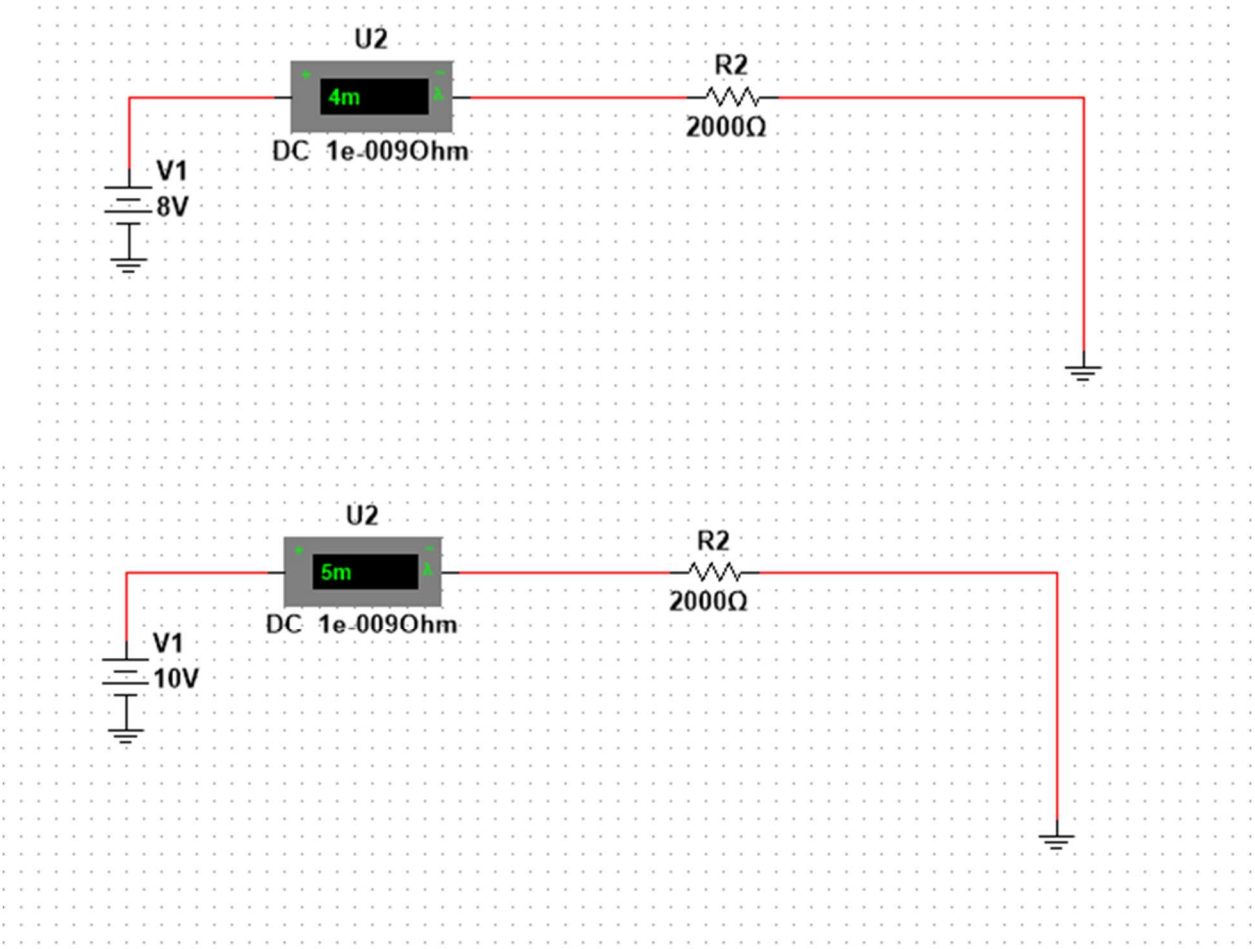
Current (mA)	Voltage (V)
1	2.000
2	4.000
3	6.000
4	8.000
5	10.000

Simulated results




U2
2m
DC 1e-009Ohm
R2
2000Ω
V1
4V


U2
3m
DC 1e-009Ohm
R2
2000Ω
V1
6V

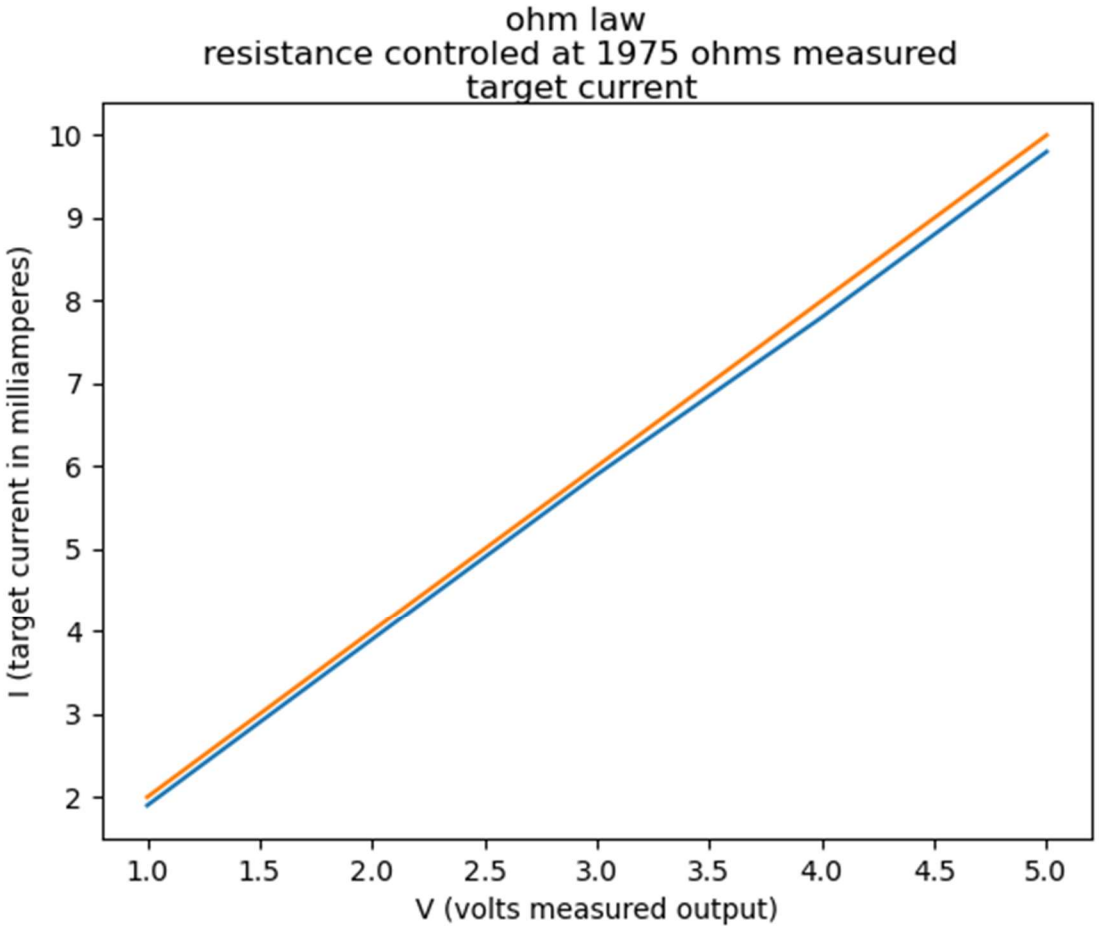


Measured results

R = 2KΩ

R_{real} = 1.975 k Ω

Source current I (mA)	Source Voltage V (volt)
1	1.9
2	3.9
3	5.9
4	7.8
5	9.8



The only thing that is variable in the predicted results vs the real results is the 2kΩ resistor which is measured to be 1.975$k\Omega$.

Ohms law is linear from $v = IR$

Current and resistance were held as constants in this experiment volts was the measured variable.

A potentiometer set at 2kΩ might have brought the experiment with better control.

Conclusion:

I was able to measure resistance, volts, and current in a DC circuit.

I was able to verify ohm's law though graphing and table plotting of ideal vs real. That the relationship between the resistance, current, and voltage are linear or $\frac{1}{x}$.

I chose to use matplotlib python library to plot the graphs. To learn it. I learned to do a multi-sim simulation I plan on using MATLAB for the next lab.

Appendix: Prelab calculations:

a) Determine the Color Codes for the Resistors used in this lab and calculate the upper and lower values for the 5% tolerance.

Table 1:

Resistor	Band 1	Band 2	Band 3 (Multiplier)	Band 4 (Tolerance)	Lower – Upper Values (ohm)
R1: 510Ω	Green	Brown	Brown	Gold	484.500 – 535.500
R2: 1000Ω	Brown	Black	Red	Gold	950.000 -1050.000
R3: 2000Ω	Red	Black	Red	Gold	1900.000 – 2100.000
R4: 4700Ω	Yellow	Purple	Red	Gold	4465.000 – 4935.000
R5: 10,000Ω	Brown	Black	Orange	Gold	9500.000 – 10500.000

b) Using Ohm's law (I=E/R) and a source voltage of ***5 volts***, calculate the current through each resistor:

Table 2:

Resistor	Current (mA)
R1	9.804
R2	5.000
R3	2.500
R4	1.064
R5	0.500

c) Using Ohm's law (E=RI) with ***R = 2KΩ***, calculate the expected source voltage E as the source current changes:

Table 3:

Current (mA)	Voltage (V)
1	2.000
2	4.000
3	6.000
4	8.000
5	10.000