

FLORISSANT VALLEY COMMUNITY COLLEGE

LAB REPORT FORM

PL
06/05/08

Lab attendant's initials & Date

Student Name: LINDA SCHMITT Roster #: 342
Course: EP2 Section: _____
Instructor: DINO
Experiment: Ohm's Law
Date: 06-05-2008

Objective: Explain the purpose of doing the lab experiment. It should be written in your own words.

To find the resistance of three resistors and three resistor combinations experimentally, and to verify the equations for resistors in series and parallel.

Diagram:

DON'T DO THIS!

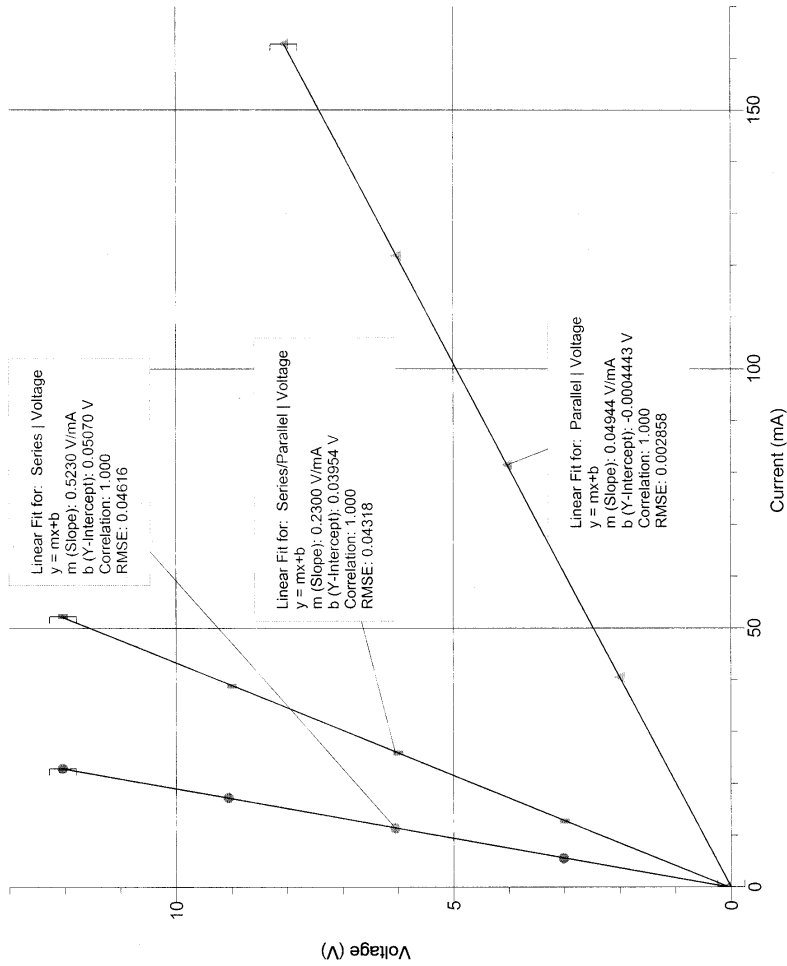
Name: L. SCHMITT

DATA: List all data gathered in the experiment. Make sure you include units for each.

| Resistor 1 | | Resistor 2 | | Resistor 3 | |
|-------------|--------------|-------------|--------------|-----------------|--------------|
| Voltage (V) | Current (mA) | Voltage (V) | Current (mA) | Voltage (V) | Current (mA) |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 2.00 | 12.28 | 2.017 | 20.29 | 2.002 | 7.51 |
| 4.05 | 25.88 | 4.06 | 40.7 | 4.01 | 15.06 |
| 6.05 | 38.7 | 6.04 | 60.4 | 6.03 | 22.67 |
| 8.04 | 51.9 | 8.02 | 80.1 | 8.04 | 30.37 |
| 10.03 | 64.8 | 10.02 | 99.9 | 10.01 | 37.8 |
| | | | | | |
| Series | | Parallel | | Series/Parallel | |
| Voltage (V) | Current (mA) | Voltage (V) | Current (mA) | Voltage (V) | Current (mA) |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 3.011 | 5.57 | 2.004 | 40.5 | 3.000 | 12.73 |
| 6.05 | 11.41 | 4.02 | 81.4 | 6.00 | 25.86 |
| 9.06 | 17.23 | 6.02 | 121.8 | 9.00 | 38.8 |
| 12.04 | 22.97 | 8.05 | 162.8 | 12.03 | 52.3 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Series/Parallel | Current (mA) | Voltage (V) |
|-----------------|--------------|-------------|
| 1 | 0.00 | 0.000 |
| 2 | 12.73 | 3.000 |
| 3 | 25.86 | 6.000 |
| 4 | 38.80 | 9.000 |
| 5 | 52.30 | 12.000 |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |
| 11 | | |
| 12 | | |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |

Resistances of Resistor Combinations



Notes:

CALCULATIONS:

The slopes of the regression lines give the experimental values of the resistances of the three individual resistors, the resistors in series, parallel, and series-parallel. This is true because my graphs were of voltage vs. current and since $V=IR$ is a linear relationship, "R" is the slope.

$$R_1 = 0.1542 \text{ k}\Omega \quad R_2 = 0.1003 \text{ k}\Omega \quad R_3 = 0.2647 \text{ k}\Omega$$

$$\text{Series} = 0.5230 \text{ k}\Omega \quad \text{Parallel} = 0.04944 \text{ k}\Omega$$

$$\text{Series-Parallel} = 0.2300 \text{ k}\Omega$$

Equivalent Resistance: Series

$$R_s = R_1 + R_2 + R_3$$

$$R_s = 0.1542 \text{ k}\Omega + 0.1003 \text{ k}\Omega + 0.2647 \text{ k}\Omega$$

$$R_s = 0.5192 \text{ k}\Omega = 519.2 \Omega$$

Since the resistance values of the individual resistors were found experimentally, each of the equivalent resistances calculated for the various combinations is also considered an experimental value. Therefore, I found the percent difference.

$$\% \text{ difference} = \frac{|\text{Equiv. Resistance Value} - \text{Exp. Value}|}{\text{Equiv. Resistance Value} + \text{Exp. Value}} \times 200\%$$

$$\begin{aligned} \% \text{ diff. (series)} &= \frac{|519.2 \Omega - 523.0 \Omega|}{519.2 \Omega + 523.0 \Omega} \times 200\% \\ &= \frac{3.8 \Omega}{1042.2 \Omega} \times 200\% \\ &= 0.73\% \end{aligned}$$

Equivalent Resistance: Parallel

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_p} = \frac{1}{0.1542 \text{ k}\Omega} + \frac{1}{0.1003 \text{ k}\Omega} + \frac{1}{0.2647 \text{ k}\Omega}$$

$$\frac{1}{R_p} = 20.2330 \text{ k}\Omega$$

$$R_p = \frac{1}{20.2330 \text{ k}\Omega} = 0.04942 \text{ k}\Omega = 49.42 \Omega$$

$$\begin{aligned} \% \text{ diff. (parallel)} &= \frac{|49.42 \Omega - 49.44 \Omega|}{49.42 \Omega + 49.44 \Omega} \times 200\% \\ &= \frac{0.02 \Omega}{98.86 \Omega} \times 200\% \\ &= 0.04\% \end{aligned}$$

Experimental Resistance: Series-Parallel

$$R_{sp} = R_1 + \frac{R_2 R_3}{R_2 + R_3}$$

$$R_{sp} = 0.1542 \text{ k}\Omega + \frac{(0.1003 \text{ k}\Omega)(0.2647 \text{ k}\Omega)}{0.1003 \text{ k}\Omega + 0.2647 \text{ k}\Omega}$$

$$R_{sp} = 0.1542 \text{ k}\Omega + \frac{0.0265494 \text{ k}\Omega^2}{0.365 \text{ k}\Omega}$$

$$R_{sp} = 0.1542 \text{ k}\Omega + 0.0727 \text{ k}\Omega = 0.2269 \text{ k}\Omega = 226.9 \Omega$$

$$\begin{aligned} \% \text{ diff. (series-parallel)} &= \frac{|226.9 \Omega - 230.0 \Omega|}{226.9 \Omega + 230.0 \Omega} \times 200\% \\ &= \frac{3.1 \Omega}{456.9 \Omega} \times 200\% \\ &= 1.36\% \end{aligned}$$

TABLE OF RESULTS

| Type of Resistor Connection | Equivalent Resistance Value | Experimental Resistance Value | Percent Difference |
|-----------------------------|-----------------------------|-------------------------------|--------------------|
| Series | 519.2 Ω | 523.0 Ω | 0.73% |
| Parallel | 49.42 Ω | 49.44 Ω | 0.04% |
| Series-Parallel | 226.9 Ω | 230.0 Ω | 1.36% |

CONCLUSION:

The equations for calculating the resistance of resistors in series, parallel, and series-parallel were verified. For each of the different connections, the experimental value for the resistance was higher than the calculated equivalent resistance, but within only 1.5%. This "higher" resistance suggests that the wires used to make the various connections have some internal resistance since more wires were used to make the connections than were used to find the resistances of the individual resistors. While the percent differences were very small, the additional resistance could still be lowered by using wires with less resistance or fewer wires to make the connections, but neither of these options is feasible with our lab's equipment or with the design of the experiment.

Even though it was mentioned in class, this lab made it more clear to me that the equivalent resistance of a series connection is more than the resistance of any one individual resistor, and for a parallel combination the equivalent resistance is less than any one individual resistor.