Lab 5: Resistors in Series and Parallel

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1 Purpose

Familiarity with the behavior of resistors in both series and parallel configurations. Experimental verification of course material and calculations of series and parallel resistors.

2 Materials

- Handheld Digital Multimeter (DMM)
- Breadboard
- Assorted Resistors (270Ω, 330Ω, and 510Ω)
- Power Supply
- Wires
- Alligator Clips

3 Theory

In this lab, we make use of the **ammeter** function in our digital multimeters for the final section. The electrical current is measured in Amperes, which is one coulomb per second ($1.0A = \frac{1.0C}{1.0s}$).

Additionally, we made use of the most useful feature of a digital multimeter, being the **voltmeter**. With this mode, our multimeter is able to measure the potential difference between any two points with the units of volts (ΔV), which gives us an idea of the difference in potential energy between two points in our circuit.

Resistors have the main property of "resistance", measured in Ohms (Ω), which can be thought of as a ratio of Volts over Amperes, or how many volts will be dropped across the resistor for a certain amount of current.

Resistors in series

$$R_{eq} = R_1 + R_2 + R_3$$

The total Voltage across resistors in series is equal to the sum of voltage drops across each subsequent resistor.

$$V_{eq} = \varepsilon = V_1 + V_2 + V_3 = IR_1 + IR_2 + IR_3$$

Resistors in parallel

$$R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_2}\right)$$

The voltage drop across each resistor in a parallel setup is equal to the potential difference of the battery ε.

$$V_{eq} = \varepsilon = V_1 = V_2 = V_3$$

4 Experiment Analysis

When we have resistors in parallel, the potential difference across them are the same.

Figure 1: Six unknown resistors on a breadboard

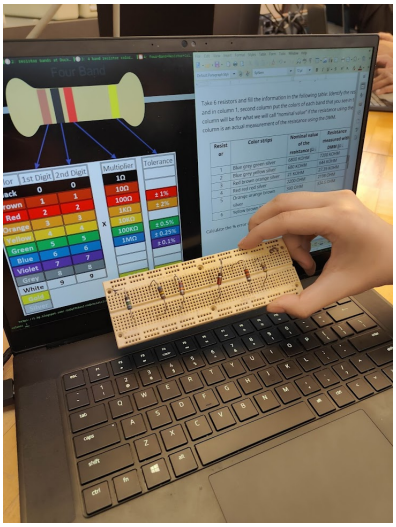
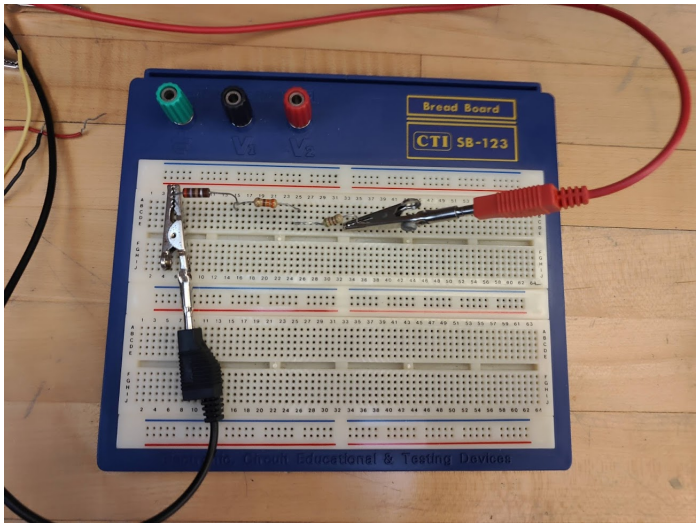


Figure 2: Resistors in a series configuration



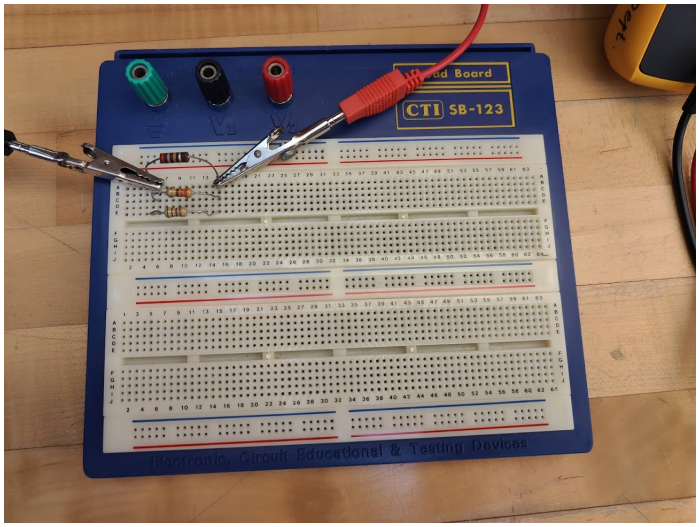
5 Procedure

5.1 Measurement of the resistors using DMM

5.2 Series Circuit

5.3 Parallel Circuit

Figure 3: Resistors in a parallel configuration



6 Data and Graphs

6.1 Part 1

6.2 Part 2

6.3 Part 3

7 Calculations & Results

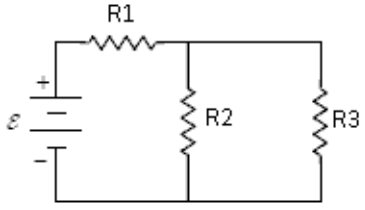
7.1 Part 1

For calculating the equivalent resistance

7.2 Part 2

8 Questions

Figure 4: Series and parallel circuit diagram



9 Conclusion