Lab #7

Series and Parallel Circuits

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Purpose

To determine the resistance of each of 2 resistors using the voltmeter-ammeter method:

a) When connected in series
b) When connected in parallel

Theory

A parallel and a series circuit are different because in parallel the electrons have a choice of path.

Parallel

In parallel electrons have multiple paths to choose from. Also in parallel, the total volts are applied to each separate resistor. Additionally, each resistor in a parallel circuit has a different number of amps. The total resistance must be less than the lowest resistance in the circuit because electrons first go on the path of lower resistance. If you add all amps from each resistor than you get the total amps of the circuit.

Series

Electrons can only follow one path. The amps anywhere are amps everywhere and the resistance can be found by adding up each the resistance of each resistor. The volts applied to each resistor depend on the Ohms that each resistor has.

The formula expresses Ohms' law and states that the current is directly proportional to volts and inversely proportional to resistance.

In a circuit, the ammeter reads amps by measuring the electron count while a voltmeter reads volts.

Materials

- Circuit board
- Variable power pack
- Alligator clips
- Banana plugs
- Multimeter

Procedure

Series Circuit

- Using alligator clips complete the circuit
- To get the amp measurement, turn the multimeter to the 200 milliamp position and record the reading anywhere, which should equal the value everywhere
- Record the amp measurement of each resistor

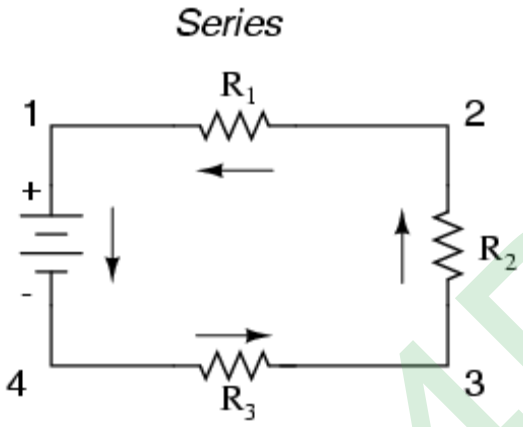
- Switch to voltmeter setting (200 position) and plug it into the battery and record value
- Plug the voltmeter into each resistor and record each individual value (add up to that of the battery)

Parallel Circuit

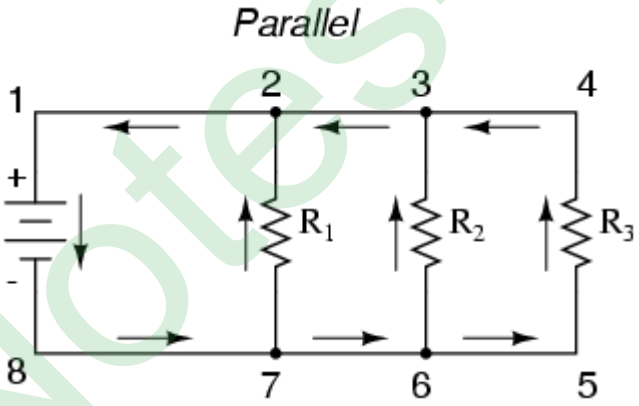
- Use banana plugs to set up the parallel circuit
- Record the amps of the battery
- Record the amps of each resistor (add up to that of the battery)
- Record the voltage of the battery which should equal the voltage everywhere
- Record the voltage of each resistor

Diagrams

Series Circuit



Parallel Circuit



Data

Series Circuit

I_t: 31.9 x $10^{-3}a$ (should be universal) V_t: 23.7 V

I_1: $31.6\ x\ 10^{-3} a$ V_1: 14.9 V

I_2: $31.7\ x\ 10^{-3} a$ V_2: 8.6 V

$R_1 = \frac{V_1}{I_1}$ = 471.52 Ω

$R_2 = \frac{V_2}{I_2}$ = 271.24 Ω

$R_t = \frac{V_t}{I_t}$ = 742.95 Ω

Percent Error: $\left|\frac{R_t - (R_1 + R_2)}{R_t}\right| = \left|\frac{742.95\ \Omega - (471.52\ \Omega + 271.24\ \Omega)}{742.95\ \Omega}\right|$ =00.2%

Parallel Circuit

I_t: $139.7\ x\ 10^{-3} a$ V_t: 24.5 V (should be universal)

I_1: $51.8\ x\ 10^{-3} a$ V_1: 24.3 V

I_2: $89.3\ x\ 10^{-3} a$ V_2: 24.2 V

$R_1 = \frac{V_1}{I_1}$ = 464.11 Ω

$R_2 = \frac{V_2}{I_2}$ = 271.00 Ω

$R_t = \frac{V_t}{I_t}$ = 175.38 Ω

Percent Error: $\left|\frac{R_t - (\frac{1}{R_1} + \frac{1}{R_2})^{-1}}{R_t}\right| = \left|\frac{175.38\ \Omega - (\frac{1}{464.11\ \Omega} + \frac{1}{271.00\ \Omega})^{-1}}{175.38\ \Omega}\right|$ =02.4%

Conclusions and Discussion of Results

We learned how to create both a series circuit and a parallel circuit. We learned to read amps and voltage from a multimeter. Using the recorded date we were able to calculate the resistance.