Simple Series Circuit Lab Experiment

Theory:

* In a simple series circuit, each electrical component is connected sequentially, one after the other. As per the conservation of energy, the sum of the voltages throughout the circuit equals the source voltage:

Vsource = V1 + V2 + V3

Vsource = I1R1 + I2R2 + I3R3

As per the conservation of charge the current is the same throughout all of the resistors. Hence the amount of charge running through each resistor is the same. Therefore,

ITotal = I1 = I2 = I3,

Vsource = ITotal(R1 + R2 + R3)

Therefore,

RTotal = R1 + R2 + R3

Objective:

- To determine the resistance and current through all of the components of a simple series circuit and compare to theoretically determined values.

* To learn how to put voltmeters and ammeters in circuit elements to take readings.
* To learn how to assemble basic circuits.

Materials:

* Variable power supply
* Voltmeter
* Ammeter
* Three different resistors (10 – 400 ).
* Wire with alligator clips and/or banana clips

Procedure:

1. Record all data and calculations in the tables below or on a separate piece of paper.
2. Connect voltmeter in parallel to one of the resistors.
3. Connect ammeter in series adjacent to the resistor being measured.
4. Measure and record voltage and current for all three resistors (Do not exceed 12 volts!)
5. Measure and record the total voltage and current for the circuit using the values from the power supply or your meters.
6. Record the color bands for each resistor so that the theoretical values can be calculated.

Analysis:

1. Summarize data and calculate the resistance of each element in the circuit as well as the total resistance (Req) of the circuit.
2. How does the sum of the voltages of each resistor compare to the total value?
3. Describe the relationship between the resistance value for each resistor and the voltage drop. What is the pattern?
4. Describe the relationship between resistance and current in the circuit. Is there a pattern?
5. Compare the calculated values for R and Req to the values determined by the bands on the resistors. How close are your measurements to the theoretical values? Why might they be different?
6. Compare Req to the resistance value of each resistor. How do they compare?
7. Calculate the power for each resistor and the total circuit. How does the power consumed by a given resistor compare to the other resistors in the circuit? Is there a pattern?

Error Analysis & Conclusions:



R1

R3

R2

+

V

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data Summary – Simple Series Circuit | | | | |
|  | R1 | R2 | R3 | Totals |
|  | Measured or Calculated  Value | Measured or Calculated  Value | Measured or Calculated  Value | Measured or Calculated  Value |
| Resistance |  |  |  |  |
| Current |  |  |  |  |
| Voltage |  |  |  |  |
| Power |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Error Analysis | | | |
|  | Measured Value for Resistance | Theoretical Value for Resistance | % Error |
| R1 |  |  |  |
| R2 |  |  |  |
| R3 |  |  |  |
| Req |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Black | Brown | Red | Orange | Yellow | Green | Blue | Violet | Gray | White |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **R1** |  |  |  |  |  |  |  |  |  |  |
| **R2** |  |  |  |  |  |  |  |  |  |  |
| **R3** |  |  |  |  |  |  |  |  |  |  |

**Rn = {(Band 1) (Band 2)} \* 10Band 3 + (Band 4)%**