University of Al-Mustaqbal
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Magnetism

the practical aspect

Second Stage

Study of connecting resistors in series

Lec 5

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The objective of the experiment :

The purpose of this experiment is to study the behavior of resistors when connected in series and to verify the laws that govern current and voltage in such connections. The experiment also aims to calculate the equivalent resistance of a group of series-connected resistors experimentally and compare it with the theoretical value using the appropriate formulas.

Equipment used in the experiment :

1. Electrical resistors of different values (R_1, R_2, R_3)
2. DC power supply
3. Electrical connecting wires
4. Ammeter
5. Voltmeter
6. Breadboard

Theory of the Experiment :

When resistors are connected in series, the **same current** flows through all resistors because there is only one available path for the electric charge to move.

The **total voltage** of the power supply is divided among the resistors according to their resistance values.

The equivalent resistance for series-connected resistors is given by:

Req = R1 + R2 + R3 + …….

The current through the circuit is:

I = V/ Req

The voltage drop across each resistor

Vi = I + Ri

The method of work :

1. Place resistors R_1, R_2, and R_3 on the breadboard in a series configuration.
2. Connect the power supply to the circuit.
3. Connect the ammeter in series to measure the total current.
4. Connect the voltmeter in parallel across each resistor to measure the voltage drop.
5. Turn on the power supply and record the current reading.
6. Measure and record the voltage across each resistor and the total voltage.
7. Calculate the theoretical equivalent resistance and compare it with the experimental value using:

   Req = V total/ I
8. Repeat measurements for accuracy.

Resistor	**Resistance (Ω)**	**Theoretical Voltage (V)**	**Theoretical Current (A)**
R_1		$V_1(th) = I(th) \times R_1$	I(th) = Vtotal / Req
R_2	_____	$V_2(th) = I(th) \times R_2$	
R_3		$V_3(th) = I(th) \times R_3$	
Total	**Req = $R_1 + R_2 + R_3$**	**Vtotal**	

Discussion

1. In a series circuit, the current through each resistor is:

A. Different
B. Constant and identical
C. Dependent only on resistance
D. Dependent only on voltage
E. Zero

2. The equivalent resistance of two resistors in series is:

A. (R1 x R2)
B. (R1 - R2)
C. (R1 + R2)
D. (R1R2/ R1 + R2)
E. Zero

3. In a series circuit, the total voltage equals:

A. The smallest voltage in the circuit
B. The sum of voltage drops across all resistors
C. The voltage across the first resistor only
D. The voltage across the largest resistor
E. None of the above

4. The current in a series circuit with three resistors depends on:

A. The largest resistor only
B. The total voltage and equivalent resistance
C. The voltage on the first resistor
D. The number of resistors only
E. It does not depend on any resistor

5. If one of the resistors in a series circuit increases, the current will:

A. Increase
B. Decrease
C. Stay the same

D. Drop to zero
E. Oscillate

6. The ammeter in the experiment is connected:

A. In parallel
B. In series
C. Not connected
D. Across the power supply
E. Across the largest resistor

7. The voltmeter is connected:

A. In series
B. In parallel
C. Inside the power supply
D. Inside the resistor
E. On one terminal of the circuit

8. The circuit symbol for a resistor is usually:

A. A circle
B. A straight line
C. A zigzag line
D. A square
E. A triangle

9. If (R1 = 10Ω) and (R2 = 20Ω), the series equivalent resistance is:

A. 10Ω
B. 20Ω
C. 15Ω
D. 30Ω
E. 5Ω

10. The unit of resistance is:

A. Ampere
B. Volt
C. Ohm
D. Watt
E. Henry

11. If the total voltage is 12V and the equivalent resistance is 6Ω, the current is:

A. 1A
B. 2A
C. 3A
D. 4A
E. 6A

12. Adding more resistors in series will cause the equivalent resistance to:

A. Decrease
B. Stay constant
C. Increase
D. Become zero
E. Become negative

13. The voltage drop across each resistor in a series circuit depends on:

A. The value of that resistor
B. Current only
C. Source voltage only
D. Nothing
E. Number of resistors

14. The reason current stays the same in a series circuit is:

A. Multiple current paths
B. A large battery is used
C. There is only one path for current
D. Voltage differences
E. Zero resistance

15. The main objective of the experiment is:

A. Measuring heat increase
B. Studying voltage distribution in parallel circuits
C. Studying series resistor connections
D. Comparing different power sources
E. Studying inductors