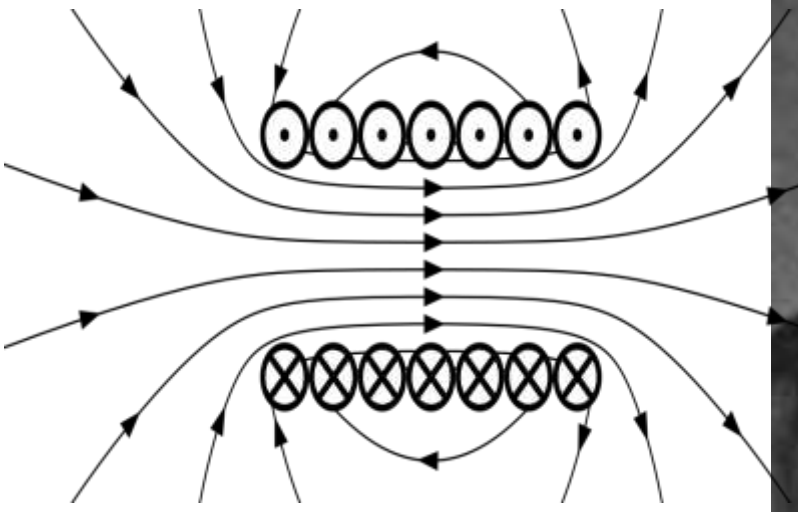

Verification of Ohm's Law

Experimental part

First Lecture (1)

First semester / First year

By

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Verification of Ohm's Law

The AIM of the Experiment:

1. To verify Ohm's law and then determine the unknown resistance of the given material of the wire from the graph.
2. Calculate the Error and Error percentage.

Theoretical Part:

Ohm's law states: that the electric current through a conductor between two points is directly proportional to the voltage across the two points. Introducing the constant of proportionality, the resistance, one arrives at the three mathematical equations used to describe this relationship:

$$V = I\,R \qquad \text{or} \qquad I = \frac{V}{R} \qquad \text{or} \qquad R = \frac{V}{I}$$

Where
I: is the current through the conductor
V: is the voltage measured across the conductor
R: is the resistance of the conductor.

More specifically, Ohm's law states that the R in this relationship is constant, independent of the current. If the resistance is not constant, the previous equation cannot be called Ohm's law, but it can still be used as a definition of static DC resistance. All conductors show some opposition to electrical current. This opposition to the current is called resistance. There are several factors that affect the resistance of a conductor, including:

- **Type of material:** copper has lower resistance than steel
- **Length:** longer wires have greater resistance
- **Thickness:** smaller-diameter wires have greater resistance
- **Temperature:** heating a wire increases its resistance.

The two main ways of increasing the current in an electrical circuit are by increasing the voltage or by decreasing the resistance. **Electrical current:** is defined as the rate of flow of charge through a circuit. **Potential difference or voltage:** is the amount of energy per unit charge needed to move that charge between two points in a circuit.

Experimental Part:

Apparatus:

A battery, an ammeter, a voltmeter, a rheostat, a plug key, a coil of an unknown substance, and a connecting wire, figure 1 shows an Ohm's law circuit.

Procedures:

1. Set up the circuit according to the circuit diagram as shown in figure:

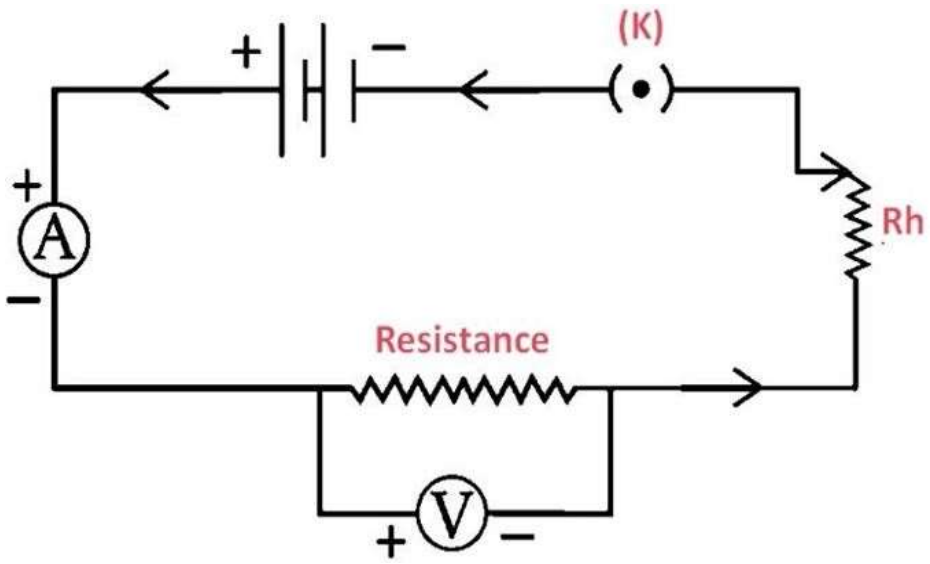


Figure (1): Shows Ohm's law circuit.

2. Initially, set the power supply to 1.5 V and note the current on ammeter

3. Increase the voltage to 2 V, observe the ammeter, and note the readings

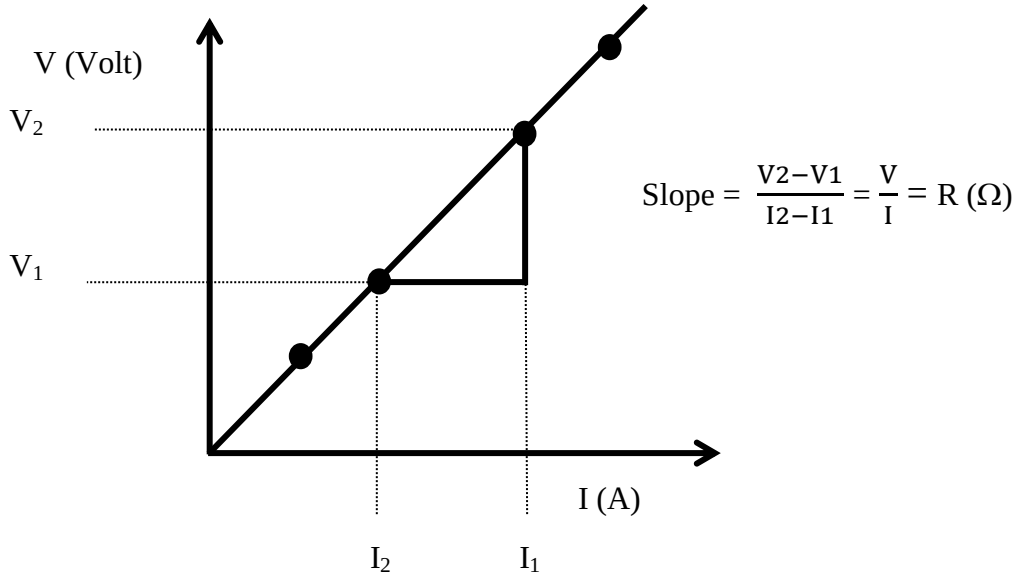
4. Repeat the above steps for 2.5 V, 3V … V.

Calcualtions:

Table 1 shows the relationship between V, I, and R. Draw a graph of current versus voltage. Since the voltage is the variable that is directly varying, it is an independent variable and will be plotted on the y-axis. The current is the dependent variable and must be plotted on the x-axis.

Table (1): The relationship between V, I, and R according to Ohm's law.

V (Volt)	I (A)	R (Ω) = $\frac{V}{I}$
1.5		
2		
2.5		
3		



We can calculate the experimental value of the resistance from the graph, while the real value of R is 100Ω, so now we can calculate the Error and Error percentage:

Error = Experimental Value - Theoretical Value

$$\textbf{Error Percentage \% } = \frac{|Error|}{Theoretical\ Value} \textbf{ x 100 \%}$$

Compare the plot with theoretical calculations.

Precautions:

- All the connections must be very tight.
- Record the current at the regular interval of voltage.
- While changing the voltage, the rheostat must only be moving in one direction.
- The least number of voltmeters and ammeters must be properly calculated.
- Do not pass a large current through the resistance.
- While measuring the voltage and current, the needle of meters should not move out of the scale.

DISSCUTION

1. State Ohm`s law, and what is resistance? And what is S.I. unit of resistance?
2. What are the applications of Ohm`s law?
3. Is there any difference between theoretical and experimental values?
4. Why the voltmeter connect in parallel with the device to measure its voltage?
5. Why the ammeter connected in series with the device to measure its current?
6. Is the experiment verifying Ohm's Law? Explain it.