Verification of Ohm's Law

1.1 Purpose/Objective:

In this lab, you will verify Ohms Law for four different resistors. You will measure the true resistance of each resistor and the voltage applied to each resistor. You will then calculate the predicted current through each resistor. Finally, you will measure the actual current through each resistor to verify (or disprove!) Ohm's Law.

1.2 Theory:

In 1928, a German scientist George Simon Ohm stated this law. Ohm's law is used to relate voltage to current and resistance. It states that at constant temperature, the amount of current flow through any conductor is directly proportional to the potential difference across the conductor. This is stated mathematically as:

$$I \propto V$$

which can be written as

$$\frac{V}{I} = \text{constant}$$

By putting the constant equal to R, the above equation becomes-

$$\frac{V}{I} = R \qquad (1)$$

where the constant R is called the resistance of the conductor in ohms, V is the voltage across the conductor in volts and I is the current passing through the conductor in amps. For metallic conductor, the ratio of voltage to current (i.e. V/I) is constant for all values of V and I. Given any two of these quantities, Ohm's law can be used to solve for the third.

Lab Work: Experiment-1: Verification of Ohm's Law

****

1.3 Equipment/ Apparatus:

a) One regulated variable Power Supply (0-30 V)

b) Two Digital Multimeter (One DC mili-ammeter, one DC voltmeter)

c) Circuit Experiment Board (Breadboard)

d) Resistors (10KΩ, 5KΩ and 1KΩ)

e) Connecting Wires

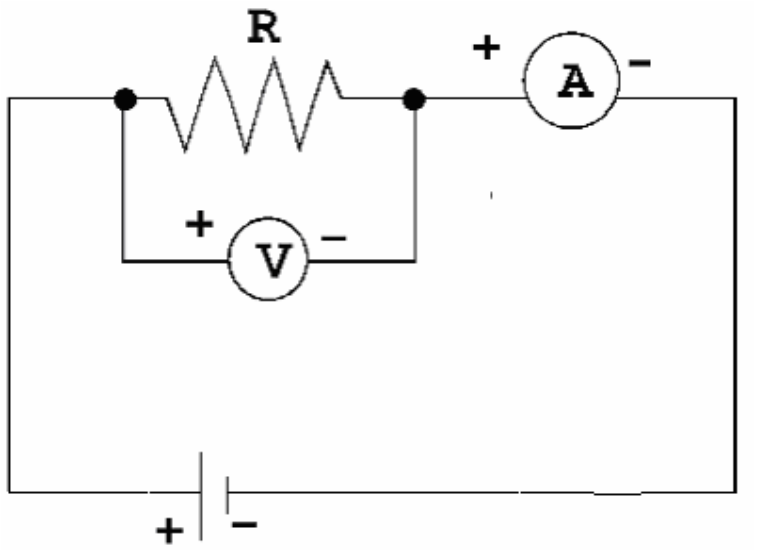
f) Cutting tools etc.

1.4 Cautions:

This equipment is delicate. Everything should go together with the lightest of touches. Do not force anything!

1.5 Circuit Diagram:

The circuit diagram to verify Ohm's law is shown below:



In the above figure, R is the resistor, V is the voltmeter which measures the voltage across the resistor and A is the milliammeter which measures the current through the resistor, E is the DC power supply (0-30 V).

****

Lab Work: Experiment-1: Verification of Ohm's Law

****

1.6 Procedure:

1. Construct the circuit on the breadboard, as shown in the above figure (an ammeter, a resistor are in series with a regulated power supply and a voltmeter is in parallel to the resistor).
2. Start the experiment from the zero voltage of the power supply. For zero supply voltage, the current flow is zero. Now increase the supply voltage from 0 to 20 V in at least ten steps, take the ammeter and voltmeter readings.
3. By using equation (1), find the value of R for each reading. Observe that the value of R must be constant for each reading, which verifies Ohm's law.
4. Plot a graph of I as a function of V (I in Y-axis and V in X-axis) with the above readings. The graph should fit a straight line passing through the origin. The slope of this line will indicate the resistance of the resistor.
5. Compare the experimental resistance value with the color coded value and direct ohmmeter reading.

1.7 Data Table:

For each reading, fill up the following table:

Reading No.	Voltage (**V**)	Current **(mA)**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

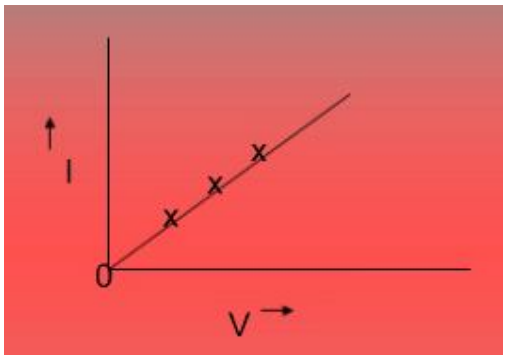
Lab Work: Experiment-1: Verification of Ohm's Law

****

1.8 Drawing I-V Graph:

Plot a graph on the graph paper against voltage V on the x-axis and current I on the y-axis.

I-V Graph of Ohm's Law should look like this:



In the above graph, we get a straight line passing through the origin, since the relationship between V and I is linear.