1.OHM'S LAW

Aim: To determine resistivity of a given wire by plotting a graph of potential difference versus current.

Apparatus: A wire of unknown resistance , battery eliminator,screw gauge,voltmeter (0-5 V),ammeter,(0– 5A), Rheostat and connecting wires.

Theory: Ohm's law states that the electric current flowing through a conductor is directly proportional to the potential difference across its ends, provided the physical state of the conductor remains unchanged.

If I be the current flowing through the conductor and V the potential difference across its ends, then according to Ohm's law,

$V \propto I$ and hence

$V = RI$ .....(1)

$R=V/I$ .....(2)

where R is the constant of proportionality and is termed as the electrical resistance of the conductor.

If V is expressed in volts and I in amperes, then R is expressed in ohms.

The resistance R, depends upon the material and dimensions of the conductor.

For a wire of uniform cross-section, the resistance depends on the length l and the area of cross-section A. It also depends on the temperature of the conductor

At a given temperature the resistance,

$$R = \rho \frac{l}{A} \quad \text{.....(3)}$$

where ρ is the specific resistance or resistivity and is characteristic of the material of wire.

From this equation ,

$$\rho = R\frac{A}{\ell}$$ .....(4)

$A=\Pi r^2$

r is the radius of the wire.

Procedure:

- Connect various components - battery,resistance wire, voltmeter, ammeter and rheostat as shown in circuit diagram.
- Adjust the rheostat knob slightly so that the ammeter and voltmeter show measurable readings.
- Note down the ammeter and voltmeter readings under I and V column
- R is found using the equation R=V/I
- Repeat the experiment for different values of current by adjusting the rheostat and note down their corresponding voltage .
- Repeat the steps 2 to 5 to gt few sets of readings and find the average value of R
- Plot V-I Graph. The slope of the graph is found

  slope=$\Delta V/\Delta I$

  The slope of the graph gives the resistance of the wire.
- By using the equation (4) find the resistivity of the given material of wire.

Result:

- The V-I relationship is established through ohm's law experiment and is verified to be true.
- Resistance of given wire

  From calculation=.....Ω

  From Graph=.....Ω

- The resistivity of the material of given wire=.....Ωm

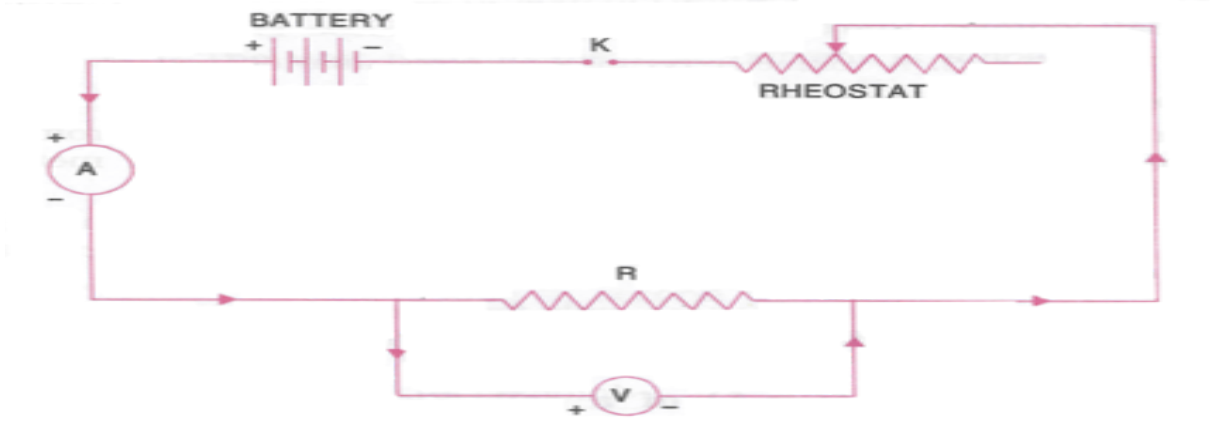
Precautions:

- The connections should be made neat and tight.
- The voltmeter should be connected in parallel and the ammeter in series with the circuit.
- The voltmeter and ammeter should be of proper ranges and their readings should be noted properly.
- The positive of the ammeter and voltmeter should be connected only to the positive of the battery.
- Low resistance rheostat should be used.

Sources of error:

- Instruments may have loose terminals.
- Rheostat may be of high resistance.
- Personal error while noting down the voltmeter and ammeter readings.

Circuit diagram:



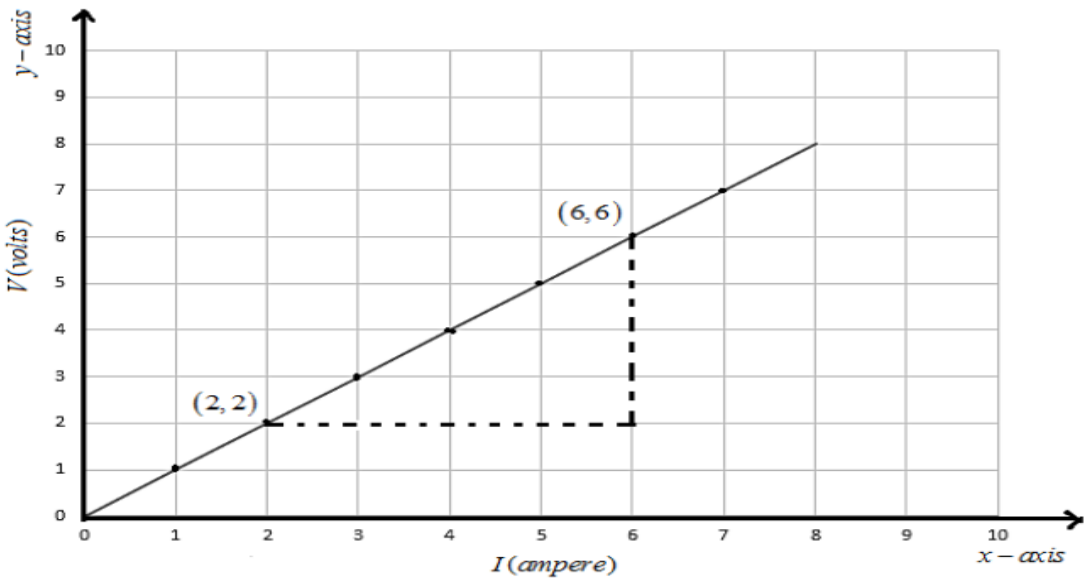
Observation:

Least Count of ammeter=.....A

Least Count of Voltmeter=.....V

No	Ammeter Reading(I) (A)	Voltmeter Reading(V) (V)	Resistance(R=V/I) (Ω)
1			R_1=
2			R_2=
3			R_3=
4			R_4=
5			R_5=
6			R_6=

Mean Resistance (R) = $\frac{R_1+R_2+R_3+R_4+R_5+R_6}{6}$ =.....Ω



(You have to draw the graph on the graph paper with values you got.)

Slope of the Graph,R=$\Delta V/\Delta I$=.....Ω

<u>Calculation</u>

Length of the wire,L=.....cm=.....m

Diameter of the wire,D=.....mm=.....m

Resistance (from Graph),R=.....Ω

Resistivity,ρ=$\frac{R\Pi D^2}{4L}$ =..... =.....Ωm