# PHYSICS                                           EXPERIMENT – 1

**Aim:** To determine resistance per cm of a given wire by plotting a graph of potential difference versus current.

**Apparatus:** A metallic conductor (coil or a resistance wire), a battery, one way key, a voltmeter and an ammeter of appropriate range, connecting wires and a piece of sand paper, a scale.

**Formulae Used:** The resistance (R) of the given wire (resistance coil) is obtained by Ohm's Law $\frac{V}{I} = R$

Where, V : Potential difference between the ends of the given resistance coil. (Conductor)

I: Current flowing through it.

If $l$ is the length of resistance wire, then resistance per cm of the wire $= \frac{R}{l}$

**Observation:**

(i) Range:

       Range of given voltmeter = 3 v

       Range of given ammeter = 500 mA
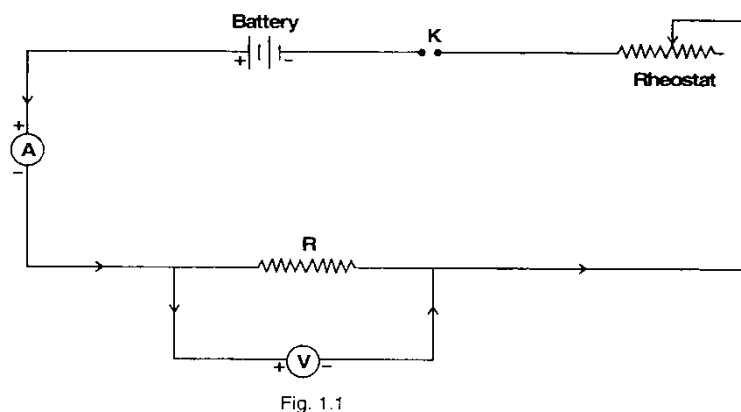


Fig. 1.1

(ii) Least count:

       Least count of voltmeter = 0.05v

       Least count of ammeter = 10 mA

(iii) Zero error:

       Zero error in ammeter, $e_1 = 0$

       Zero error in voltmeter, $e_2 = 0$

**Ammeter and Voltmeter Readings:**

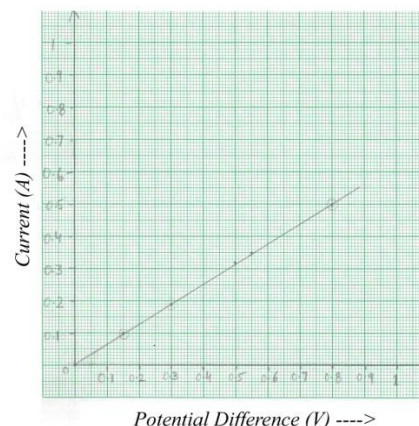| Sr. No. | Ammeter Reading I (A) | | Voltmeter Reading, V (v) | | $\frac{V}{I} = R$ |
|---|---|---|---|---|---|
| | **Observed** | **Value** | **Observed** | **Value** | |
| 1 | 50 | 500 mA | 16 | 16x0.05=0.8 | 1.6 Ω |
| 2 | 35 | 350 mA | 11 | 0.55 | 1.57 Ω |
| 3 | 32 | 320 mA | 10 | 0.50 | 1.56 Ω |
| 4 | 19 | 190 mA | 6 | 0.30 | 1.58 Ω |
| 5 | 10 | 100 mA | 3 | 0.15 | 1.5 Ω |

       Mean R = 1.56

Length of resistance wire: 28 cm

**Graph between potential difference & current:**

Scale: X – axis : 1 cm = 0.1 V of potential difference

       Y – axis: 1 cm = 0.1 A of current

The graph comes out to be a straight line.



Potential Difference (V) ---->

**Result:** It is found that the ratio V/I is constant, hence current voltage relationship is established i.e. V ∝ I or Ohm's Law is verified.

Unknown resistance per cm of given wire = $5.57 \times 10^{-2} \, \Omega \, cm^{-1}$

**Precautions:** Voltmeter and ammeter should be of proper range.

- The connections should be neat, clean & tight.

**Source of Error:** Rheostat may have high resistance.

The instrument screws may be loose.

## EXPERIMENT – 2

**Aim:** To find resistance of a given wire using Whetstone's bridge (meter bridge) & hence determine the specific resistance of the material.

**Apparatus:** A meter bridge (slide Wire Bridge), a galvanometer, a resistance box, a laclanche cell, a jockey, a one-way key, a resistance wire, a screw gauge, meter scale, set square, connecting wires and sandpaper.
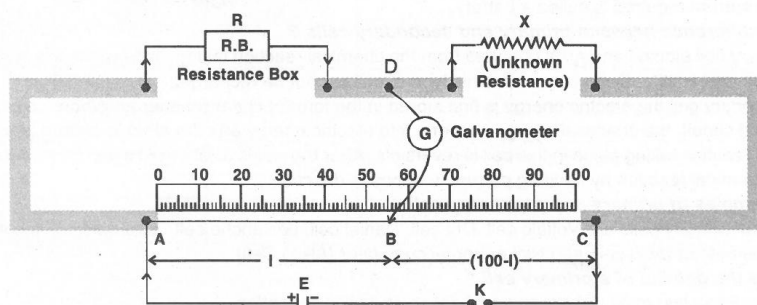

Fig. 2.1 Circuit Diagram - Meter Bridge

**Formulae Used:**

(i) The unknown resistance X is given by:

$$X = \frac{(100 - l)}{l} \times R \qquad \text{Where,}$$

R = known resistance placed in left gap.

X = Unknown resistance in right gap of meter bridge.

*l*=length of meter bridge wire from zero and upto balance point (in cm)

(ii) Specific resistance ($\rho$) of the material of given wire is given $\rho = \dfrac{X \pi D^2}{4L}$

Where,

**D**: Diameter of given wire          **L**: Length of given wire.

**Observation Table for length (*l*) & unknown resistance, X:**

| Sr. No. | Resistance from resistance box R (ohm) | Length AB = *l* cm | Length BC = (100-l) cm | Unknown Resistance $X = R.\dfrac{(100-l)}{l}\Omega$ |
|---|---|---|---|---|
| 1 | 2 | 41 | 59 | 2.87 |
| 2 | 4 | 60 | 40 | 2.66 |
| 3 | 6 | 69 | 31 | 2.69 |
| 4 | 8 | 76 | 24 | 2.52 |

**Table for diameter (D) of the wire:**

| Sr. No. | Linear Scale Reading (N) mm | Circular Scale Reading | | Observed diameter D = N + n x L.C. mm |
|---|---|---|---|---|
| | | No. of circular scale divisions coinciding (n) | Value n x (L.C.) mm | |
| 1 | 0 | 34 | 0.34 | 0.34 |
| 2 | 0 | 35 | 0.35 | 0.35 |
| 3 | 0 | 36 | 0.36 | 0.36 |
| 4 | 0 | 35 | 0.35 | 0.35 |

**Observations:**

- Least count of screw gauge: 0.001 cm

Pitch of screw gauge: 0.1 cm

Total no. of divisions on circular scale: 100

$$\text{Least Count} = \frac{Pitch}{No.\,of\;divisions\;on\;circular\;scale}$$

$$\therefore LC = 0.001\,cm$$

- **Length of given wire, L = 25cm**
  **Calculation:**
- For unknown resistance, X:

  $$\text{Mean X} = \frac{X_1 + X_2 + X_3 + X_4}{4} = 2.68\Omega$$

- Mean diameter, $\text{D} = \dfrac{D_1 + D_2 + D_3 + D_4}{4} = 0.035\,cm$

- Specific Resistance, $\rho = X.\dfrac{\pi D^2}{4L} = 1.03\times10^{-4}\,\Omega\,cm$

**Result:** Value of unknown resistance = 2.68 $\Omega$

Specific resistance of material of given wire $= 1.03\times10^{-4}\,\Omega\,cm$

**Precautions:** All plugs in resistance box should be tight. Plug in key, K should be inserted only while taking observations.

**Sources of Error:** Plugs may not be clean.

Instrument screws maybe loose.

# EXPERIMENT – 3

**Aim:** To verify the laws of combination (series & parallel) of resistances using meter bridge (slide Wire Bridge)

**Apparatus:** A meter bridge, laclanche cell, a galvanometer, a resistance box, a jockey, two resistances wires, set square, sand paper and connecting wires.
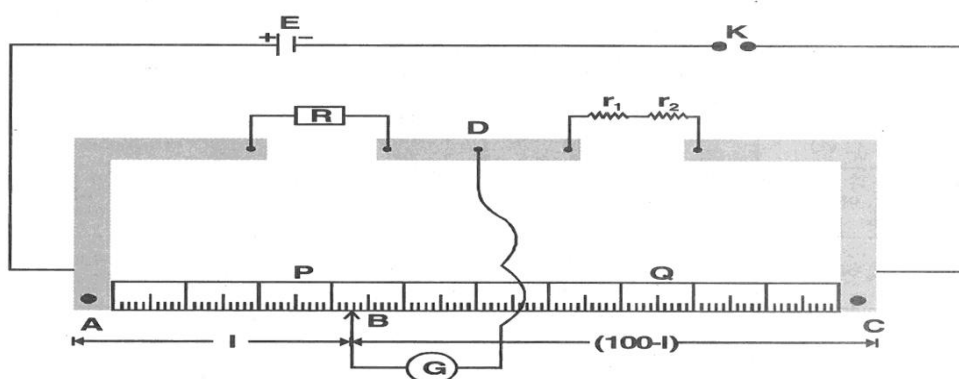
(i) In series

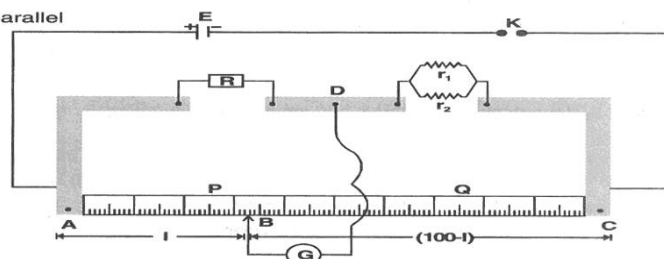Fig. 3.1 Series combination of resistances

(ii) In parallel

Fig. 3.2 Parallel combination of resistances

**Observations:** Table for length (l) & unknown resistance (r):