

O P JINDAL SCHOOL, SAVITRINAGAR

CLASS NOTES

CLASS XII PHYSICS PRACTICAL (EXPERIMENT-04)

DATE : 14/05/20

Aim

To find resistance of a given wire using metre bridge and hence determine the resistivity (specific resistance) of its material.

Materials Required

1. A metre bridge
2. A Leclanche cell (battery eliminator)
3. A galvanometer
4. A resistance box
5. A jockey
6. A one-way key
7. A resistance wire
8. A screw gauge
9. A metre scale
10. A set square
11. Connecting wires
12. A piece of sandpaper

Theory

Metre bridge apparatus is also known as a slide wire bridge. It is fixed on the wooden block and consists of a long wire with a uniform cross-sectional area. It has two gaps formed using thick metal strips to make the [Wheatstone's bridge](#).

Then according to Wheatstone's principle, we have:

$$XR = l(100 - l)$$

The unknown resistance can be calculated as:

$$X = R \frac{l}{(100 - l)}$$

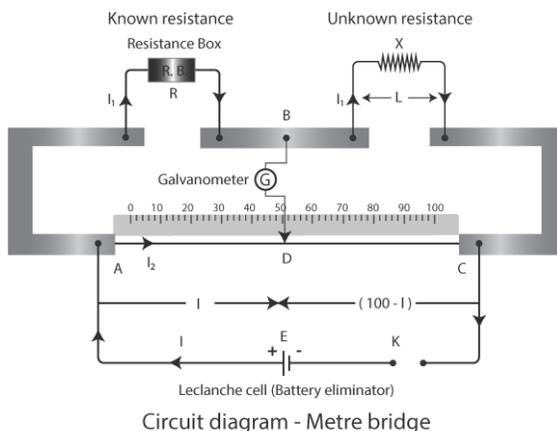
Then the specific resistance of the material of the is calculated as:

$$\rho = \pi r^2 XL$$

Where,

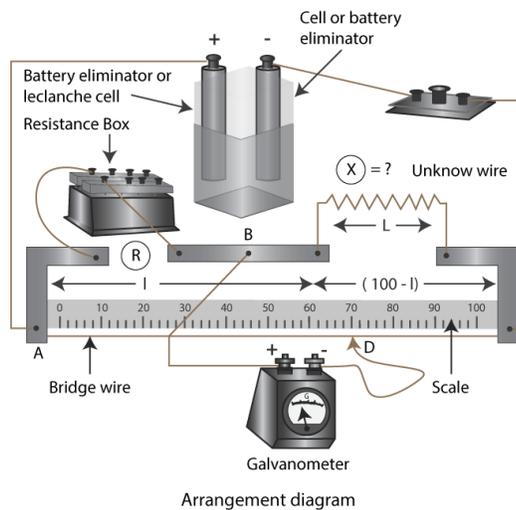
- L is the length of the wire
- r is the radius of the wire

Circuit Diagram



Procedure

1. The arrangement of the apparatus should be as shown in the circuit diagram.
2. The wire whose resistance is to be determined should be connected in the right gap between C and B without any formation of loops.
3. The resistance box should be connected in the left gap between A and B.
4. All the other connections should be as shown in the circuit diagram.
5. Plug the key K in place of 2-ohm resistance in the resistance box.
6. The jockey should be first touched gently to the left end and then to the right end of the bridge.
7. The deflections in the galvanometer should be in opposite directions and if it is in one direction then the circuit connections are not correct. Note the galvanometer deflection.
8. Let D be the null point where the jockey is touching the wire. The movement of the jockey should be gentle from left to the right of the galvanometer.
9. Take a 12 value from the resistance box should be taken such that when the jockey is nearly in the middle of the wire, there shouldn't be any deflection.
10. Note the position of D to know the length of $AD = l$.
11. Four sets of observations should be taken by changing the value of 12.
12. Record the observations in a tabular form.
13. Stretch the resistance wire to find its length using a metre scale.
14. Using screw gauge measure the diameter of the wire at four different places keeping it in a mutually perpendicular direction.
15. Record the observations in the table.



Observations

Length of given wire $L = \dots\dots\dots$ cm

Table for unknown resistance (X)

Resistance from box, R (Ohm)	Length AB = l (cm)	Length BC = (100-l) (cm)	Unknown Resistance $X = [R(100-l)]/L$ (Ohm)
0.5	58.3	41.7	0.35
0.7	60.7	39.3	0.45
1	61.9	38.1	0.61
1.5	61.1	38.9	0.95

Least count of the screw gauge

Pitch of screw gauge =mm

Total no. of divisions on the circular scale =

∴ L.C of the given screw gauge = $\frac{\text{pitch}}{\text{no. of divisions on the circular scale}}$ =mm

Zero error e =mm

Zero correction c = -e =mm

Radius of the resistance wire

Main scale reading (mm)	Circular scale reading	Total reading (diameter) (mm)	Mean D (mm)	Mean radius (D/2) (mm)
0	43	0.43	0.42	0.21

Calculations

Calculation for X

The value of l is determined from the position of D and recorded in column 3 of table 1.

Find length (100 – l) cm and write in column 4.

Calculate X and write in column 5,

Mean $X = \frac{X_1 + X_2 + X_3 + X_4}{4} = \dots\dots \text{ohm}$

Calculation for D

Mean corrected diameter = $\frac{D_1(a) + D_1(b) + \dots + D_4(a) + D_4(b)}{8} = \dots\dots \text{mm} = \dots\dots \text{cm}$

Calculation for specific resistance

Specific resistance of the material of the given wire,

$\rho = \frac{X \cdot \pi D^2}{4L} = \dots\dots \text{ohm cm} = \dots\dots \text{ohm m}$

Standard value of the specific resistance of the material of the given wire,

$\rho_0 = \dots\dots \text{ohm.m}$

Percentage error = $\frac{\rho - \rho_0}{\rho_0} \times 100 = \dots\dots \%$

Result

1. The value of unknown resistance X =
2. The specific resistance of the material of the given wire =
3. Percentage error =