Physics Laboratory Report 04

Experiment: Determination of Unknown Resistance using Meter Bridge

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Theory

The meter bridge works on the Wheatstone bridge principle. At the balance point, the ratio of the two resistances in the gaps is equal to the ratio of the two segments of the bridge wire. Using this relation, the unknown resistance can be found. Mathematically, we can express this as:

$$X/R = l / (100 - l)$$

$$\Rightarrow X = [R (100 - l)] / l$$

where X is the unknown resistance, R is the resistance box reading, and l is the balance length.

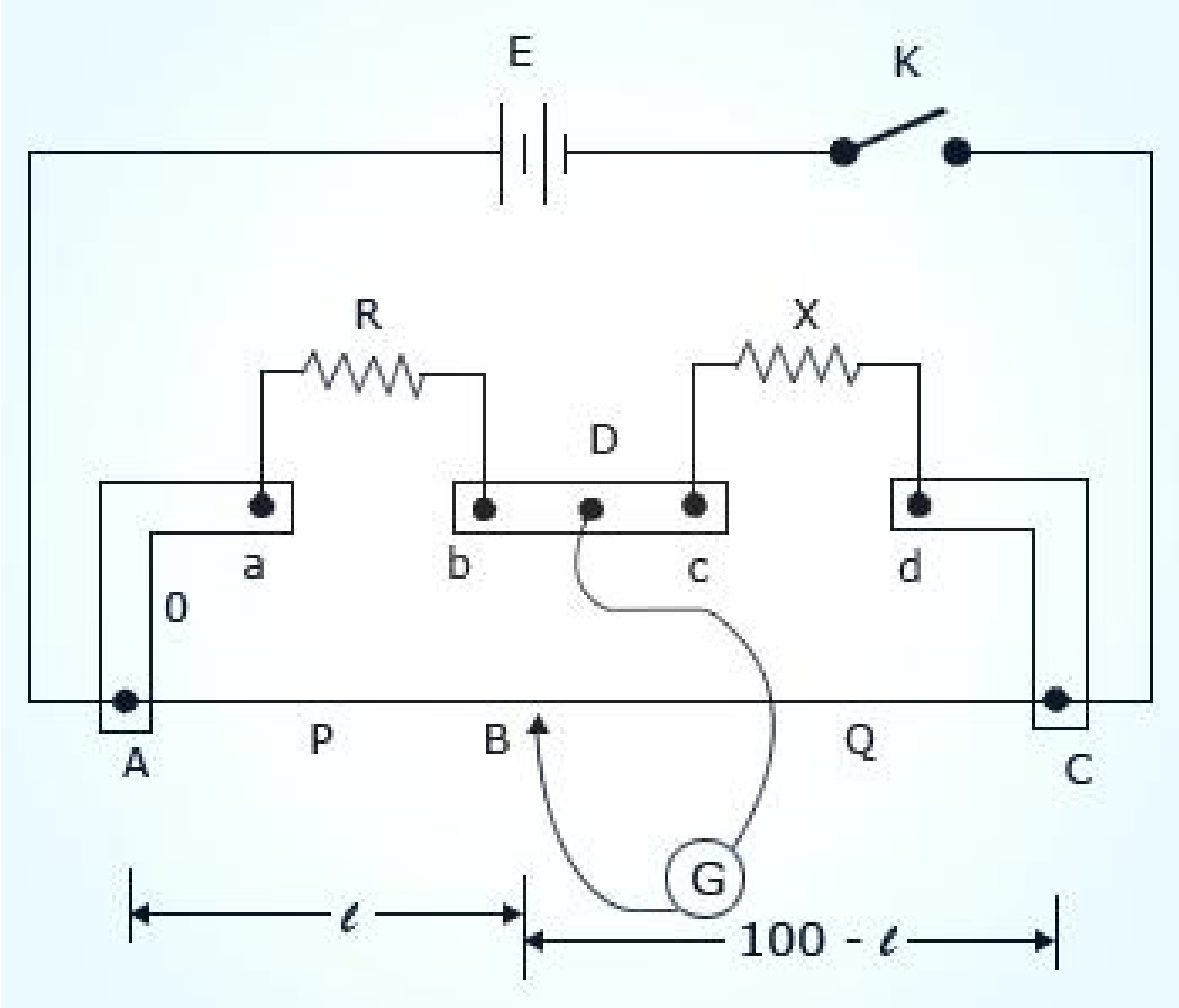
Apparatus

The apparatus required includes:

1. Meter bridge,
2. resistance box,
3. galvanometer,
4. jockey,
5. cell, one-way key,
6. connecting wires, and
7. the given resistance wire.

Circuit Diagram

The circuit consists of a meter bridge wire, with the resistance box (R) in one gap and the unknown resistance (X) in the other. A galvanometer is connected through a jockey to the central strip, and a cell with a key completes the circuit.



Observation

Table 1: Determination of Unknown Resistance (X)

Serial No.	R (Ω)	Balance length l (cm)	X = R(100-l)/l (Ω)
1	1	57.5	0.739
2	2	42	2.762
3	3	37	5.108
4	5	39	7.821
5	8	31	17.806

Mean resistance from above readings = 6.847 Ω

Table 2: Determination of Diameter of the Wire using Screw Gauge

Obs. No.	M (mm)	CS (div)	LC (mm)	D (mm)
1	0.5	18	0.01	0.68
2	0.5	17	0.01	0.67
3	0.5	16	0.01	0.66
4	0.5	18	0.01	0.68
5	0.5	16	0.01	0.66

Average diameter D = 0.67 mm

Radius r = D/2 = 0.335 mm = 0.000335 m

Result

1. The mean value of the unknown resistance (X) = 6.847 Ω
2. Average diameter of the wire = 0.67 mm
3. Radius of the wire = 0.000335 m
4. Specific resistance of the material of the wire = 2.41×10^{-6} Ω·m

Discussion

The experiment was performed carefully to determine the unknown resistance using the meter bridge. All the observations were noted systematically and the mean values were calculated. Although minor errors may have occurred due to the limitations of the screw gauge and balancing length measurements, the results are consistent with expected values. The experiment was completed with precision and served its objective well.