Experiment No.: …… **Date: …….**

TO DTERMINE THE INTERNAL RESISTANCE OF A CELL BY USING A POTENTIOMETER

APPARATUS REQUIRED:

1. Potentiometer
2. DC Power Supply (2V-4V)
3. Rheostat
4. Connecting wires
5. Test cells (1 cell)
6. Three-way switch
7. Galvanometer
8. Jockey
9. A resistance box

THEORY:

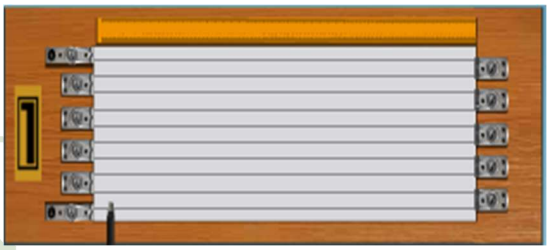
The potentiometer is an instrument used to measure the unknown voltage by comparing it with the known voltage. It can be used:

1. To determine the emf of a cell.
2. To determine the internal resistance of the given cell.
3. To compare the emf of different cells.

[In measuring the emf of a cell, potentiometer is preferred over voltmeter.]

Construction of potentiometer:

It consists of a long resistance wire (generally made of constantan or manganin) that is stretched on a wooden board. Usually, the potentiometer wire consists of 10 segments of uniform cross-section each of length $1m$ stretched on the wooden board. The wires are connected serially on the board by using metal strips.



Principle of potentiometer:

"When a constant current is passed through a wire (conductor) of uniform cross-sectional area, the potential drop across any segment of the wire is directly proportional to the length of the segment."

i.e. $V \propto l$

or, $V = K\,l$

Here, $K = \frac{V}{l}$ is called as potential gradient of potentiometer.

Ohm's law: $V = IR$

$$V = I\,\frac{\rho l}{A}$$

$$V = \frac{I\rho}{A}\,l$$

$$V = K\,l$$

$$K = \frac{V}{l} \quad \text{OR} \quad K = \frac{I\rho}{A}$$

K is called as **potential gradient.**

Unit of potential gradient**:** $\boldsymbol{V/m}$

(Behaves as Least Count potentiometer)

Emf of a cell (E):

The amount of work done in moving a unit positive charge from lower potential to higher potential inside a cell in an open circuit is called as its emf.

The potential difference across a cell in an open circuit is called as the emf of the cell.

Terminal potential difference TPD (V):

The amount of work done in moving a unit positive charge from lower potential to higher potential inside a cell in a close circuit is called as its emf.

The potential difference across a cell in a close circuit is called as the emf of the cell.

Internal resistance(r):

The resistance within a cell offered by the electrolyte lying within the electrodes of the cell when current flows through it (in closed circuit) is called as its internal resistance.

If I current flows through a cell in a close circuit, the potential drop across the cell is: $\boldsymbol{Ir}$