**Experiment No.: ……** **Date: …….**

## TO COMPARE THE EMF'S OF TWO CELLS BY USING A POTENTIOMETER

**APPARATUS REQUIRED:**

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

**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 (voltage) across a cell in an open circuit is called as the emf of the cell.***

**To compare the emfs of two cells:**

The experimental arrangement to compare emfs of two cells is shown in figure.

Here, we have to compare the emfs of two test cells having emf $E_1$ *and* $E_2$.

During experiment, we slide a jockey over the potentiometer wire in order to obtain null deflection in the galvanometer. (Like meter bridge, the potentiometer also works under balanced condition).

**Step 1: When $K_1$ is close and $K_2$ is open:**

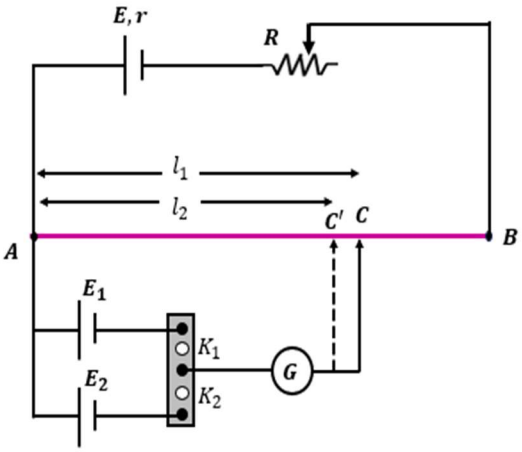


Figure: Comparison of Emf of two cells ($E_1$: $E_2$) using *Potentiometer*