

EXPERIENTIAL LEARNING ACTIVITY (EMF, Terminal Potential difference and Internal Resistance of a cell)

Subject	PHYSICS
Class	XII
Chapter/Unit	Current Electricity
Topic	EMF, Terminal Potential difference and Internal Resistance of a cell
Time	30 min
Nature of Activity	Individual

What will I learn (Learning Outcome)?

The relationship between EMF, Terminal Potential difference and Internal Resistance of a cell

Skills:

Experimenting, observing, analyzing, Interpreting

What I have to do?

To verify the relationship between EMF, Terminal Potential difference and Internal Resistance of a cell

What do I require?

Few identical Christmas bulbs, cell of 1.5V, connecting wires, crocodile clips

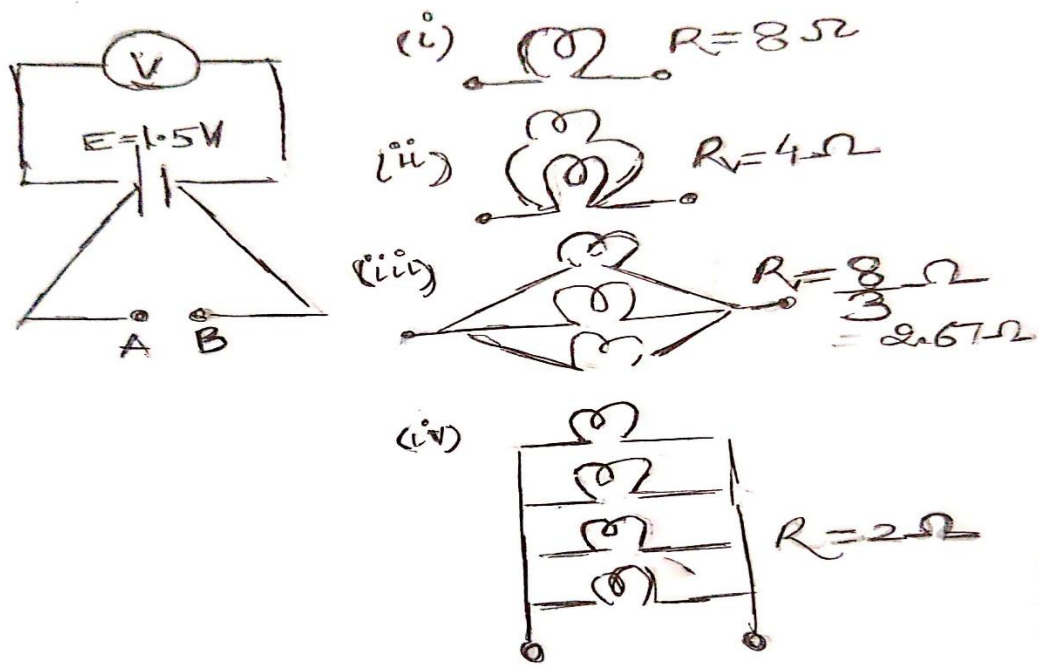
What do I need to know?

EMF, Terminal potential difference and internal resistance of a cell

➤ **Teacher's Activity**

➤ Teacher will

- enable students to recall the terms EMF, Terminal potential difference and internal resistance of a cell and the relationship between them
- ask students to read the value of terminal potential difference V by changing the value of external resistance R after fixing E and hence verify the relationship between E , V and r
- perform the activity by using identical Christmas bulbs each having resistance of 8Ω and a cell of 1.5V and make students observe the readings carefully (filled in the table given below) and ask students to perform similar activity on their own by trying some variations i.e. using some other bulbs and interpret the result after filling the observation table as given below



How will I proceed?

➤ student's Activity

Student will

- make a circuit comprising of 1.5V cell connected across a high resistance voltmeter V and note it's reading
- connect one christmas bulb across the cell in the gap AB and note voltmeter reading and the intensity of glow of bulb
- connect two christmas bulbs in parallel across the cell in the gap AB and note voltmeter reading
- connect three christmas bulbs in parallel across the cell in the gap AB and note voltmeter reading
- Repeat the above steps by increasing the number of bulbs in parallel across the cell in the gap and note voltmeter reading

What have I observed?

S.NO	No.of bulbs Christmas bulbs (in parallel) connected across AB	RESISTANCE	Voltmeter reading(v)	Difference between E and V
1	Nil	Nil	1.5V(approx.)	Zero(aprox)
2	1 bulb	8Ω	1.45V	.05V
3	2 bulbs in parallel combination-	4Ω	1.4V	.10V
4	3 bulbs in parallel combination-	$\frac{8}{3}\Omega$	1.325V	.175V
5	4 bulbs in parallel combination-	2Ω		

As the resistance in the external circuit decreases, the current in the circuit---- (increases/decreases) hence the volts lost across the internal resistance of cell----- (increases/decreases) and the terminal potential difference(V) across the cell----- (increases/decreases)

What have I learnt?

When current is drawn from the cell the terminal potential difference across the cell is ----- (not equal to/equal to) the emf of the cell . When no current is drawn from the cell the terminal potential difference across the cell is ----- (not equal to/equal to) the emf of the cell .

$$E = V + Ir$$

What am I curious to learn?

a) To find internal resistance of the cell graphically by plotting V Vs. I graph

b) To establish the relationship between E, V and r when a cell is charged

Let me evaluate myself

Q1 Define the following terms and write relationship between them, when the current is drawn from the cell

a) EMF

b) Terminal potential difference

c) internal resistance of a cell

Q2 write the relationship between EMF, Terminal potential difference and internal resistance of a cell when the cell is charged.

Q3 Out of EMF and terminal potential difference of a cell , which is the cause and which is the effect? Why is emf considered to be a misnomer?

Q4a) What is the terminal potential difference for a cell of emf 2V and internal resistance 1 ohm when it is connected to a 9 ohm resistor?

b) Now, swap the 9ohm resistor in part a) with 1ohm resistor and calculate terminal p.d. for a cell .

c) In which of the above two cases

(i) terminal potential difference is more (ii) Volts lost are more and why?

Q5) The potential difference across the cell when no current flows through the circuit is 3 V. When the current $I = 0.37 \text{ A}$ is flowing, the terminal potential difference falls to 2.8 Volts. Determine the internal resistance (r) of the cell?