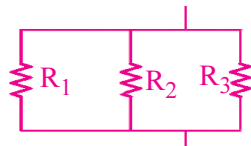




# 6. CURRENT ELECTRICITY



## IMP DEFINITIONS & FORMULAS

1. **Electric current** is the stream of charged particles between two points.

2. **Electric current** (i) is the rate of charge passing through the area of cross section of

$$\text{a conductor. } i = \frac{Q}{t} = \frac{dQ}{dt}$$

**SI units:** ampere (A).

3. **Voltage** is an electro motive force which pushes electrons to move in a direction.

4. **Voltage** is the cause and current is its effect. Voltage  $V = iR$  where R is the resistance.

5. The voltage between the terminals of a cell is called **terminal voltage** (V).

$$V = \epsilon - ir$$

where  $\epsilon$  is emf and r is internal resistance

6. **Resistance** is the measure of the opposition to the electric current in a circuit.

7. **Resistance** is the ratio between voltage and current .  $R = \frac{V}{i}$

**SI units:** ohm ( $\Omega$ )

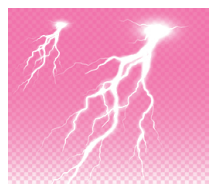
8. The **resistance** of a metal **increases with the rise of temperature**. But resistance of insulators and semiconductors decreases with the rise of temperature.

9. **Resistivity** ( $\rho$ ): It is the resistance of a conductor per unit length per unit area of cross section of material of the conductor .

• **Formula:**  $\rho = \frac{RA}{l}$  (or)  $\rho = \frac{E}{j}$

• **SI units:**  $\Omega m$ .

## BULLET MASTER'S PHYSI BEATS!



### 6) CURRENT ELECTRICITY [1 LAQ]

Two Heroes of Current Electricity: **Mr. Ohm & Mr. Kirchoff**

Current Electricity means 'Flow of Electrons' in a wire.

The number of charges that move per second is measured in Amperes.

Current కి Speed Brakes వేసేదే Resistor

Charged electrons ను ముందుకు Push చేసే Pressure నే Voltage అంటారు.

**Kirchoff** సారు ఏమని సెలవిచ్చారంటే .....

ఎంత కరెంట్ జంక్షన్ లోనికి వెళుతుందో అంతే కరెంట్ జంక్షన్ బయటికి వస్తుంది!

**Ohm** మహాశయుడు ఏమని సెలవిచ్చారంటే.... Voltage (V) పెరిగితే Current (i) పెరుగుతుంది!

Cell యొక్క emf ని కొలిచే device ను Potentiometer అంటారు.

**City** కాని City ఏమిటి? **Electricity. So silly!**

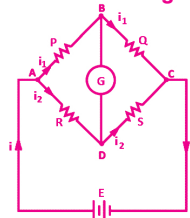
**Daily Uses:** Turning on Bulbs, Fans, TV, Phones; starting Bikes, cars...

### IPE View

☞ **IMP LAQ :** Kirchoff's law and balancing condition of wheatstone bridge,

Working principle of potentiometer : Comparing an emf of two primary cells and internal resistance.

Wheatstone bridge



10. Current passing through a circuit with a cell of emf  $\varepsilon$ , internal resistance  $r$  and external

$$\text{resistance } R \text{ is } i = \frac{\varepsilon}{R + r}$$

11. Equivalent resistance of 2 resistors connected in series is  $R_s = R_1 + R_2$

$$\text{For } n \text{ resistors } R_s = nR$$

12. Equivalent resistance of 2 resistors connected

$$\text{in parallel is } R_p = \frac{R_1 R_2}{R_1 + R_2}$$

$$\text{For } n \text{ resistors } R_p = R/n$$

13. When  $n$  cells each emf  $e$  and internal resistance  $r$  are connected in parallel,

(i) equivalent emf  $\varepsilon' = \varepsilon$ ,

(ii) equivalent internal resistance  $r' = r/n$ ,

(iii) current through circuit  $i = \frac{\varepsilon}{R + (r/n)}$

14. When  $n$  cells each emf  $e$  and internal resistance  $r$  are connected in series,

(i) equivalent emf  $\varepsilon' = n\varepsilon$ ,

(ii) equivalent internal resistance  $r' = nr$ ,

(iii) current through circuit  $i = \frac{n\varepsilon}{R + nr}$

15. When a conductor is stretched, its length increases, area of cross section decreases, volume, density remain constant.

$$\text{Its resistance } R \propto l^2 \text{ Hence, } \frac{R_2}{R_1} = \frac{l_2^2}{l_1^2}$$

16. Heat produced in a current carrying

$$\text{conductor is } H = i^2 R t \Rightarrow H = \frac{V^2 t}{R}$$

17. Electric power  $P = Vi$

$$\text{(or) } P = i^2 R \quad \text{(or) } P = \frac{V^2}{R}$$

18. In parallel combination, electric power is inversely proportional to resistance because pd  $V$  remains constant in it.

$$P = \frac{V^2}{R} \quad \text{(or) } P \propto \frac{1}{R}$$

19. In series combination, electric power is directly proportional to resistance because current  $i$  remains constant in it.

$$P = i^2 R \quad \text{(or) } P \propto R$$

20. Kirchoff's junction rule:  $\sum i_{\text{in}} = \sum i_{\text{out}}$

$$\text{Kirchoff's loop rule: } \sum \varepsilon + \sum iR = 0$$

21. Wheatstone bridge - balance condition:

$$\frac{R_2}{R_1} = \frac{R_4}{R_3}$$

22. Emf of the cell balancing a length ( $l$ ) on the potentiometer wire is given by

$$\varepsilon = \phi l$$

where  $\phi$  is potential drop per unit length.

23. Comparison of emfs of cells with

$$\text{potentiometer } \frac{\varepsilon_1}{\varepsilon_2} = \frac{l_1}{l_2}$$

24. Internal resistance of a cell - potentiometer

$$r = R \left( \frac{l_1}{l_2} - 1 \right)$$

25. Colour code of resistors:

0 = Black

1 = Brown

2 = Red

3 = Orange

4 = Yellow

5 = Green

6 = Blue

7 = Violet

8 = Gray

9 = White

The 1<sup>st</sup> and 2<sup>nd</sup> colours represent simply digits in the places.

But the third colour represents the power of the decimal multiplier.

4<sup>th</sup> colour represents tolerance.

Gold = 5% tolerance,

Silver = 10% tolerance,

No colour = 20% tolerance.