Q No 1.

→ **GIVEN:** Current $I = 3$ Ampere, Time $t = 24 \times 60 \times 60s$
$t = 86400s$

→ **REQUIRED:**
Charge $Q = ?$

→ **FORMULA:** $I = \frac{Q}{t}$ or $Q = I \times t$ (i)

→ **CALCULATIONS:**
Putting values in eq (i) we get
$Q = 3 \times 86400 \ (A \times s)$
$Q = 259200C$

→ **RESULT:**
The amount of charge flow is 259200C.

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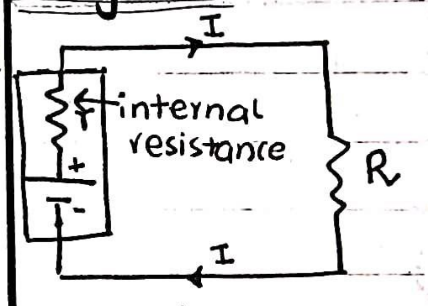
Q No 2 (a) While analyzing a circuit the internal resistance is ignored.

→ **INTERNAL RESISTANCE:** Internal resistance of the cell is resistance offered by electrolyte of the cell. Internal resistance behaves as it is connected in series with the source

Diagram:



internal resistance.

→ **REASON FOR NEGLECTING:** Internal resistance is neglected because the voltage drop across it is very small such that it doesn't matter if it isn't considered.

→ **Mathematically:** Terminal potential difference V_t and emf can be related as $E = V_t + Ir$ 'r' is very small, $r \approx 0$ Thus $E \approx V_t$

QNO.3: Diameter of aluminum wire is greater.

→REASON: Resistivity 'ρ' of Al is greater than resistivity of copper. $\rho_{AL} = 2.63 \times 10^{-8}\ \Omega m$ $\rho_{Cu} = 1.72 \times 10^{-8}\ \Omega m$

→Mathematically: $R = \frac{\rho L}{A}$ Putting $A = \pi r^2$, $r = D/2$

$R = \rho L \div \pi (\frac{D}{2})^2$, $R = \frac{4\rho L}{\pi D^2}$

according to given condition, $R_{AL} = R_{Cu}$

thus $\frac{4(\rho_{AL})L}{\pi D^2_{AL}} = \frac{4(\rho_{Cu})L}{\pi D^2_{Cu}}$

$$\frac{D^2_{Cu}}{D^2_{AL}} = \frac{\rho_{Cu}}{\rho_{AL}}$$

$$\boxed{\frac{D_{Cu}}{D_{AL}} = \sqrt{\frac{\rho_{Cu}}{\rho_{AL}}}} \quad (i)$$

→CONCLUSION: Direct relation between diameter and resistivity show that metal with higher 'ρ' has larger 'D'.

QNo.4 (xvi) Terminal potential difference of the battery is greater than its emf when battery is being charged.

→EXPLANATION: When another battery with higher emf is connected with the battery being charged in opposite direction, the current reverses in the emf source being charged. This makes the terminal potential difference greater than the emf.

→Mathematically:

$$V_t = \mathcal{E} - (-Ir)$$

$$\boxed{V_t = \mathcal{E} + Ir} \quad (i)$$

→CONCLUSION: Equation (i) clearly shows that reversal in direction of current during charging process makes terminal potential difference greater than emf ε itself.

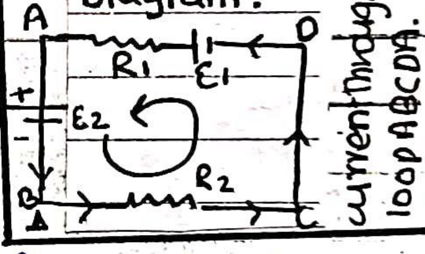
QNO: 5 ELECTROMOTIVE FORCE | TERMINAL POTENTIAL DIFFERENCE

(i) Definition	
→ EMF is the energy supplied to unit charge by the cell.	→ 'Vt' is the work done in bringing the unit positive charge from +ve to -ve terminal within the circuit.
(ii) Mathematically	
→ $E = W/q$	→ $\Delta V = W/q$
(iii) Presence	
→ Always present even when no current flows through circuit	→ Becomes zero when no current flows through circuit
→ It is cause.	→ It is effect
→ Greater than terminal P.D	→ lesser than emf of source.
(iv) Dependence on circuit resistance	
→ Doesn't depend	→ Directly depends

QNo. 6 (1) KIRCHHOFF'S VOLTAGE (LOOP) RULE:

→ Statement: "In any closed electrical circuit the algebriac sum of all the electromotive force and voltage drops in resistor is equal to zero.

Diagram:

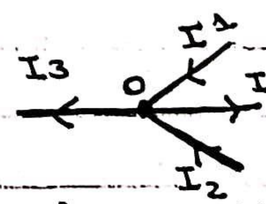


→ Mathematically: $\Sigma \mathcal{E} - \Sigma IR = 0$ This is law of conservation of energy

(2) KIRCHHOFF'S CURRENT (JUNCTION) RULE:

→ Statement: "Algebriac sum of all the currents meeting at a junction in an electrical circuit is zero."

Diagram:



▲ junction at O with four branches

→ Mathematically:

$$I_1 + I_2 = I_3 + I_4$$

Current flowing towards junction = current flowing away from junction

This is law of conservation of charge.

Q No 7 (Page 2/6) When temprature of conductor rises;

→ **Effect on kinetic energy of free electrons:** Kinetic energy of free electrons rises.

→ **Effect on amplitude of vibration of atoms:** Atoms in the lattice experience vibration with a greater amplitude.

→ **Collision between free electrons and atoms:** Collisions between the free electrons and atoms of conductor increase.

→ **NET RESULT:** Hindrance is offered to the flow of free electrons thus rise in temprature increases the resistance of a conductor.

→ **Mathematically:** $R_T = R_0(1+\alpha T)$ $R_T > R_0$

R_T is resistance at high temprature, R^o is resistance at 0°C.

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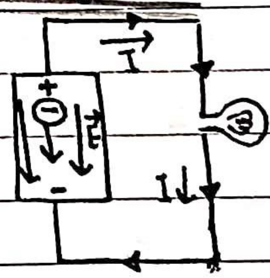
Q NO.8 Direction of emf is independent of the direction of current flow through the battery.

→ **EXPLANATION:**

Direction of Emf: It's decided by the construction of the battery cell. Inside the battery chemical reactions occur which move +ve ions from -ve terminal to positive terminal and -ve ions from positive to negative terminal of battery.

Diagram:



▲ current flow

Direction of Current: Conventional current flows from positive towards negative terminal of the battery

→ **CONCLUSION:**

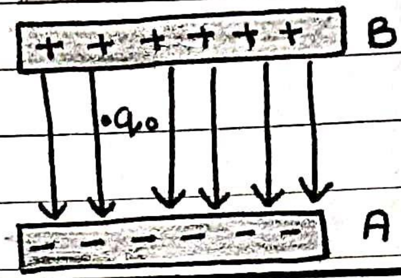
Thus direction of polarity of emf depends on emf source's internal composition whereas conventional current flows from +ve → -ve terminal

Q. No. 9 (Page 1/6) Voltages are always measured between two points because it is a relative quantity.

EXPLANATION:

Measure of electric potential difference: Voltage is a measure of electric potential difference between two points which means energy per unit charge required to move a positive test charge from one point to other. The work done is stored in form of potential energy which is a relative quantity.

Diagram:



→ Mathematically: $V_B - V_A = \frac{W_{AB}}{q_o}$

$\Delta V = \Delta U / q_o$

→ CONCLUSION: Voltage is a potential difference between two points where one point is at higher & other is at lower potential.

Q No 10: (a) Yes, every emf is a potential difference.

→ EXPLANATION:

Emf is the potential difference of the battery when no current is being drawn from it or when the internal resistance of battery is zero. $(r = 0)$

→ Mathematically: $\mathcal{E} = V + Ir$, $\mathcal{E} = V + I(0)$, $\mathcal{E} = V$

(b) No, every potential difference is not an emf.

→ EXPLANATION:

- Potential difference between two arbitrary points in circuit isn't emf.
- Potential difference across load isn't emf

→ CONCLUSION: Emf is a cause and remaining all potential differences of a circuit are effects. Thus although emf is inherently a potential difference, but every potential difference isn't emf.

Q No. 11 (Page 310) **GIVEN:**

Current $I = 0.0001A$

Time $t = 1min = 60s$

→ REQUIRED:

Charge $Q = ?$

→ FORMULA:

$$I = Q/t \quad (i)$$

→ CALCULATIONS:

Putting values in eq (i)

$$0.0001 = Q/60s$$

$$Q = 60s \times 0.0001A$$

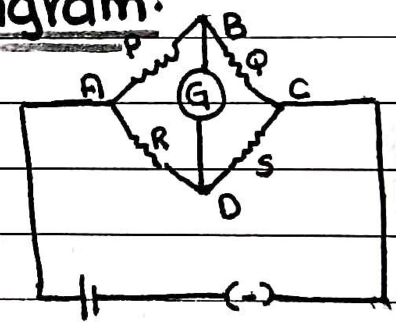
$$Q = 6 \times 10^{-3} \text{ coulomb}$$

→ RESULT:

Charge which flows each minute is 6mC.

Q NO 12: At balanced point, no current flows through galvanometer.

Diagram:



▲ wheatstone bridge

→ REASON:

Cause Behind Current flow: It's the potential difference between two points in a circuit.

At Balanced point: Potential at point B is same as potential at point D. Thus for current to flow through the galvanometer, no potential difference is present as the potential difference is zero.

→ Mathematically: $V_B = V_D$, $I_g = \frac{V_B - V_D}{R_g}$, $I_g = \frac{0}{R_g} = 0$

→ CONCLUSION: As potential at point D is equal to potential at point B, no current flows through galvanometer.