Current Electricity

Assertion & Reason Type Questions

Directions: In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

a. Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

b. Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).

c. Assertion (A) is true but Reason (R) is false.

d. Both Assertion (A) and Reason (R) are false.

Q1. Assertion (A): Current flows in a conductor only when there is an external electric field within the conductor.

Reason (R): The drift velocity of the electrons is directly proportional to the electric field.

Answer : (b) In the absence of electric field, the electrons move randomly in all directions. Hence, there is no net motion of electrons and no current flow in the conductor. But <u>in the presence of electric field, electrons move in a particular direction. Each electron experiences a force in the direction opposite to that of the electric field and moves from the negative end to the positive end of the conductor. Thus, there is a current flow. The drift velocity</u>, $v_d \propto \vec{E}$ i.e., $\vec{v}_d = \mu \vec{E}$ where, μ = mobility.

Q2. Assertion (A): For good conductors, the /-V graph is a perfect straight line inclined to current axis.

Reason (R): By Ohm's law, voltage across the ends of a conductor is directly proportional to the resistance of the conductor.

Answer : (d) The given graph shows the V-I graph of a good conductor. Ohm's law states that, current flowing through a conductor is directly proportional to the voltage between the ends of a given conductor i.e., $V \propto I$.

or $\quad\quad\quad\quad$ V = RI

where, the constant of proportionality R is called the resistance of the conductor.
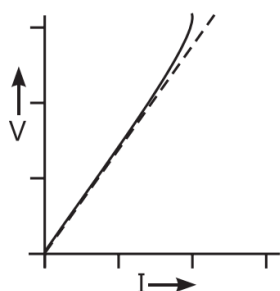
Q3. Assertion (A): Ohm's law is not valid, if current depends on voltage non-linearly.

Reason (R): Ohm's law is a fundamental law of nature.

Answer : (c) <u>Ohm's law is not a fundamental law of nature.</u> It fails in the following conditions:

(i) Voltage depends on current non-linearly.

(ii) The relation between voltage and current depends on the sign of voltage for the same absolute value of voltage.

(iii) Behaviour of semiconductor devices and unilateral devices such as diodes, transistors, etc.

Q4. Assertion (A): The internal resistance of a cell is constant.

Reason (R): Ionic concentration of the electrolyte remains same during use of a cell.

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Answer : (d) <u>The internal resistance of an electric cell is not constant. This is because the internal resistance depends on the concentration of the electrolyte.</u>

Q5. Assertion (A): The given figure does not show a balanced Wheatstone bridge.
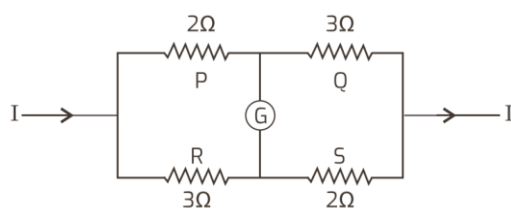
Reason (R): For a balanced bridge, small current should flow through the galvanometer. **(CBSE 2023)**

Answer : (c) The bridge is said to be balanced when no current flow through the galvanometer.

Q6. Assertion (A): If the length of the conductor is doubled, the drift velocity will become half of the original value (keeping potential difference unchanged).

Reason (R): At constant potential difference, drift velocity is inversely proportional to the length of the conductor.

Answer : (a) Drift velocity of free electrons is given by,

$$v_d = \frac{eE}{m}\tau$$

where, $E = \dfrac{\text{Potential difference}}{\text{length}} = \dfrac{V}{l}$

$$\therefore \quad v_d = \frac{eV}{ml}\tau$$

Thus $v_d \propto \dfrac{1}{l}$ where $\dfrac{eV\tau}{m}$ is constant

It means if l is doubled, the drift velocity will become half of the original value.

Q7. Assertion (A): Kirchhoff's junction rule can be applied to a junction of several lines or a point in a line.

Reason (R): When steady current is flowing, there is no accumulation of charges at any junction or at any point in a line.

Answer : (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

Q8. Assertion: In a simple battery circuit, the point of the lowest potential is positive terminal of the battery.

Reason: The current flows towards the point of the higher potential, as it does in such a circuit from the negative to the positive terminal.

Q9. Assertion: A larger dry cell has higher emf.

Reason: The emf of a dry cell is proportional to its size.

Q10. Assertion: A current continues to flow in superconducting coil even after switch is off.

Reason: Superconducting coils show Meissner effect.

Q11. Assertion: Voltmeter is connected in parallel with the circuit.

Reason: Resistance of a voltmeter is very large.

Q12. Assertion: Ohm's law is applicable for all conducting elements.
Reason: Ohm's law is a fundamental law.

Q13. Assertion: An electric bulb becomes dim, when the electric heater in parallel circuit is switched on.
Reason: Dimness decreases after sometime.

ANSWER KEY 8 to 13

Q8 : (d) **Q9 :** (d) **Q11 :** (b) **Q12 :** (c) **Q13 :** (b)