## Conductor and conductance

**1.** **Answer:** (d) $Zn/ZnSO_4$ is a reference electrode

**Explanation:**

- **Option (a):** Wrong. In $KO_2$ (potassium superoxide), oxygen has an oxidation number of $-½$ (not zero).
- **Option (b):** Wrong. Specific conductance **increases** with dilution because molar conductance increases.
- **Option (c):** Wrong. $Sn^{2+}$ is a reducing agent; it reduces $Fe^{3+}$ to $Fe^{2+}$ instead of oxidizing it.
- **Option (d):** Correct. $Zn/ZnSO_4$ electrode is commonly used as a **reference electrode** in electrochemical cells.

**2.** (b) $\lambda^{\infty} BaCl_2 = \frac{1}{2}\lambda^{\infty} Ba^{2+} + \lambda^{\infty} Cl^{-}$

$= \frac{127}{2} + 76 = 139.5\ ohm^{-1}\ cm^{-1}\ eq^{-1}$.

**3.** (d) Dilution, temperature and nature of electrolyte affect the conductivity of solution.

**4.** **Answer:** (a) 630 $\Omega^{-1}\cdot cm^2\cdot mol^{-1}$

**Solution:**

1. **Molar conductance formula:**
   $\Lambda_m = (\kappa \times 1000) / c$
   where
   $\kappa$ = specific conductance ($\Omega^{-1}\cdot cm^{-1}$)
   c = concentration (mol/L)
2. Given:
   $\kappa = 6.3 \times 10^{-2}\ \Omega^{-1}\cdot cm^{-1}$, c = 0.1 M

3. Calculation:

$\Lambda_m = (6.3 \times 10^{-2} \times 1000) / 0.1$

$\Lambda_m = 63 / 0.1 = 630\ \Omega^{-1}\cdot cm^2\cdot mol^{-1}$

**Final Answer:** 630 $\Omega^{-1}\cdot cm^2\cdot mol^{-1}$

**5.** (a) Generally strong electrolyte on dilution shows conductivity characters.

**6.** (b) Molar conductivity = $\frac{1000}{MX}$.

**7.** (b) $C = \frac{K[A]A}{l}$, $K = \frac{C \times l}{[A]A} = \frac{Sm}{mol\ m^{-3}\ m^2} = Sm^2 mol^{-1}$.

**8.** **Answer:** (a) Energised electrons moving to the other part of the metal

**Explanation:**

- Metals conduct heat mainly through the **motion of free (energized) electrons**.
- When one end is heated, the free electrons gain kinetic energy and transfer it to other parts of the metal, causing the other end to become hot.
- The vibration of atoms also contributes, but in metals, **electron motion is the dominant mechanism**.

**9.** (b) Conductivity of a solution is directly proportional to the number of ions.

**10.** **Answer:** (d) Degree of ionisation of the electrolyte

**Explanation:**

- When an electrolyte is diluted, more of its molecules **ionise into ions**.
- More ions in solution lead to **greater movement under an electric field**, increasing the **equivalent (molar) conductance**.

- This effect is particularly significant for **weak electrolytes**, where ionisation increases markedly with dilution.

**11.** (a) $NaCl \rightleftharpoons Na^+ + Cl^-$. So it conduct electricity.

**12.** (b) Graphite is a good conductor of electricity.

**13.** **Answer:** (b) $ohm^{-1} \cdot cm^2 \cdot (gm\ equivalent)^{-1}$

**Explanation:**

Equivalent conductivity ($\Lambda$) is defined as: $\Lambda = (\kappa \times 1000) / C$

- $\kappa$ = specific conductance ($\Omega^{-1} \cdot cm^{-1}$)
- C = concentration in g–equivalent/L
- Therefore, the unit is $\Omega^{-1} \cdot cm^2 \cdot (gm\ equivalent)^{-1}$

**14** **Answer:** (b) Hydrogen chloride gas in water solution ionizes

**Explanation:**

- Gaseous HCl consists of neutral molecules → poor conductor
- In water, HCl **ionizes completely** into $H^+$ and $Cl^-$ ions, which **carry current**, making the solution a good conductor

**15.** (b) Electrolytic conduction resistance decreases with increasing temperature.

**16.** (d) Because conductance is increase when the dissociation is more.

**17.** (b) Strong electrolyte ionize completely at all dilutions and the number of ions does not increase on dilution. A small increase in $\wedge_m$ volume with dilution is due to the weakening of electrostatic attraction between the ions on dilution.

**18.** (d) In electrolytic conductors, a single stream of electrons flow from cathode to anode.

**19.** (b) In solid state $NaCl$ does not dissociate into ions so it does not conduct electricity.

**20.** (c) The ions are not free to move in solid state and held up in lattice due to strong coulombic forces of attraction.

**21.** (b) $C_2H_5OH$ being non electrolyte so does not ionize.

**22.** (a) Since molar conductance $\propto \frac{1}{\text{Molarity}}$.

**23.** (c) Molar condcutivity $= \frac{1}{\rho M}$

So its unit will be $\Omega^{-1} cm^2 mol^{-1}$.

**25.** (a) $l/a = 0.5\, cm^{-1}, R = 50\ ohm$

$$p = \frac{Ra}{l} = \frac{50}{0.5} = 100$$

$$\Lambda = k \times \frac{1000}{N} = \frac{1}{p} \times \frac{1000}{N} = \frac{1}{100} \times \frac{1000}{1}$$

$10\ ohm^{-1} cm^2\ gm\ eq^{-1}$

**26.** (b) $\Lambda^o_{m(C_6H_5COOH)} = \Lambda^o_{(C_6H_5COO^-)} + \Lambda^o_{(H^+)}$

$= 42 + 288.42 = 330.42$

$$\alpha = \frac{\Lambda^c_m}{\Lambda^o_m} = \frac{12.8}{330.42} = 3.9\%$$

**27.** (d) Conductance $= \frac{1}{\text{resistance}}$ $= \frac{1}{ohm} = ohm^{-1}$ or $mho$