SOLUTION TEST-A

1. K = 1.0×10^8, $\log K = \frac{nE°}{0.059}$ $E° = \frac{0.059}{2}\log 10^8$

   n = 2 $E° = \frac{0.059 \times 8}{2} = 0.059 \times 4$

   $E°_{cell} = 0.236\,V$

   $E°_{cell} = E°_{Fe^{3+}/Fe^{2+}} - E°_{I_2/I^-}$ or $E°_{Fe^{3+}/Fe^{2+}} = E°_{cell} + E°_{I_2/I^-}$

   $E°_{Fe^{3+}/Fe^{2+}} = +0.236 + 0.54 = 0.776\,V$

   The correct answer is (iv)

2. **The correct answer is (iii)**, $2Cl^- \longrightarrow Cl_2 + 2e^-$

3. Any metal having E° value greater than –0.44 V will oxidise Fe to Fe^{2+}. All three metals given will oxidise Fe to Fe^{2+}.

   The correct answer is (iv)

4. Assertion and reason are correct and reason is the correct explanation.

   $E°_{Zn^{2+}/Zn} < E°_{Cu^{2+}/Cu}$, so copper cannot displace zinc from zinc sulphate solution.

   The correct answer is (i)

5. Assertion is wrong.

   The conductivity increases with increase in concentration for both strong and weak electrolytes.

6. $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$

   1 mol $O_2 \rightarrow$ 4 mol $e^- \rightarrow 4F$

   $\rightarrow 4 \times 96500 = 386000$ C

7. It states that at infinite dilution, the total molar conductance of an electrolyte is equal to the sum of their ionic conductances.

8. Fuel cells are the cells in which heat energy of the fuel directly converted into electrical energy.

   For $H_2 – O_2$ cell

   Anode: $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$

   Cathode: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

   Net reaction: $2H_2 + O_2 \rightarrow 2H_2O$

9. I = 100 mA = 0.1 A

   $n_{H_2} = \frac{112}{22400} = 5 \times 10^{-3}$ mol

   from 1st law of electrolysis m = ZIt

$$m_{H_2} = \frac{MW_{H_2}}{2 \times 96500} \times I \times t$$

$$\frac{m_{H_2}}{MW_{H_2}} = n_{H_2} = \frac{I \times t}{2 \times 96500}$$

$$t = \frac{n_{H_2} \times 2 \times 96500}{I}$$

$$t = \frac{5 \times 10^{-3} \times 2 \times 96500}{0.1} = 9650 \text{ s}$$

10. (i) On dilution, the inter-ionic interaction between the oppositely charged ions decreases. The ions are more free to move and molar conductance increases linearly with dilution according to the equation $\wedge = \wedge^{o} + A\sqrt{C}$.

(ii) D.C voltage results in the electrolysis of the solution which changes the concentration. This change in concentration changes the resistance. Hence, accurate value of resistance cannot be measured

11. $E^{o}_{cell} = E^{o}_{Fe^{3+}/Fe^{2+}} - E^{o}_{I^{-}/I_2}$

$$E^{o}_{cell} = +0.77 - 0.57 = 0.20V$$

$$\Delta rG° = -nFE°$$

$$\Delta rG° = -2 \times 96500 \times 0.20$$

$$\Delta rG° = -38600 \text{ J mol}^{-1}$$

$$K = \text{anti}\log\left(\frac{nE°}{0.059}\right)$$

$$K = \text{anti}\log\left(\frac{2 \times 0.20}{0.059}\right)$$

$$K = \text{anti}\log(6.779)$$

$K = 6.02 \times 10^{6}$

12. (i) $Pt(s) \mid H_2(g) \mid H^{+}_{aq}(0.02\,M) \,\|\, Ag^{+}_{aq}(0.01M) \mid Ag(s)$
$(-ve)$ $(+ve)$

(ii) $E^{o}_{cell} = E^{o}_{Ag^{+}/Ag} - E^{o}_{H^{+}/H_2} = +0.80 - 0$

$$E^{o}_{cell} = +0.80\,V$$

$$E_{cell} = E^{o}_{cell} - \frac{0.059}{n}\log\frac{[H^{+}]^2}{[Ag^{+}]^2}$$

$$E_{cell} = 0.80 - \frac{0.059}{n}\log\left(\frac{0.02}{0.01}\right)^2$$

$$E_{cell} = +0.80 - 0.059 \log 2$$

$$E_{cell} = 0.80 - 0.059 \times 0.301$$

$$E_{cell} = 0.80 - 0.0178$$

$$E_{cell} = 0.7822\,V$$

13. $R_{KCl} = 180\,ohm$

$\kappa_{KCl} = 1.23 \times 10^{-3}\ S\,cm^{-1}$

$R_{AgNO_3} = 230\,ohm$

(i) cell constant $= \kappa_{KCl} R_{KCl}$

cell constant $= 1.23 \times 10^{-3} \times 180 = 0.2214\ cm^{-1}$

(ii) $\kappa_{AgNO_3} = \frac{\text{cell constant}}{R_{AgNO_3}} = \frac{0.2214}{220} = 1.00 \times 10^{-3}\,S\,cm^{-1}$

(iii) $\wedge = \frac{10^3\,\kappa}{M}$

$$\wedge = \frac{10^3 \times 1.00 \times 10^3}{0.002} = 500\ S\ cm^2\ mol^{-1}$$

14. (i) It states that the mass of an element produced at a given electrode is directly proportional to the amount of electricity passed.

(ii) (a) anode: O_2 gas

cathode: Ag

(b) anode: Ag^+ + impurities

cathode: pure silver

15. (a) (i) Corrosion is an electrochemical process as it involves redox reaction.

anode : $Fe \rightarrow Fe^{2+} + 2e^-$

cathode: $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$

Net: $2Fe + O_2 + 4H^+ \rightarrow 2Fe^{2+} + 2H_2O$

(ii) Presence of alkaline medium neutralises H^+ ion and prevent the forward reaction.

(b) The net reaction during discharging of lead storage battery is

$$Pb + PbO_2 + 2H_2SO_4 \rightarrow 2PbSO_4 + 2H_2O$$

Due to the formation of H_2O, the density of H_2SO_4 decreases.

(c) Zn < Al < Mg

(d) Cell constant is the ratio of the distance separating two electrodes to the area of cross section in a conductivity cell. Cell constant is unaffected by changing concentration.

