JEE (MAINS)

Q.1 $k = \frac{1}{R} \cdot \frac{l}{A}$

$1.3 = \frac{1}{50} \cdot \frac{l}{A}$

$\frac{l}{A} = 65\ m^{-1}$

$k = \frac{1}{R} \cdot \frac{l}{A}$

$k = \frac{1}{260} \times 65$

$\lambda_m = \frac{65/260}{1000 \times 0.4} = 6.25 \times 10^{-4}\ S m^2 mol^{-1}$

Q.2 $2e^{\ominus} + 2H^+ \longrightarrow H_2$

$E = 0 - \frac{.0591}{2} \log \frac{P_{H_2}}{[H^+]^2}$

potential will be negative if $P_{H_2} > (H^+)^2$

that is satisfied by option (1)

Q.3 $X + Y^{+2} \longrightarrow X^{+2} + Y$

for spontaneous rxn. $\mathcal{E} = \mathcal{E}_{X|X^{+2}} + \mathcal{E}_{Y^{+2}|Y}$

$\mathcal{E} = \mathcal{E}_{Y^{+2}|Y} - \mathcal{E}_{X^{+2}|X}$

so reduction potential $Y^{+2}|Y$ must be greater than reduction potential of $X^{+2}|Y$
So option (1) is correct

Q.4. Species that have highest value of reduction potential will behave as strongest oxidising agent i.e. $MnO_4^{\ominus}$

Q.5. $\lambda_m = \lambda^\circ_m - b\sqrt{c}$

$\lambda_{eq} \times n\text{-factor} = \lambda^\circ_{eq} \times n\text{-factor} - b\sqrt{c}$

$\lambda_{eq} = \lambda^\circ_{eq} - \frac{b}{n\text{-factor}}\sqrt{c}$

$\lambda_c = \lambda_\infty - 2\sqrt{c}$

Q.6 $k = \frac{1}{R}\frac{l}{A}$

$1.4 = \frac{1}{50}\cdot\frac{l}{A} \Rightarrow \frac{l}{A} = 70\ m^{-1}$

$k = \frac{1}{R}\cdot\frac{l}{A} \Rightarrow k = \frac{1}{280}\times 70 = \frac{1}{4}\ Sm^{-1}$

$\lambda_m = \frac{1/4}{1000 \times 0.5} = 5\times10^{-4}\ Sm^2mol^{-1}$

Q.7 $5e^{\ominus} + 8H^{+} + MnO_4^{\ominus} \longrightarrow Mn^{+2} + 4H_2O$

$$\mathcal{E}_{MnO_4^{\ominus}/Mn^{+2}} = \mathcal{E}^{\circ}_{MnO_4^{\ominus}/Mn^{+2}} - \frac{.059}{5} \log \frac{1}{[H^+]^8}$$

$$E_{MnO_4^{\ominus}/Mn^{+2}} = 1.51 - \frac{.059}{5} \log \frac{1}{(10^{-3})^8}$$

$$E_{MnO_4^{\ominus}/Mn^{+2}} = 1.22 \text{ Volt}$$

Now $MnO_4^{\ominus}$ can oxidise ion $X^{\ominus}$ then

$$\Rightarrow E_{MnO_4^{\ominus}/Mn^{+2}} + E_{X^{\ominus}/X_2} > 0$$

$$\Rightarrow E_{MnO_4^{\ominus}/Mn^{+2}} > E_{X_2/X^{\ominus}}$$

this condition is satisfied by $I^{\ominus}$ & $Br^{\ominus}$

Q.8 If $\mathcal{E}_{ext} < 1.1$ current will flow in natural direction that will be cathod to anode.

But if $\mathcal{E}_{ext} > 1.1$ current will flow from anode to cathod

9. Eq. (Cu) = number of faradays

$$\frac{w_{Cu}}{63.5} \times 2 = 2$$

$$m_{Cu} = 63.5 \text{ gm.}$$

10. Copper can not displace Zn^{+2} as Zn is above in electrochemical ~~series~~ series with respect to copper.

11.

$$\begin{array}{l} CH_2-COOK \\ | \\ CH_2-COOK \end{array} + 2H_2O \longrightarrow H_{2(g)} + \begin{array}{l} CH_2 \\ \| \\ CH_{2(g)} \end{array} + 2CO_{2(g)} + 2KOH$$

$$Eq.\ H_2 = Eq.\ C_2H_4 = Eq.\ CO_2 = 0.2$$

$$n_{H_2} \times 2 = n_{C_2H_4} \times 2 = n_{CO_2} \times 1 = 0.2$$

$$n_{H_2} = 0.1\ mol \quad n_{C_2H_4} = 0.1\ mol \quad n_{CO_2} = 0.2\ mol$$

Total volume at 1 atm 273 kelvin $= 0.4 \times 22.4$

$= 8.96$ lit

12. Species that have ligest value of oxidation potential will be strongest reducing agent i.e. Cr

13.

$$Fe^{+2} + 2e^{\ominus} \longrightarrow Fe \qquad E_1^\circ = -0.47$$

$$Fe^{+3} + e^{\ominus} \longrightarrow Fe^{+2} \qquad E_2^\circ = +0.77$$

$$Fe^{+3} + 3e^{\ominus} \longrightarrow Fe$$

$$E^\circ = \frac{n_1 E_1^\circ + n_2 E_2^\circ}{n} = \frac{2(-.47) + 0.77}{3}$$

$$E^\circ = -.057$$

Q.14. $M + 3Ag^{+} \longrightarrow M^{+3} + 3Ag$

$$0.421 = \left(\mathcal{E}^{\circ}_{M/M^{+3}} + 0.8\right) - \frac{.0591}{3} \log \frac{10^{-3}}{(10^{-2})^{3}}$$

$$0.421 = \mathcal{E}^{\circ}_{M/M^{+3}} + 0.8 - .0591$$

$$\mathcal{E}_{M/M^{+3}} = -0.3199$$

$$\mathcal{E}_{M^{+3}/M} = +0.3199 \text{ volt}$$

Q.15 $B_2H_6 + 3O_2 \longrightarrow B_2O_3 + 3H_2O$

$$\frac{27.66}{27.6} = 1 \text{ mol}$$

required O_2 = 3 mol

$$Eq.O_2 = \frac{It}{96500}$$

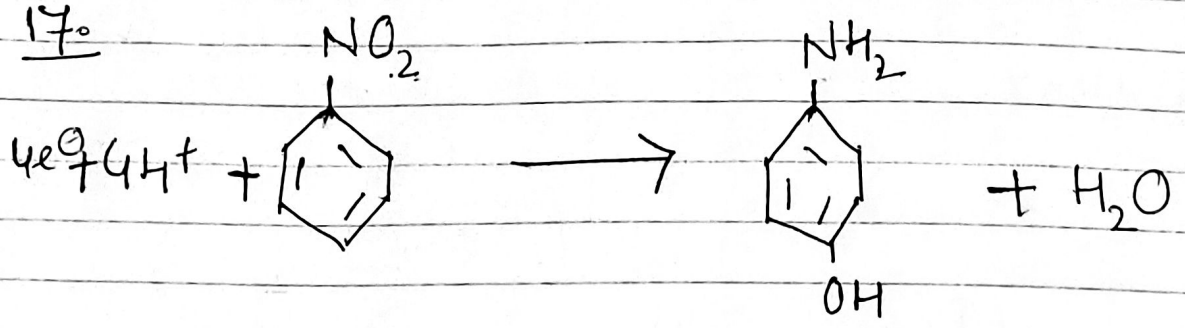
$$3 \times 4 = \frac{100 \times t}{96500} \Rightarrow t = 11580 \text{ sec}$$

$$t = 3.217 \text{ hours}$$

Q.16 $$Eq.H_2 = \frac{I \cdot t}{96500}$$

$$\frac{11.2}{22400} \times 2 = \frac{I \times 965}{96500} \Rightarrow I = 1 \text{ amp}$$

17.



$$\text{Eq.(p-aminophenol)} = \frac{It}{96500}$$

$$\frac{m}{109} \times 4 = \frac{9.65 \times 3600}{96500}$$

$$m = 9.81 \text{ gm}$$