

JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- CHEMISTRY

CLASS :- 12th

CHAPTER :- ELECTROCHEMISTRY

PAPER CODE :- CWT-2

ANSWER KEY

1.	(B)	2.	(B)	3.	(C)	4.	(B)	5.	(C)	6.	(B)	7.	(B)
8.	(C)	9.	(A)	10.	(A)	11.	(C)	12.	(C)	13.	(A)	14.	(B)
15.	(C)	16.	(D)	17.	(A)	18.	(B)	19.	(D)	20.	(A)	21.	0.728
22.	4300	23.	500	24.	9	25.	45	26.	32	27.	1350	28.	60
29.	3	30.	1080										

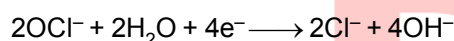
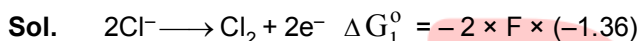
SOLUTIONS

1. (B)

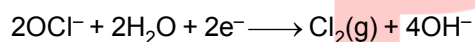
$$\text{Sol. } \frac{W}{E} = \frac{9.65 \times 3 \times 3600}{96500} = 1.08; \frac{W}{M} = 0.54$$

$$[\text{Ni}^{2+}] = \frac{2 \times 0.5 - 0.54}{0.5} = 0.92 \text{ M}]$$

2. (B)



$$\Delta G_2^\circ = -4 \times F \times (0.94)$$



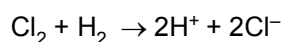
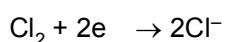
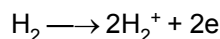
$$\Delta G_3^\circ = -2 \times F \times E_3^\circ$$

$$-2 \times F \times E_3^\circ = -2 \times F \times (-1.36) - 4F(0.94)$$

$$E_3^\circ = -1.36 + 2 \times 0.94 = 0.52 \text{ V Ans.]}$$

3. (C)

$$\text{Sol. } E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{RT}{nF} \ln Q$$



$$(E_{\text{cell}})_1 = E_{\text{cell}}^\circ - \frac{0.0591}{2} \log [\text{H}^+]_1^2 [\text{Cl}^-]_1^2$$

If conc. is changed by factor of 10 in both compartments

$$\text{Change} = -0.0591 \log 100 = -2 \times 0.0591 = -0.1182 \text{ Volt}]$$

4. (B)

$$\text{Sol. } G^* = \frac{l}{a} = \frac{10}{100} = 0.1; G = 0.0001 \text{ S}; V =$$

$$100 \times 10 = 1000 \text{ cm}^3 = 1 \text{ litre}$$

$$\kappa = G G^* = 0.1 \times 0.0001 = 10^{-5}$$

$$\Lambda_m^\circ = \frac{\kappa \times 100}{M} = \frac{(0.1 \times 0.0001) \times 1000}{0.5} = 0.02$$

$\text{Scm}^2 \text{ mol}^{-1}$ Ans.]

5. (C)

Sol. Let t sec be used

$$\text{No. of farads} = \frac{4 \times t}{96500}$$

$$\text{No. of moles of H}_2\text{O} = 2 \Rightarrow \frac{4 \times t}{96500} = 2 \times 2$$

$$\Rightarrow t = 96500 \text{ sec.]}$$

6. (B)

Sol. for (A) and (D) $E_{\text{cell}}^\circ = -ve \Rightarrow \Delta G^\circ = +ve$

$$\text{for (C)} \quad E_{\text{cell}}^\circ = +0.46$$

$$\text{for (B)} \quad E_{\text{cell}}^\circ = +1.56$$

ΔG° is most negative for (B)]

7. (B)

$$\text{Sol. } E_{\text{I}^-/\text{AgI}/\text{Ag}}^\circ = E_{\text{Ag}^+/\text{Ag}}^\circ + \frac{0.059}{1} \log K_{\text{sp}}]$$

8. (C)

9. (A)

10. (A)

Sol. Before equivalence point NO_3^- is replacing Cl^- . After equivalence point conductance will increase because of increase in conc. of Ag^+ and NO_3^- ions.]

11. (C)
Sol. (A) In dry cell :
 $2\text{MnO}_2(\text{s}) + \text{H}_2(\text{g}) \rightarrow \text{Mn}_2\text{O}_3(\text{s}) + \text{H}_2\text{O}(\text{l})$
 $\begin{matrix} +4 & & +3 \end{matrix}$
 Reduction of Mn from +4 to +3 state occurs
 (B) During discharging
 $\text{Pb}(\text{s}) + \text{PbO}_2(\text{s}) + 2\text{H}_2\text{SO}_4(\text{l}) \rightarrow 2\text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})$
 H_2SO_4 consumed in the reaction thus density decreases.
 (C) Anode : $4\text{H}_2\text{O} + \text{C}_2\text{H}_6 \rightarrow 2\text{CO}_2 + 14\text{H}^+ + 14\text{e}^-$
 Cathode : $4\text{e}^- + 4\text{H}^+ + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
 permole of e^- only 1 mole of H^+ will produce.

(D) If fuel cell $\eta = \frac{\Delta G}{\Delta H}$ if $\Delta S > 0, \Delta H < 0$
 $\Delta G = \Delta H - T\Delta S$
 $\Delta G > \Delta H$
 and $n > 100\%$]

12. (C)
Sol. $E_{\text{Cell}} = E_{\text{Zn}^{2+}/\text{Zn}}^\circ + E_{\text{Cl}^-/\text{Cl}_2(\text{g})}^\circ$
 $= 0.76 + 1.36 = 2.12 \text{ V}$]
13. (A)
Sol. Near one electrode pH increases and near other it decreases. This occur because of following two reactions.
 At cathode : $2\text{e}^- + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{OH}^- + \text{H}_2(\text{g})$
 At anode : $2\text{H}_2\text{O}(\text{l}) \rightarrow 4\text{e}^- + 4\text{H}^+ + \text{O}_2(\text{g})$

14. (B)
Sol. During electrolysis of $\text{Li}_2\text{SO}_4(\text{aq})$
Cathode **Anode**
 $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ $2\text{OH}^- \rightarrow \text{H}_2\text{O} + \frac{1}{2} \text{O}_2 + 2\text{e}^-$
 pH will remain constant.]

15. (C)
Sol. $\Lambda_{\text{mAgCl}}^\circ = \frac{K \times 1000}{S}$
 $135 = \frac{K \times 1000}{10^{-5}}$
 $K = 135 \times 10^{-8} = 1.35 \times 10^{-6} \Omega^{-1} \text{ cm}^{-1}$]

16. (D)
Sol. $E = E^\circ - \frac{.06}{2} \log \frac{[\text{Fe}^{2+}][\text{Zn}^{2+}]}{[\text{Fe}^{3+}]^2}$
 If conc. of Fe^{2+} increase
 E decrease
 $\Delta G = -nEE$
 Less non PV work will be obtained.

17. (A)
Sol. On increasing concentration number of ion per unit volume increases as a result conductivity increases.

18. (B)
Sol. 'Cs' is used in photoelectric cell as its ionisation energy is lowest
 Hence Ans (B)

19. (D)
Sol. Ionic
 $C_{\text{NaCl}} \gg C_{\text{BaSO}_4}$ at temp 'T'

20. (A)
Sol. $\Lambda_{m1} = \frac{K_1 \times 1000}{M_1} = \frac{K \times 1000}{10}$
 $\Lambda_{m2} = \frac{K_2 \times 1000}{20}$
 $\Lambda_{m2} = \frac{K_2 \times 1000}{0.80}$

It is given that $k_1 = k_2$
 $K_1 = \frac{\Lambda_{m1}^2}{2}$ $K_2 = \frac{\Lambda_{m2}^2}{4}$
 Applying the given condition on conductivity.
 $\Lambda_{m2} = 2 \Lambda_{m1}$

21. 0.728
Sol. $8\text{e}^- + 2 \text{Ph} - \text{NO}_2 \rightarrow \text{Ph} - \text{N} = \text{N} - \text{Ph}$
 $\text{OH}^- \rightarrow \frac{1}{4} \text{O}_2 + \frac{1}{2} \text{H}_2\text{O} + \text{e}^-$
 $\text{C}_{60} + 60 \text{O}_2 \rightarrow 60 \text{CO}_2$
 $\frac{96 \times 10^{-3}}{60 \times 12} \times 60 \times 4 \times \frac{1}{8} \times 182 \Rightarrow 0.728 \text{ gm}$]

22. 4300
Sol. $0.6 = E_{\text{Cell}}^\circ - 0.06 \log [\text{H}^+]$
 $0.6 = E_{\text{Cell}}^\circ + 0.06 \text{ pH}_1$
 $0.75 = E_{\text{Cell}}^\circ + 0.06 \text{ pH}_2$
 $0.15 = 0.06 (6.8 - \text{pH})$
 $2.5 = 6.8 - \text{pH}$
 $\text{pH} = 6.8 - 2.5$
 $= 4.3$ **Ans.]**

23. 500

Sol. $\kappa = \frac{1}{R} \times \frac{l}{A} = \frac{1}{50} \times \frac{4}{10} = 8 \times 10^{-3} \text{ S-cm}^{-1}$

$$\Lambda_m = \frac{\kappa \times 1000}{0.1} = 80 \text{ S-cm}^2\text{mol}^{-1}$$

$$\Lambda_m^\infty(\text{CH}_3\text{COOH}) = \Lambda_m^\infty(\text{HCl}) + \frac{1}{2} \Lambda_m^\infty(\text{Ca}(\text{HCOO})_2)$$

$$- \frac{1}{2} \Lambda_m^\infty(\text{CaCl}_2)$$

$$= 425 + 115 - 140 = 400 \text{ S-cm}^2\text{mol}^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\infty} = 0.2$$

$$K_a = \frac{0.1 \times \alpha^2}{1 - \alpha} = \frac{0.1 \times 0.04}{0.8} = 5 \times 10^{-3} \text{ M}$$

Ans.]

24. 9

Sol. $\Lambda_N = \frac{\Lambda_m}{n_f} \Rightarrow \Lambda_m = 200 \times 2 = 400 \Omega^{-1} \text{ cm}^2$

mol^{-1}

$$400 = \frac{4 \times 10^{-5} \times 1000}{S} \Rightarrow S = \frac{4 \times 10^{-2}}{400} \Rightarrow 1 \times$$

10^{-4}

$$K_{sp}(\text{BaSO}_4) = 1 \times 10^{-8} \text{ M}^2$$

$(x + y) = 9$ **Ans.**

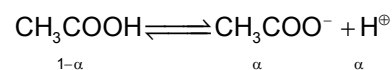
25. 45

Sol. $p_v = \frac{l}{A} \quad \Lambda_m = \frac{k \times 1000}{C}$

$$\frac{100 \times 4}{2} = p \quad \Lambda_m = \frac{1}{200} \times \frac{1000}{0.1}$$

$$\frac{1}{p} = k \frac{1}{200} \quad \Lambda_m = 50$$

$$\frac{\Lambda_m}{\Lambda_m^\infty} = \frac{50}{400} = \frac{1}{8}$$

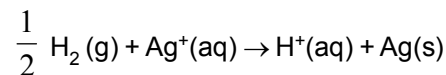
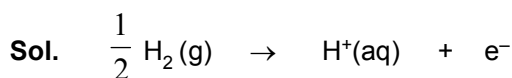


$$1 + \alpha = \frac{9}{8}$$

$$\Delta T_b = K_b \times m \times i$$

$$= 0.5 \times 0.1 \times \frac{9}{8} \times 800 = 45]$$

26. 32



$$E_{\text{cell}} = E_{\text{cell}}^\circ - \frac{0.06}{1} \log \frac{[\text{H}^+]}{[\text{Ag}^+](P_{\text{H}_2})^{1/2}}$$

$$= 0.8 - 0.06 \log \frac{0.2}{2 \times 10^{-9}}$$

$$= 0.8 - 0.06 \log 10^8$$

$$= 0.32]$$

27. 1350

Sol. $i = 0.5 \text{ Amp}$

$$\text{Current efficiency} = \frac{1000}{12} \%$$

$$t = 9.65 \text{ hr} = 9.65 \times 3600 \text{ sec.}$$

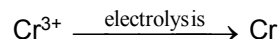
$$w = \frac{Eit}{96500} = \frac{9 \times \frac{12}{100} \times 1 \times 0.5 \times 9.65 \times 3600}{96500}$$

$$\therefore E_{\text{Al}} = 9$$

$$= \frac{9 \times 5 \times 9.65 \times 3}{965} = 1.35 \text{ g} = 1350 \text{ mg}]$$

28. 60

Sol. Initially 0.1 M



Finally 0.08 M

$$\text{Number of moles of Cr}^{3+} \text{ reduced} = M_1V_1 - M_2V_1$$

$$= 0.1 \times 1 - 0.08 \times 1$$

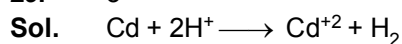
$$= 0.02 \text{ mole}$$

Number of equivalent of Cr^{3+} reduced = 0.02×3 equ.

$$\therefore 0.02 \times 3 = \frac{i.t}{96500}$$

$$i.t = 0.02 \times 3 \times 96500$$

$$t = \frac{0.02 \times 3 \times 96500}{96.5} = 60 \text{ sec.}]$$

29. 3

$$E = E^\circ - \frac{0.06}{n} \log \frac{[\text{Cd}^{+2}][\text{H}_2]}{[\text{Cd}][\text{H}^+]^2}$$

$$= 0.39 - \frac{0.06}{2} \log \left[\frac{K_{\text{sp}}}{[\text{OH}^-]^2 \times 1} \right]$$

$$= 0.39 - 0.03 \log \frac{K_{\text{sp}}}{(K_w)^2}$$

$$E = 0$$

$$\therefore 0.39 = 0.03 \log \frac{K_{\text{sp}}}{K_w^2}$$

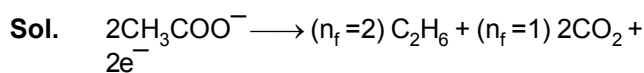
$$13 = \log \frac{K_{\text{sp}}}{K_w^2}$$

$$13 = \log K_{\text{sp}} - \log K_w^2$$

$$13 = \log K_{\text{sp}} + 28$$

$$\log K_{\text{sp}} = -15$$

$$\frac{1}{5} \log K_{\text{sp}} = \frac{1}{5} \times 15 = 3$$

30. 1080

Number of equivalents deposited

$$= \frac{\text{it}}{96500} = \frac{2 \times 965 \times 60 \times 60}{96500} = 72$$

$$\text{Moles of } \text{C}_2\text{H}_6 = \frac{72}{2} = 36$$

$$\text{Moles of } \text{CO}_2 = \frac{72}{1} = 72$$

$$\text{Total moles} = 36 + 72 = 108$$

Total volume

$$= \frac{nRT}{P} = \frac{108 \times 0.0821 \times 10}{1} = 1080 \text{ L}$$

PE