Self Practice Paper (SPP)

1. The standard electrode potentials (reduction) of Pt/Fe^{3+}, Fe^{2+} and Pt/Sn^{4+}, Sn^{2+} are + 0.77 V and 0.15 V respectively at 25° C. The standard EMF of the reaction $Sn^{4+} + 2Fe^{2+} \longrightarrow Sn^{2+} + 2Fe^{3+}$ is

(1) – 0.62 V (2) – 0.92 V (3) + 0.31 V (4) + 0.85 V

2. The standard oxidation potentials, E^o, for the half reactions are as

$Zn \longrightarrow Zn^{2+} + 2e^-$; $E^0 = +0.76$ V $Fe \longrightarrow Fe^{2+} + 2e^-$; $E^0 = +0.41$ V

The EMF for the cell :

$$Fe^{2+} + Zn \longrightarrow Zn^{2+} + Fe$$

(1) –0.35 V (2) + 0.35 V (3) + 1.17 V (4) – 1.17 V

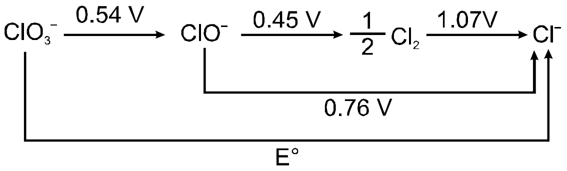
3. Which is/are correct among the following ?

Given, the half cell emf's $E^0_{Cu^{+2}\,|\,Cu} = 0.337$, $E^0_{Cu^{+1}\,|\,Cu} = 0.521$

(1) Cu^{+1} disproportionates (2) Cu and Cu^{2+} comproportionates.

(3) $E^0_{Cu\,|\,Cu^{+2}} + E^0_{Cu^{+1}\,|\,Cu}$ is positive (4) (1) and (3) Both

4.



The E° in the given figure is about :

(1) 0.5 V (2) 0.6 V (3) 0.7 V (4) 0.8 V

5. How many g of silver will be displaced from a solution of $AgNO_3$ by 4 g of magnesium?

(1) 18 g (2) 4 g (3) 36 g (4) 16 g

6. The standard reduction potential for Zn^{+2}/Zn ; Ni^{+2}/Ni ; and Fe^{+2}/Fe are –0.76V, –0.23V, –0.44V respectively. The reaction $X + Y^{+2} \longrightarrow X^{+2} + Y$ will be non-spontaneous when :

	X	Y
(I)	Ni	Fe
(II)	Ni	Zn
(III)	Fe	Zn
(VI)	Zn	Ni

(1) I, II, IV (2) I, II, III (3) II, III, IV (4) all of these

7. The electrode potentials for

$Cu^{2+}_{(aq)} + e^- \longrightarrow Cu^+_{(aq)}$ and $Cu^+_{(aq)} + e^- \longrightarrow Cu_{(s)}$

are +0.15 V and + 0.50V respectively. The value of $E^0_{Cu^{2+}/Cu}$ will be :

(1) 0.500 V (2) 0.325 V (3) 0.650 V (4) 0.150 V

8. A given cell reaction is spontaneous when :

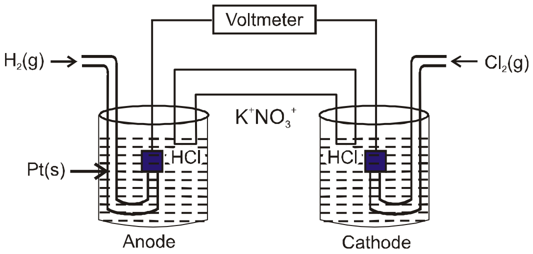
(1) $E°_{red}$ is negative (2) $E°_{red}$ is positive (3) E^o_{cell} is positive (4) E_{cell} is positive

9. How much will the reduction potential of a hydrogen electrode change when its solution initially at pH = 0 is neutralised to pH = 7 at 25° C ?

(1) Increases by 0.059 V (2) Decreases by 0.059 V

(3) Increases by 0.41 V (4) Decreases by 0.41 V

10. Consider the following Galvanic cell as shown in figure.



By what will value the cell voltage change when concentration of ions in anodic and cathodic compartments are both increased by factor of 10 at 298 K

(1) + 0.591 V (2) – 0.0591 V (3) – 0.1182 V (4) 0 V

11. Pt | Cl_2 (P_1 atm) | HCl (0.1 M) | Cl_2 (P_2 atm) | Pt, cell reaction will be spontaneous if :

(1) $P_1 = P_2$ (2) $P_1 > P_2$ (3) $P_2 > P_1$ (4) $P_1 = P_2 = 1$ atm

12. In a cell that utilise the reaction : $Zn (s) + 2H^+ (0.1M) \longrightarrow Zn^{2+} (aq) + H_2 (g)$

addition of 0.1 M H_2SO_4 to cathode compartment will :

(1) increase the cell emf and shift equilibrium to the left.
(2) lower the cell emf and shift equilibrium to the right.
(3) increase the cell emf and shift equilibrium to the right.
(4) lower the cell emf and shift equilibrium to the left.

13. For the following cell with hydrogen electrodes at two different pressure p_1 and p_2,

Pt | $H_2(g)$ | $H^+(aq)$ | $H_2(g)$ | Pt
p_1 1M p_2

emf is given by :

(1) $\frac{RT}{F}\log_e\frac{p_1}{p_2}$ (2) $\frac{RT}{2F}\log_e\frac{p_1}{p_2}$ (3) $\frac{RT}{F}\log_e\frac{p_2}{p_1}$ (4) $\frac{RT}{2F}\log_e\frac{p_2}{p_1}$

14. The chemical reaction, $2AgCl(s) + H_2(g) \longrightarrow 2HCl (aq) + 2Ag (s)$

taking place in a galvanic cell (under standard condition) is represented by the notation.

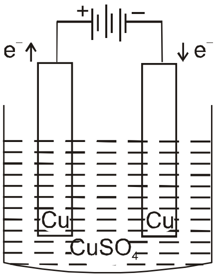
(1) Pt(s) | H_2(g), 1 bar | 1 M KCl (aq) | AgCl(s) | Ag (s)
(2) Pt(s) | H_2(g), 1 bar | 1 M HCl (aq) | 1 M Ag^+ (aq) | Ag (s)
(3) Pt(s) | H_2(g), 1 bar | 1 M HCl (aq) | AgCl (s) | Ag (s)
(4) Pt(s) | H_2(g), 1 bar | 1 M HCl (aq) | Ag (s) | AgCl (s)

15. Which of the following reactions is possible at anode :

(1) $2 Cr^{3+} + 7H_2O \rightarrow Cr_2O_7^{2-} + 14H^+$ (2) $F_2 \rightarrow 2F^-$

(3) $\frac{1}{2}O_2 + 2H^+ \rightarrow H_2O$ (4) displacement reaction

16. In the given figure, the electrolytic cell contains 1 L of an aqueous 1 M Copper (II) sulphate solution. If 0.4 mole of electrons are passed through cell, the concentration of copper ion after passage of the charge will be :



(1) 0.4 M (2) 0.8 M (3) 1.0 M (4) 1.2 M

17. Cost of electricity for the production of 'X' litre H_2 at NTP at cathode is Rs. X. Then cost of electricity for the production 'X' litre O_2 gas at NTP at anode will : (assume 1 mole of electrons as one unit of electricity)

(1) 2X (2) 4X (3) 16X (4) 32X

18. A current of 0.1A was passed for 2hr through a solution of cuprocyanide and 0.3745 g of copper was deposited on the cathode. Calculate the current efficiency for the copper deposition. (Cu – 63.5)

(1) 79% (2) 39.5 % (3) 63.25% (4) 63.5%

19. A current is passed through 2 voltameters connected in series. The first voltameter contains XSO_4 (aq.) and second has Y_2SO_4 (aq.). The relative atomic masses of X and Y are in the ratio of 2 : 1. The ratio of the mass of X liberated to the mass of Y liberated is

(1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) None of the above

20. A current of 9.95 amp following for 10 minutes, deposits 3 g of a metal. Equivalent weight of the metal is

(1) 12.5 (2) 18.5 (3) 21.5 (4) 48.5

21. The ratio of wt. deposited of metal x, y, z on passing electric charge in ratio of 1 : 2 : 3 respectively is 3 : 2 : 1 then the ratio of equivalent weights for the above metals respectively is :

(1) 1 : 1 : 1 (2) 1 : 2 : 3 (3) 3 : 2 : 1 (4) 9 : 3 : 1

22. Charge produced in butane – O_2 Fuel cell if 2 mol butane is consumed, will be :

(1) 26 F (2) 49 F (3) 21 F (4) 52 F

23. For a cell given below :

$$\underset{-}{Ag} \mid Ag^+ \parallel Cu^{2+} \mid \underset{+}{Cu}$$

$Ag^+ + e^- \longrightarrow Ag$ $E^o = x$

$Cu^{2+} + 2e^- \longrightarrow Cu,$ $E^o = y$

The value of E^o_{cell} is :

(1) x + 2y (2) 2x + y (3) y –x (4) y – 2x

24. The specific conductance of a N/10 KCl at 25°C is 0.0112 $ohm^{-1}\ cm^{-1}$. The resistance of cell containing solution at the same temperature was found to be 55 ohms. The cell constant will be

(1) 6.16 cm^{-1} (2) 0.616 cm^{-1} (3) 0.0616 cm^{-1} (4) 616 cm^{-1}

25. The equivalent conductance of a N/10 NaCl solution at 25ºC is $10^{-2}\ Sm^2eq^{-1}$. Resistance of solution contained in the cell is 50 Ω. Cell constant is :

(1) 50 m^{-1} (2) $50 \times 10^{-6}\ m^{-1}$ (3) $50 \times 10^{-3}\ m^{-1}$ (4) $50 \times 10^{3}\ m^{-1}$

26. For an NaCl (aq.) solution, which of the following quantities go to zero as NaCl concentration goes to zero?
(Assume the solvent's contribution to conductivity has been subtracted off).
(1) $\wedge_m$ (2) κ (3) $\lambda_m(Na^+)$ (4) $\lambda_m(C\ell^-)$

27. Conductance (with unit Siemens S) is directly proportional to area of the electrode plates and the concentration of the solution in the cell and is inversely proportional to the separation between the electrode plates. Then the unit of the constant of proportionality is :
(1) $Sm\ mol^{-1}$. (2) $Sm^2\ mol^{-1}$. (3) $S^{-2}m^2$ mol. (4) $S^2m^2\ mol^{-1}$.

28. For a cell reaction involving a two electron change, the standard emf of the cell is found to be 0.295 V at 25°C. The equilibrium constant of the reaction at 25°C will be :
(1) 1×10^{-10} (2) 29.5×10^{-2} (3) 10 (4) 1×10^{10}

29. Standard electrode potentials of three metals A, B and C are + 0.5 V, – 3.0 V and – 1.2 V respectively. The reducing power of these metals is in the order :
(1) B > C > A (2) A > B > C (3) C > B > A (4) A > C > B

30. Consider a very weak acid HA having $K_a = 10^{-10}$. If concentration of HA taken is 1M, then find the specific conductivity of the solution.
$\wedge^{\infty}(H^+) = 350\ Scm^2/mol$
$\wedge^{\infty}(A^-) = 100\ Scm^2/mol$
(1) 0.45 S/cm (2) 4.5×10^{-6} S/cm (3) 3.5×10^{-6} S/cm (4) 0.35 S/cm

31. Acetic acid is titrated with NaOH solution. Which of the following statement is correct for this titration?
(1) conductance increases upto equivalence point, then it decreases
(2) conductance increases upto equivalence point, then it increases
(3) first conductance increases slowly upto equivalence point and then increases rapidly
(4) first conductance increases slowly upto equivalence point and then drops rapidly .

32. If a salt bridge is removed from the two half cells, the voltage:
(1) drops to zero gradually (2) does not change
(3) increases gradually (4) Drops to zero rapidly

33. If the pressure of hydrogen gas is increased from 1 atm. to 100 atm, keeping the hydrogen ion concentration constant at 1M, the voltage of the hydrogen half cell is at 25°C will be
(1) 0.059 V (2) – 0.059 V (3) 0.295 V (4) 0.118 V

34. The standard free energy change for the following reaction is – 210 kJ. What is the standard cell potential ?

$$2H_2O_2\ (aq) \longrightarrow 2H_2O\ (\ell) + O_2\ (g)$$

(1) +0.752 (2) +1.09 (3) +0.420 (4) +0.640

35. Total charge required for the oxidation of two moles Mn_3O_4 into MnO_4^{2-} in presence of alkaline medium is :
(1) 5 F (2) 10 F (3) 20 F (4) None of these

36. The weight of silver (eq. wt. = 108) displaced by that quantity of current which displaced 5600 mL of hydrogen at STP is:
(1) 54 g (2) 108 g (3) 5.4 g (4) None of these

37. How many electrons are delivered at the cathode during electrolysis by a current of 1A in 60 seconds?
(1) 3.74×10^{20} (2) 6.0×10^{23} (3) 7.48×10^{21} (4) 6.0×10^{20}

38. Time required to deposit one millimole of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ion is :

(1) 30 s (2) 10 s (3) 30,000 s (4) 10,000 s

39. If x specific resistance (in S^{-1} cm) of the electrolyte solution and y is the molarity of the solution, then Λ_m (in S cm^2 mol^{-1}) is given by :

(1) $\frac{1000x}{y}$ (2) $1000\frac{x}{y}$ (3) $\frac{1000}{xy}$ (4) $\frac{xy}{1000}$

40. The limiting conductivity of NaCl, KCl and KBr are 126.5, 150.0 and 151.5 S cm^2 eq^{-1}, respectively. The limiting equivalent ionic conductance for Br^- is 78 S cm^2 eq^{-1}. The limiting equivalent ionic conductance for Na^+ ions would be :

(1) 128 (2) 125 (3) 49 (4) 50

41. The standard emf of a galvanic cell involving cell reaction with n = 2 is found to be 0.295 V at 25ºC. The equilibrium constant of the reaction would be :

(Given F = 96500 C mol^{-1} ; R = 8.314 JK^{-1} mol^{-1})

(1) 2.0×10^{11} (2) 4.0×10^{12} (3) 1.0×10^{2} (4) 1.0×10^{10}

42. A smuggler could not carry gold by depositing iron on the gold surface since

(1) Gold is denser (2) Iron rusts

(3) Gold has higher reduction potential then iron (4) Gold has lower reduction potential than iron.

43. The correct order of increasing oxidizing power is

(1) $F_2 < Cl_2 < Br_2 < I_2$ (2) $F_2 < Br_2 < Cl_2 < I_2$ (3) $Cl_2 < Br_2 < F_2 < I_2$ (4) $I_2 < Br_2 < Cl_2 < F_2$

44. The hydrogen electrode is dipped in a solution of pH = 3 at 25°C. The potential of the cell would be (value of 2.303 RT/F is 0.059 V)

(1) 0.177 V (2) 0.087 V (3) – 0.177 V (4) 0.059 V

45. In electrolysis of NaCl, when platinum electrode is taken then H_2 is liberated at the cathode while with mercury cathode it forms sodium amalgam. This is because

(1) Hg is more inert than Pt

(2) More voltage is required to reduce H^+ at Hg than at Pt

(3) Na is dissolved in Hg while it does not dissolve in Pt

(4) Conc. of H^+ ions is larger when Pt electrode is taken

SPP Answers

1.	(1)	**2.**	(2)	**3.**	(4)	**4.**	(2)	**5.**	(3)	**6.**	(2)	**7.**	(2)
8.	(4)	**9.**	(4)	**10.**	(3)	**11.**	(3)	**12.**	(3)	**13.**	(2)	**14.**	(3)
15.	(1)	**16.**	(3)	**17.**	(1)	**18.**	(1)	**19.**	(1)	**20.**	(4)	**21.**	(4)
22.	(4)	**23.**	(3)	**24.**	(3)	**25.**	(1)	**26.**	(2)	**27.**	(2)	**28.**	(4)
29.	(1)	**30.**	(2)	**31.**	(3)	**32.**	(1)	**33.**	(2)	**34.**	(2)	**35.**	(3)
36.	(1)	**37.**	(1)	**38.**	(1)	**39.**	(3)	**40.**	(4)	**41.**	(4)	**42.**	(3)
43.	(4)	**44.**	(3)	**45.**	(2)								

SPP Solutions

1. $E_{cell} \Rightarrow E^0_{Sn^{4+}/Sn^{2+}} + E^0_{Fe^{2+}/Fe^{3+}} \quad \Rightarrow \quad 0.15 - 0.77 = -0.62\ V$

2. $EMF = E^o_{cathode} - E^o_{anode} = 0.76 - 0.41 = 0.35.$

3. $2Cu^{+1} \longrightarrow Cu + Cu^{+2}$

$2Cu^{+1} + 2e \longrightarrow 2Cu$

$Cu - 2e \longrightarrow Cu^{+2}$

$2Cu^{+1} \longrightarrow Cu^{+2} + Cu$

$\therefore \quad E^\circ = 0.184$

4. $ClO_3^- + 2H_2O + 4e \longrightarrow ClO^- + 4OH^- \quad ; \Delta G_1^\circ$

$ClO^- + H_2O + e \longrightarrow \frac{1}{2} Cl_2 + 2OH^- \quad ; \Delta G_2^\circ$

$\frac{1}{2} Cl_2 + e \longrightarrow Cl^- \quad ; \Delta G_3^\circ$

$ClO_3^- + 3H_2O + 3e \longrightarrow Cl^- + 6OH^- \quad ; \Delta G^\circ$

$\therefore \quad \Delta G^\circ = \Delta G_1^\circ + \Delta G_2^\circ + \Delta G_3^\circ$

$-6FE^\circ = -4F \times 0.54 - 1F \times 0.45 - 1F \times 1.07$

$\therefore \quad E^\circ = +\frac{3.68}{6} = +0.61\ V$

5. $\frac{W_1}{E_1} = \frac{W_2}{E_2}\ ;\ \frac{4}{12} = \frac{W_{Ag}}{108}\ ;\ W_{Ag} = 36$

6. $Zn + Ni^{+2} \longrightarrow Zn^{+2} + Ni$

$E^o = E^o_{Ni^{+2}/Ni} - E^o_{Zn^{+2}/Zn}$

$= -0.23 - (-0.76) = +0.53\ V$

Positive value shows that the process is spontaneous.

Rest of all (I) (II) (III) combination have negative E^o value.

(I) $E^o = -0.44 - (-0.23) = -0.21\ V$

(II) $E^o = -0.76 - (-0.23) = -0.53\ V$

(III) $E^o = -0.76 - (-0.44) = -0.32\ V$

7. $Cu^{2+} + 1e^- \rightarrow Cu^+$ $E_1^0 = 0.15$ v $\Delta G_1^0 = -n_1 E_1^0 F$

$Cu^+ + 1e^- \rightarrow Cu$ $E_2^0 = 0.50$ v $\Delta G_2^0 = -n_2 E_2^0 F$

$Cu^{2+} + 2e^- \rightarrow Cu$ $\Delta G^o = \Delta G^o_1 + \Delta G^o_2$

$(-1)\, n E^0 F = (-1)\, n_1 E_1^0 F + (-1)\, n_2 E_2^0 F$

$$E^0 = \frac{n_1E_1^0 + n_2E_2^0}{n} = \frac{0.15\times1+0.50\times1}{2} = 0.325V$$

8. $\Delta G = -nFE$; if $E > 0$; $\Delta G < 0$ ⇒ Spontaneous reaction.

If $E^o_{cell} > 0$, then the reaction will be spontaneous at standard conditions, not necessarily at all condition or given condition.

9. $H^+ + e^- \longrightarrow \frac{1}{2} H_2$. $E = 0 - \frac{.0591}{1} \log_{10} \frac{1}{[H^+]} = +0.0591 \log_{10}[H^+]$.

$E_1 = 0$ {pH = 0}.

$E_2 = +0.0591\log_{10}[10^{-7}] = -.0591 \times 7$ {at pH = 7} $= -0.41$ V.

10. $E_{cell} = E^0_{cell} - \frac{0.0591}{1}\log_{10}[H^+][Cl^-]$ and $E'_{cell} = E^0_{cell} - \frac{0.0591}{1}\log_{10} 100[H^+][Cl^-]$.

$E'_{cell} - E_{cell} = -2 \times 0.0591 = -0.1182$.

11. $$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log_{10}\frac{P_{Cl_2\,(anode)}}{P_{Cl_2\,(cathode)}} = 0 - \frac{0.0591}{2}\log_{10}\frac{P_1}{P_2}$$

If $P_1 < P_2$, $E_{cell} = +$ ve (spontaneous)

13. The E^o of cell will be zero.

14. Cell notation is anode || cathode.

15. Here Cr^{3+} is oxidised to $C_2O_7^{2-}$

16. Number of moles of Cu^{2+} produced from anode = number of moles of Cu^{2+} deposited at cathode.

17. For same charge passed mole of H_2 produced = 2 × moles of O_2 produced.

18. m (theoretical) = $\frac{63.5\times0.1\times7200}{96500} = 0.4738$ g

∴ % efficiency = $\frac{0.3745}{0.4738} \times 100 = 79$ %

19. $$\frac{m_X}{m_Y} = \frac{\frac{A_X}{2}\times Q}{\frac{A_Y}{1}\times Q} \Rightarrow \frac{m_X}{m_Y} = 1 \quad \because \quad A_X = 2A_Y$$

20. $$\frac{W}{E} = \frac{it}{96500} \Rightarrow \frac{3}{E} = \frac{9.95\times10\times60}{96500} \Rightarrow E = 48.5$$

21. Let wt of metal deposited for x, y, z is 3a, 2a, a respectively & let moles of e^- passing for x, y, z be 1, 2 and 3 respectively then the wt of x, y, z deposited is E_x, $2E_y$, $3E_z$ (where E_x, E_y, E_z are equivalent wt. of x, y, z)

$\therefore$ $E_x = 3a$

$2E_y = 2a \Rightarrow E_y = a$

& $3E_z = a \Rightarrow E_z = \frac{a}{3}$

$\therefore$ Ex : Ey : Ez

$= 3a : a : \frac{a}{3}$

$= 9 : 3 : 1$

22.

$$C_4H_{10} + \frac{13}{2}O_2 \longrightarrow 4CO_2 + 5H_2O$$

2 mol 13mol O_2

$\Downarrow$

52 mol electron transfer

23. At LHS (oxidation) 2 × ($Ag \longrightarrow Ag^+ + e^-$) $E^o_{ox} = -x$

At RHS (reduction) $Cu^{2+} + 2e^- \longrightarrow Cu$ $E^o_{red} = +y$

$2Ag + Cu^{2+} \longrightarrow Cu + 2Ag^+$, $E^o_{red} = (y - x)$

24. $K = \frac{1}{R}\left(\frac{\ell}{a}\right) \Rightarrow 0.0112 = \frac{1}{55}\left(\frac{\ell}{a}\right) \Rightarrow \frac{\ell}{a} = 0.616$

25. $\lambda_{eq} = \dfrac{\left(\frac{1}{R} \times G^*\right) \times 10^{-3}}{N}$

$\therefore 10^{-2} = \dfrac{\left(\frac{1}{50} \times G^*\right) \times 10^{-3}}{1/10}$

$\therefore G^* = 50\ m^{-1}$

26. Λ_m(NaCl), $\lambda_m(Na^+)$, $\lambda_m(Cl^-)$ keep on increasing as concentration decreases but keeps on decreasing with dilution.

27. $K = \frac{1}{\rho} = \frac{1}{R}\frac{\ell}{A}$

28. $0 = 0.295 - \frac{0.059}{2}\log K$; $\log K = 10$; **$K = 10^{10}$.**

29.

	A	B	C
E^o_{red}	+0.5 V	–3.0 V	–1.2 V

The reducing power follows the following order : B > C > A.

30. α of HA = $\sqrt{\frac{10^{-10}}{1}} = 10^{-5}$; $\Lambda_\infty(HA) = \Lambda_\infty(H^+) + \Lambda_\infty(A^-)$ = 450 S cm²/mol

$\Rightarrow \alpha = \frac{\wedge_M}{\wedge_\infty}$

$\Rightarrow \wedge_m = \wedge_\infty . \alpha$ = 450 x 10^{-5} Scm²/mol.

Also $\wedge_m = \frac{\kappa \times 1000}{C}$

$\Rightarrow K = \frac{\Lambda_m \times C}{1000}$

$= \frac{450 \times 10^{-5} \times 1}{1000}$

$\kappa = 4.5 \times 10^{-6}$ Scm^{-1}

31. $CH_3COOH + NaOH \longrightarrow Na^+ + CH_3COO^- + H_2O$ Conductance Ist increases slowly since no. of ions increases. After end point it increases sharply due to OH^- ions.

32. The e.m.f. of cell decreases gradually and finally to zero due to liquid junction potential arised in cell after removal of salt bridge.

33. $E_{H_2/H^+} = -\frac{0.0591}{1}\log_{10}\frac{[H^+]}{\sqrt{pH_2}}$.

34. n = 2 for given reaction so $\Delta G^o = -nFE^o$

$\therefore$ $-210 \times 1000 = -2 \times 96500 \times E^o$

$\Rightarrow$ E = 1.09 V

35. 1 mole Mn_3O_4 lose $\left(6 - \frac{8}{3}\right) \times 3 = 10$ mole

electron; so total charge required = 2 × 10 ⇒ 20 F

36. Eq. of Ag = Eq. of H_2 ;

$\frac{W}{108} = \frac{5600 \times 2}{22400 \times 1}$

$\therefore$ $W_{Ag} = 54$ g

37. Q = it

= 60 × 1

= 60

Number of electron = $60 \times 6.02 \times 10^{23} = 3.74 \times 10^{20}$.

38. $Al \longrightarrow Al^{3+} + 3e^-$

$\frac{x \times 9.65 \times 27}{3 \times 96500} = 10^{-3} \times 27$ (here, x is time in second)

By solving

x = 30 s

39. $\Lambda_m = \frac{\kappa \times 1000}{M} \Rightarrow \frac{1}{\rho} \times \frac{1}{M} \times 1000$;

$\Lambda_m = \frac{1000}{xy}$

40. $\Lambda^\infty_m(NaBr) = \Lambda^\infty_m(NaCl) + \Lambda^\infty_m(KBr) - \Lambda^\infty_m(KCl)$

$\Lambda^\infty_m(Na^+) + \Lambda^\infty_m(Br^-) = 126.5 + 151.5 - 150$

$\Lambda^\infty_m(Na^+) = 50$