

15	Determine the values of equilibrium constant (K_c) and ΔG^0 for the following reaction: $\text{Ni(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Ni}^{2+}(\text{aq}) + 2\text{Ag(s)}$, $E^0_{\text{cell}} = 1.05\text{V}$, ($F = 96500\text{C}$) (Ans: $\Delta G^0_{\text{cell}} = -202,650\text{J}$, $K_c = 3.917 \times 10^{35}$.)	2
16	Write the reaction taking place at cathode anode when the lead –acid storage battery is in use.	2
17	What is the difference between an electro-chemical cell and an electrolytic cell?	2
18	Calculate the standard cell potential of the galvanic cell in which the following reaction takes place: $2\text{Cr(s)} + 3\text{Cd}^{2+}(\text{aq}) \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{Cd(s)}$ Given $E^0_{\text{Cr}^{3+}/\text{Cr}} = -0.74\text{V}$, $E^0_{\text{Cd}^{2+}/\text{Cd}} = -0.40\text{V}$, $F = 96500\text{C mol}^{-1}$ Also calculate the $\Delta_r G^0$ value of the reaction. (Ans: $E^0_{\text{cell}} = 0.34\text{V}$, $\Delta_r G^0 = -196.86\text{kJ mol}^{-1}$)	2
19	For what concentration of $\text{Ag}^+(\text{aq})$ will the emf of the given cell be zero at 298 K, if concentration of $\text{Cu}^{2+}(\text{aq})$ is 0.01M? $\text{Cu(s)}/\text{Cu}^{2+}(0.1\text{M}) // \text{Ag}^+(\text{aq}) / \text{Ag(s)}$. Given $E^0_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$, $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$. (Ans: $[\text{Ag}^+] = 1.48 \times 10^{-9}\text{M}$)	2
20	The chemistry of corrosion is essentially an electrochemical phenomenon. Explain the reactions occurring during the corrosion of iron in the atmosphere.	2
21	Write the anode and cathode reactions occurring in a commonly used mercury cell. How is the overall reaction represented?	2
22	Give reasons: i) On the basis of E^0 values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl ii) Conductivity of CH_3COOH decreases on dilution.	
23	Define the molar conductivity and Explain the variation in molar conductivity with change in concentration of a weak electrolyte and a strong electrolyte in its solution.	2
24	For the reaction $2\text{AgCl(s)} + \text{H}_2(\text{g})(1\text{atm}) \rightarrow 2\text{Ag(s)} + 2\text{H}^+(0.1\text{M}) + 2\text{Cl}^-(0.1\text{M})$, $\Delta G^0 = -43600\text{J}$ at 25°C . Calculate the e.m.f. of the cell. $[\log 10^{-n} = -n]$ Ans: $E_{\text{cell}} = 0.344\text{V}$	
25	A copper-silver cell is set up. The copper ion concentration is 0.10M. The concentration of silver ions is not known. The cell potential was found to be 0.422V. Determine the concentration of silver ions in the cell. (Given: $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$, $E^0_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$) (Ans: $7.1 \times 10^{-2}\text{M}$)	3
26	What are primary cells and secondary cells? Give one example for each.	3

27	<p>i) A current of 1.5 ampere was passed through an electrolytic cell containing AgNO_3 solution with inert electrodes. The weight of Ag deposited was 1.50g. How long did the current flow? (Ans: 893.51 sec)</p> <p>ii) Write the reactions taking place at the anode and cathode in the above cell?</p> <p>iii) Give reactions taking place at the two electrodes if these are made up of Ag.</p>	3
28	<p>A voltaic cell is set up at 25°C with the following half cells, Al^{3+} (0.001M) and Ni^{2+} (0.50M). Write the cell reaction when the cell generates an electric current and determine the cell potential. (Given $E^\circ_{\text{Ni}^{2+}/\text{Ni}} = -0.25\text{V}$, $E^\circ_{\text{Al}^{3+}/\text{Al}} = -1.66\text{V}$) (Ans: $E_{\text{cell}} = 1.46\text{V}$)</p>	3
29	<p>The molar conductivity at infinite dilution for NH_4Cl, NaOH and NaCl are 129.8, 217.4, and $108\text{Scm}^2\text{mol}^{-1}$ respectively. If the molar conductivity of 0.01M solution of NH_4OH is $9.33\text{Scm}^2\text{mol}^{-1}$. Calculate the dissociation constant of NH_4OH (Ans: 1.60×10^{-5})</p>	3
30	<p>One half cell in a voltaic cell is constructed from a silver wire dipped in silver nitrate solution of unknown concentration. The other half cell consists of a zinc electrode in a 0.10M solution of $\text{Zn}(\text{NO}_3)_2$. A voltage of 1.48V is measured for this cell. Use this information to calculate the concentration of silver nitrate solution. (Given: $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.763\text{V}$, $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$) (Ans: $[\text{Ag}^+] = 1.247 \times 10^{-2}\text{M}$)</p>	3
31	<p>Calculate the equilibrium constant for the reaction equilibrium $\text{Fe}(\text{s}) + \text{Cd}^{2+}(\text{aq}) \rightarrow \text{Fe}^{2+}(\text{aq}) + \text{Cd}(\text{s})$ (Given: $E^\circ_{\text{Cd}^{2+}/\text{Cd}} = -0.40\text{V}$, $E^\circ_{\text{Fe}^{2+}/\text{Fe}} = -0.44\text{V}$) (Ans: $K_c = 22.57$)</p>	3
32	<p>a) Calculate the charge in coulombs required for oxidation of 2 moles of water to oxygen? [Given $1\text{F} = 96,500\text{Cmol}^{-1}$]</p> <p>b) Zinc/silver oxide cell is used in hearing aids and electric watches. The following reaction occur:</p> $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \quad E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$ $\text{Ag}_2\text{O} + \text{H}_2\text{O} + 2\text{e}^- \rightarrow 2\text{Ag} + 2\text{OH}^- \quad E^\circ_{\text{Ag}^+/\text{Ag}} = +0.344\text{V}$ <p>Calculate i) standard potential of the cell ii) Standard Gibbs energy (Ans: $E^\circ_{\text{cell}} = 1.104\text{V}$, $\Delta G^\circ = -213072\text{J}$)</p>	3
33	<p>Give reason:</p> <p>a) Why does an alkaline medium inhibit the rusting of iron?</p> <p>b) Why is zinc better than Tin in protecting iron from corrosion?</p> <p>c) What are antirust solutions? Give one example.</p>	3

34	a) Why does a dry cell become dead after a long time even if it has not been used? b) What is the role of $ZnCl_2$ in a dry cell?	3
35	Two electrolytic cells containing electrolyte $AgNO_3$ and $CuSO_4$ are connected in series. A steady current of 2.5 Amperes were passed through them until 1.078g of Ag were deposited. How long did the current flow? What mass of copper was deposited? (Ans; 386sec, 0.3175g)	3
36	a) Two electrolytic cells containing silver nitrate solution and dilute sulphuric acid solution were connected in series. A steady current of 2.5 amp was passed through them till 1.078g of silver was deposited. [$Ag = 107.8 g mol^{-1}$, $1F = 96,500C$] i) How much electricity was consumed? (Ans: 0.01 F or 965C) ii) What was the weight of oxygen gas liberated? (Ans: 0.16g) b) Give reason: i) Rusting of iron pipe can be prevented by joining it with a piece of magnesium. ii) Conductivity of an electrolyte solution decreases with the decrease in concentration.	5
37	Write the cell reaction and calculate the emf of the following cell at 298K $Sn(s) Sn^{2+}(0.004 M) H^+(0.020 M) H_2(g)(1 bar) Pt(s)$ (Given : $E^0_{Sn^{2+}/Sn} = -0.14 V$)	Ans: $E_{cell} = 0.1105 V$
38.	a) What is a fuel cell? What is its main advantage? b) What are the reactions occurring at the cathode and anode of a Leclanche cell? c) In the button cell widely used for watches and other devices, the following reaction takes place: $Zn(s) + Ag_2O(s) + H_2O(l) \rightarrow Zn^{2+}(aq) + 2Ag(s) + 2OH^-(aq)$ Give the cell representation and determine the value of K_c for the above reaction using the following data: $Ag_2O(s) + H_2O(l) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq)$ ($E^0 = 0.344V$) $Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$ ($E^0 = -0.76V$) (Ans: $\Delta G^0 = -213072J$, $K_c = 2.649 \times 10^{37}$)	5
39.	The following chemical reaction is occurring in an electrochemical cell $Mg(s) + 2Ag^+(0.0001M) \rightarrow Mg^{2+}(0.10M) + 2Ag(s)$ Given $E^0_{Mg^{2+}/Mg} = -2.36V$ and $Ag^+/Ag = 0.81V$ For this cell calculate/write i) a) E^0 value for the electrode $2Ag^+/2Ag$. b) Standard cell potential E^0_{cell} . ii) Cell potential (E_{cell}) iii) a) Symbolic representation of the above cell. b) Will the above cell reaction be spontaneous. (Ans: i) a) 0.81V b) 3.17V (ii) 2.96 V , iii) b) yes.	5