

## UNIT - 3

### ELECTROCHEMISTRY

#### 2 Marks Questions

- 1 How many faraday of charge is required for conversion of  $C_6H_5NO_2$  into  $C_6H_5NH_2$ ?
- 2 Explain why Zn dissolves in dil. HCl to liberate  $H_2(g)$  but from conc.  $H_2SO_4$ , the gas evolved is  $SO_2$ .
- 3 Cu does not dissolve in HCl but dissolves in nitric acid. Explain why?
- 4 Fluorine has a low electron gain enthalpy compared to chlorine, yet it is a more powerful oxidant. Explain why?
- 5 If  $Zn^{2+}/Zn$  electrode is diluted 100 times, then what will be the change in emf?
- 6 You are acquainted with the construction and working of a lead-storage battery. Give the plausible reasons for these facts:
  1. There is only a single compartment unlike other electrochemical cells.
  2. Replacement of water is necessary for maintenance.
- 7 For what concentration of  $Ag^+(aq.)$ , will the emf of given cell be zero at  $25^\circ C$ , if the concentration of  $Cu(s) | Cu^{2+}(0.1M) || Ag^+(aq.) | Ag(s)$ ?  
Given,  $E^0_{Ag^+/Ag} = 0.80V$ ;  $E^0_{Cu^{2+}/Cu} = 0.34V$ .
- 8 In a small town along the costal area, it is observed that iron objects rust easily. Being an industrial town, it also faces air pollution problem. Identify any 4 factors which are contributing to rusting phenomenon.
- 9 Iodine( $I_2$ ) and Bromine( $Br_2$ ) are added to a solution containing iodide( $I^-$ ) and bromide ions( $Br^-$ ). What reaction would occur if the concentration of each species is 1M? The electrode potentials are  $E^0_{I_2/I^-} = 0.54V$  and  $E^0_{Br_2/Br^-} = 1.08V$

### 3 Marks Questions

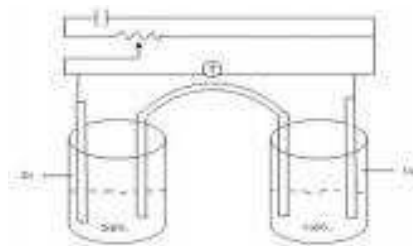
10. In an industrial plant, aluminium is produced by electrolysis of alumina dissolved in cryolite. This takes a current of 20000A. If the current efficiency is 90%, how much Al will be produced per day?  
 $\longrightarrow$
11. In an experiment 0.04 F was passed through 400 mL of 1M soln. of NaCl. What would be pH of the soln. after electrolysis.
12. Estimate the minimum P.D. needed to reduce  $\text{Al}_2\text{O}_3$  at 500 0 C. The free energy change for the decomposition reaction is 960 kJ.  
 $2/3 \text{ Al}_2\text{O}_3 \quad 4/3 \text{ Al} + \text{O}_2; \Delta G = 960 \text{ kJ}$
13. A cell with N/50 KCl soln. offered a resistance of 550 ohms at 298 K. The specific conductance of N/50 KCl at 298 K is  $0.002768 \text{ ohm}^{-1}\text{cm}^{-1}$ . When the cell is filled with N/10  $\text{ZnSO}_4$  soln, it offered a resistance of 72.18 ohms at 298 K. Find the cell constant and molar conductance of  $\text{ZnSO}_4$  soln. at 298K.
14. Which of the following has larger molar conductance:  
 a. 0.08 M soln. having conductivity equal to  $2 \times 10^{-2} \text{ ohm}^{-1}\text{cm}^{-1}$ .  
 b. 0.10 M soln. having resistivity equal to 5.8 ohm cm.
15. The  $K_{\text{sp}}$  of AgCl at 298 K is  $1 \times 10^{-10}$ . Calculate electrode potential of Ag electrode immersed in 1 M KCl soln..  
 [Given:  $E^\circ \text{ Ag}^+/\text{Ag} = 0.799 \text{ V}$  ]
16. Tarnished siver contains  $\text{Ag}_2\text{S}$ . Can this tarnish be removed by immersing the tarnished silverware in an Al pan containing an inert electrolyte soln. such as NaCl?  
 Given that standard electrode potentials for half reactions are:  
 $\text{Ag}_2\text{S}(\text{s}) + 2\text{e}^- \quad 2\text{Ag}(\text{s}) + \text{S}^{2-}(\text{aq.})$  is -0.71 V  
 $\text{Al}^{3+}(\text{aq.}) + 3\text{e}^- \quad \text{Al}(\text{s})$  is -1.66 V.

## 5 Marks Questions

- 17 Observe the diagram carefully and answer the questions below:

An external opposite potential is applied such that it exceeds the cell potential.

- Is this an electrochemical cell or electrolytic cell?
- Which substance gets dissolved?
- Which substance gets deposited and where?
- Write half cell reactions.
- Is the needle in the voltmeter correctly marked?



- 18 2 beakers A and B contain 1 M  $\text{ZnSO}_4$  solution. To A, Strip of Mg is dipped, while in B, A zinc rod is put. If both are connected to a standard hydrogen electrode, which cell would show a deflection? Explain with suitable reason.
- 19 The standard electrode potentials of different electrodes are given as  
 $E_{\text{Co}^{3+}/\text{Co}^{2+}}^0 = 1.81 \text{ V}$ ,  $E_{\text{Al}^{3+}/\text{Al}}^0 = -1.66 \text{ V}$ ,  $E_{\text{Fe}^{2+}/\text{Fe}}^0 = -0.44 \text{ V}$ ,  
 $E_{\text{Br}_2/\text{Br}^-}^0 = 1.01 \text{ V}$
- Identify all the possible combination for construction of a feasible electrochemical cell?
  - Write their electrochemical cell representation.
  - Calculate the emf in each case.
- 20
- During electrolysis of NaOH,  $\text{Cl}_2$  and  $\text{H}_2$  while for molten NaCl only Na metal and  $\text{Cl}_2$  gas are obtained. Explain these observations with suitable eqn.
  - Electrolysis of conc. and dil. sulphuric acid are different. Explain with eqn.
- 21 An Aq. solution of  $\text{AuCl}_3$  was electrolysed with a current of 0.5A until 1.20g of Au had been deposited on the cathode. At another electrode in series with this, the only reaction was evolution of  $\text{O}_2$ . Find—
- The no. of moles
  - The volume at NTP
  - The mass of  $\text{O}_2$  liberated
  - the no. of coulombs passed through the solution and
  - the duration of electrolysis