LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

FOURTH SEMESTER – **APRIL 2015**

CH 1020 - ELECTROCHEMISTRY

Date : 25/04/2015 Dept. No. Max. : 100 Marks

Time : 09:00-12:00

Part-A

Answer all questions. Each question carries two marks: ***(10x2=20)***

1. Define electrochemical potential.
2. State Bjerrum hypothesis of ion association.
3. The standard emf of Daniel cell involving the cell reaction, $Zn_{(s)} + Cu^{2+}{}_{(aq)} \rightarrow Zn^{2+}{}_{(aq)} + Cu_{(s)}$ is 1.10 V. Calculate the equilibrium constant of the cell reaction.
4. What is the role of supporting electrolyte in an electrochemical cell?
5. Calculate zeta potential of a particle in aqueous solution if electrophoretic mobility is3.12×10^{-6} cm $V^{-1}s^{-1}$ (the values of η and ε for water are 8.91×10^{-4} $Kgm^{-1}s^{-1}$ and 78.3 respectively and $\varepsilon_0 = 8.85\times10^{-12}C^2J^{-1}m^{-1}$).
6. What is a polarisable electrode? State the condition for its ideal polarisability.
7. Mention the factors which affect the symmetry factor in an electrode reaction.
8. How can stoichiometric number be determined experimentally?
9. What are fuel cells?
10. Define exchange current density.

Part-B

Answer any eight questions. Each question carries five marks: ***(8x5=40)***

11. For the cell reaction, $Zn + 2AgCl_{(s)} \rightarrow 2Ag + Zn^{2+} + 2Cl^-$, E^o cell at 298 K is 1.034 V. Evaluate ΔG^o, ΔH^o, and ΔS^o for the cell if the temperature coefficient of cell EMF is -2.54×10^{-4} VK^{-1}
12. Apply Bornmodel to find out the energy of ion solvent interaction.
13. Derive Lippmann equation. Mention its significance.
14. Describe any two applications of Debye-Huckel limiting law.
15. Calculate the thickness of ionic atmosphere in 0.01 M KCl at 25^0C in ethanol as solvent (dielectric constant is 24.3).
16. Discuss the theoretical background of Debye-Huckel-Onsager equation.
17. Explain the application of electrochemistry in refining of metals.
18. Derive Tafel equation for cathodic process.
19. Explain any two applications of polarography.
20. Discuss any four types of over potential for an electrode system.
21. Deduce Nernst equation fromButler-Volmer equation for one electron process.
22. Explain the mechanism of corrosion. Mention any two methods to prevent corrosion.

Part-C

Answer any four questions. Each question carries ten marks: ***(4x10=40)***

23a. Derive linearized Poisson-Boltzmann equation for interionic interactions. **(7)**

b. Calculate the mean activity coefficient of 0.001 M sodium sulphate aqueous solution at 25°C. **(3)**

24. DiscussGouy-Chapman model of electrified interface. What are its limitations? How are they overcome in Stern's model?

25. Explain the evidences for the theory of electrolytic conductance based on the existence ofionic atmosphere.

26. Describe electrokinetic phenomena in detail.

27. Derive the Butler-Volmer equation for a multistep electrochemical reaction.

28. Write a note on cyclic voltammetry and amperometric titrations.

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