

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – CHEMISTRY

FOURTH SEMESTER – NOVEMBER 2022

UCH 4501 – ELECTROCHEMISTRY

Date: 26-11-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

PART-A

Answer ALL questions.

(10 x 2 = 20 Marks)

1. What is meant by standard electrode potential?
2. The potential for $\text{Fe}^{3+}|\text{Fe}^{2+}$ half-cell is +0.750 V relative to the standard hydrogen electrode. What is its potential when using a saturated calomel electrode ($E^\circ=0.2444$ V).
3. What is a reversible cell? Give an example.
4. What is liquid junction potential? How can it be minimized?
5. Write any two advantages of conductometric titration.
6. Define transport number.
7. Distinguish between strong and weak electrolytes.
8. Calculate the ionic strength of 0.01 M aqueous solution of CuSO_4 at 298K.
9. Write Ilkovic equation and its use.
10. What is concentration polarization?

PART-B

Answer any EIGHT questions.

(8 x 5 = 40 Marks)

11. Describe the construction and working of a standard calomel electrode.
12. Calculate the electrode reduction potentials of the following single electrode at 25°C.
 $\text{Sn}|\text{Sn}^{2+}$ ($a = 0.01\text{M}$) $E^\circ_{\text{Sn}^{2+}|\text{Sn}} = -0.14$ V
13. Derive the Nernst equation for measuring electrode potential.
14. How is the pH of a solution determined using a quinhydrone electrode?
15. Discuss the principle of potentiometric titration.
16. State and explain Kohlrausch's law.
17. At 25°C, the transport numbers of H^+ ions in HCl and CH_3COO^- ions in CH_3COONa are 0.81 and 0.47 respectively. The equivalent conductance at infinite dilution of HCl and CH_3COONa are $426 \Omega^{-1} \text{cm}^2 \text{equi}^{-1}$ and $91.0 \Omega^{-1} \text{cm}^2 \text{equi}^{-1}$ respectively. Calculate the equivalent conductance of acetic acid at infinite dilution.
18. Explain the principle of conductometric titration of strong acid with strong base.
19. Describe electrophoretic effect and asymmetric effect.
20. Discuss Arrhenius theory of electrolytic dissociation.
21. Describe the electrochemical theory of corrosion.
22. Write the advantages and disadvantages of dropping mercury electrode in polarography.

PART-C

Answer any FOUR questions.

(4 x 10 = 40 Marks)

23. a) Explain the applications of electrochemical series.
b) Calculate the standard free energy ΔG° for the reaction $\text{Zn}_{(s)} + \text{Cu}^{2+}_{(aq)} \rightarrow \text{Zn}^{2+}_{(aq)} + \text{Cu}_{(s)}$ at 298 K. The E°_{cell} at this temperature is 1.10 V. Is the cell reaction spontaneous or not? (6+4)
24. Derive an expression for the EMF of a concentration cell with transference.
25. How are ΔH , ΔS , ΔG and K determined from EMF data?
26. How is transference number of ions determined using a moving boundary method?
27. Discuss the Debye-Huckel theory of strong electrolytes.
28. Explain the working principle and applications of polarography.

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