



LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

FOURTH SEMESTER – NOVEMBER 2024

UCH 4501 – ELECTROCHEMISTRY



Date: 13-11-2024

Dept. No.

Max. : 100 Marks

Time: 09:00 am-12:00 pm

SECTION A - K1 (CO1)

Answer ALL the Questions -

(10 x 1 = 10)

1. Multiple Choice Question

- _____ is the electrode potential of an electrode when the activities of all the reactants and products are unity.
i) Standard electrode potential ii) EMF iii) Cell potential iv) None of the above
- Which is a reversible electrochemical cell?
i) Zinc-silver cell ii) Daniel cell iii) Concentration cell iv) None of the above
- The SI unit of conductivity is _____.
i) S ii) S/m iii) S/V iv) None of the above
- Which of the following is a bi-bivalent electrolyte?
i) KCl ii) CdSO₄ iii) AlCl₃ iv) MgCl₂
- _____ is a process in which ions or molecules move under the influence of an electric field.
i) Diffusion ii) Migration iii) Convection iv) None of the above

2. Multiple Choice Question

- _____ is used to determine the pH of the solution.
i) DME ii) SHE iii) Copper electrode iv) None of the above
- For the cell $\text{Zn} | \text{Zn}^{2+} (\text{C}_1) || \text{Zn}^{2+} (\text{C}_2) | \text{Zn}$, ΔG is negative if _____.
i) $\text{C}_1 > \text{C}_2$ ii) $\text{C}_1 = \text{C}_2$ iii) $\text{C}_1 < \text{C}_2$ iv) None of these
- The _____ is defined as the velocity of an ion under a potential gradient of 1 Volt/m.
i) ionic atmosphere ii) ionic number iii) ionic mobility iv) transport number
- The ionic strength of 0.1 N NaCl is _____.
i) 1 N ii) 0.01 N iii) 0.05 N iv) 0.1 N
- The chemical formula of rust is _____.
i) Fe₂O ii) Fe₂O₃ iii) Fe₃O₄ iv) Fe(OH)₂

SECTION A - K2 (CO1)

Answer ALL the Questions

(10 x 1 = 10)

3. Answer the following

- What is EMF?
- How is liquid junction potential minimized?
- Give an example of strong electrolyte.
- State Ostwald's dilution law.

e)	Define overvoltage.	
4.	Answer the following	
a)	What is the potential of a standard hydrogen electrode?	
b)	Write the relation between ΔG and EMF.	
c)	What is the use of moving boundary method?	
d)	How is activity related to the activity coefficient of an electrolyte?	
e)	Write Ilkovic equation.	
SECTION B - K3 (CO2)		
Answer any TWO of the following		(2 x 10 = 20)
5.	a) Describe the construction and working of a Weston cell. (5) b) Predict whether zinc reacts with 1N H_2SO_4 to give out hydrogen gas or not when it is connected to a standard hydrogen electrode separately. ($E^\circ_{Zn^{2+}/Zn} = -0.76 V$; $E^\circ_{Ag^+/Ag} = 0.80 V$). (5)	
6.	Explain potentiometric redox titration. (10)	
7.	a) Derive Nernst equation for measuring cell potential. (5) b) Calculate the equivalent and molar conductivities of the 0.2 N $ZnSO_4$ solution. The specific conductance is $0.02109 \text{ ohm}^{-1} \text{ cm}^{-1}$. (5)	
8.	a) Discuss Arrhenius theory of electrolytic dissociation. (5) b) How is half-wave potential measured experimentally? (5)	
SECTION C – K4 (CO3)		
Answer any TWO of the following		(2 x 10 = 20)
9.	a) How is the single electrode potential of a copper electrode determined? (5) b) Describe the construction and working of a calomel electrode. (5)	
10.	How are thermodynamic parameters determined from EMF measurements? (10)	
11.	a) Calculate the molar solubility of Ag_2SO_4 in water at $25^\circ C$ if $K_{sp} = 9 \times 10^{-12}$. (5) b) How does the equivalent conductance of electrolytes vary with dilution? (5)	
12.	a) Describe electrophoretic effect and asymmetric effect. (5) b) Explain electrochemical theory of corrosion. (5)	
SECTION D – K5 (CO4)		
Answer any ONE of the following		(1 x 20 = 20)
13.	a) Explain the applications of electrochemical series. (10) b) Describe any two methods to determine pH of the solution. (10)	
14.	a) How is transference number of ions determined using Hittorf's method? (10) b) Illustrate the Debye-Huckel theory of strong electrolytes. (5) c) Explain the working principle of polarography. (5)	
SECTION E – K6 (CO5)		
Answer any ONE of the following		(1 x 20 = 20)
15.	a) Describe the types of electrodes with examples, electrode reactions, and potentials. (10)	

	b) Derive an expression for the EMF of a concentration cell with transference. (10)
16.	a) Discuss the following conductometric titrations: (i) Strong acid vs strong base (ii) Weak acid vs strong base. (10) b) Calculate the mean activity coefficient of 0.01 M aqueous solution of NaCl. (5) c) Explain the role of dropping mercury electrode in polarography. (5)
