



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**

a) \_\_\_\_\_ 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

b) Which is a reversible electrochemical cell?  
 i) Zinc-silver cell    ii) Daniel cell    iii) Concentration cell    iv) None of the above

c) The SI unit of conductivity is \_\_\_\_\_.  
 i) S    ii) S/m    iii) S/V    iv) None of the above

d) Which of the following is a bi-bivalent electrolyte?  
 i) KCl    ii) CdSO<sub>4</sub>    iii) AlCl<sub>3</sub>    iv) MgCl<sub>2</sub>

e) \_\_\_\_\_ 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**

a) \_\_\_\_\_ is used to determine the pH of the solution.  
 i) DME    ii) SHE    iii) Copper electrode    iv) None of the above

b) For the cell  $Zn|Zn^{2+}(C_1) \parallel Zn^{2+}(C_2)|Zn$ ,  $\Delta G$  is negative if \_\_\_\_\_.  
 i)  $C_1 > C_2$     ii)  $C_1 = C_2$     iii)  $C_1 < C_2$     iv) None of these

c) 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

d) The ionic strength of 0.1 N NaCl is \_\_\_\_\_.  
 i) 1 N    ii) 0.01 N    iii) 0.05 N    iv) 0.1 N

e) The chemical formula of rust is \_\_\_\_\_.  
 i) Fe<sub>1</sub>O    ii) Fe<sub>2</sub>O<sub>3</sub>    iii) Fe<sub>3</sub>O<sub>4</sub>    iv) Fe(OH)<sub>2</sub>

**SECTION A - K2 (CO1)**

**Answer ALL the Questions (10 x 1 = 10)**

**3. Answer the following**

a) What is EMF?

b) How is liquid junction potential minimized?

c) Give an example of strong electrolyte.

d) State Ostwald's dilution law.

e)	Define overvoltage.
4.	<b>Answer the following</b>
a)	What is the potential of a standard hydrogen electrode?
b)	Write the relation between $\Delta G$ 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. ( $E^\circ_{Zn^{2+}/Zn} = -0.76\text{ V}$ ; $E^\circ_{Ag^+/Ag} = 0.80\text{ V}$ ). (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-Hückel 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)
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