

B. Sc. CHEMISTRY  
FOURTH SEMESTER  
PHYSICAL CHEMISTRY IV  
BSC – 403 [SPECIAL REPEAT]  
[USE OMR FOR OBJECTIVE PART]

**SET  
A**

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

( Objective )

Marks: 20

Choose the correct answer from the following:

1X20=20

- The difference between the electrode potentials of two electrodes when no current is drawn through the cell is called \_\_\_\_\_.
  - Cell potential
  - Cell emf
  - Potential difference
  - Cell voltage
- Which of the following statement is not correct about an inert electrode in a cell?
  - It does not participate in the cell reaction
  - It provides surface either for oxidation or for reduction reaction.
  - It provides surface for conduction of electrons
  - It provides surface for redox reaction.
- For the given cell,  $\text{Mg} | \text{Mg}^{2+} || \text{Cu}^{2+} | \text{Cu}$  (i) (ii)
  - Mg is cathode
  - Cu is cathode
  - Cu is the oxidising agent
  - None of the above
- EMF is measured in
  - Volt
  - Volt. Coulomb
  - Coulomb
  - Joule
- In an electrolytic cell the electrode at which the electrons enter the solution is called the \_\_\_\_\_. the chemical change that occurs at this electrode is called \_\_\_\_\_.
  - Anode, oxidation
  - Anode, reduction
  - Cathode, oxidation
  - Cathode, reduction
- Which of the following is a weak electrolyte?
  - $\text{CH}_3\text{COOH}$
  - $\text{NaOH}$
  - $\text{KCl}$
  - $\text{H}_2\text{SO}_4$
- The unit of specific conductance is
  - $\text{ohm cm}$
  - $\text{ohm}^{-1} \text{cm}^{-1}$
  - $\text{ohm cm}^{-1}$
  - $\text{ohm}^{-1} \text{cm}$
- The degree of dissociation of an electrolyte is
  - $\Lambda_m^0 / \Lambda_m$
  - $\Lambda_m - \Lambda_m^0$
  - $\Lambda_m / \Lambda_m^0$
  - $\Lambda_m^0 - \Lambda_m$



**( Descriptive )**

Time : 2 hrs. 30 min.

Marks : 50

**[ Answer question no.1 & any four (4) from the rest ]**

1. a. What do you mean by liquid junction potential? How EMF measurement is useful in the determination of activity coefficient of electrolyte? 5+5=10
- b. What are concentration cells? Derive expressions for the EMFs of concentration cell without transference.

2. a. What are the different types of electrochemical cells? 2+5+3
- b. Derive the equation =10

$$E = \frac{0.0591}{n} (\log K - \log \frac{[C]^c [D]^d}{[A]^a [B]^b})$$

- c. A zinc rod is placed in 0.1M solution of Zinc sulphate at 25°C. Assuming that the salt is dissociated to the extent of 95 percent at this dilution, calculate the potential of the electrode at this temperature?  $E^\circ (Zn^{2+}, Zn) = -0.76V$ .
3. a. What is electrode potential? Write the conditions of Standard electrode potential? 4+2+4
- b. Write the relation of electrical energy and free energy change of a cell reaction. =10
- c. For the Daniel cell involving the cell reaction  
 $Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$   
The standard free energies of formation of  $Zn(s)$ ,  $Cu(s)$ ,  $Cu^{2+}(aq)$  and  $Zn^{2+}(aq)$  are 0, 0, 64.4 kJ mole<sup>-1</sup> and -154.0 kJ/ mole<sup>-1</sup> respectively. Calculate the standard EMF of the cell?

4. a. Discuss Arrhenius theory of electrolytic dissociation. What are the limitations of the said theory? 5+3+2
- b. Define specific conductivity and equivalent conductivity. Deduce the relation between them. =10
- c. Find the expression for molar ionic conductance at infinite dilution in terms of limiting ionic mobility.

5. a. Explain the mechanism of high mobility  $H^+$  ions. Mention the factors on which conductance of an ion depend. 5+2+3  
=10
- b. Explain what do you mean by Debye-Hakenhagen effect.
- c. State and explain Walden's rule.
6. a. Why Clausius-Mosotti equation is not obeyed by polar molecules. How Debye improved upon that? 4+2+4  
=10
- b. Using Maxwell's relation and Clausius-Mosotti equation derive Lorentz-Lorenz equation.
- c. If  $\mu$  is dipole moment of mono substituted benzene then derive expressions for 1,2- and 1,3- disubstituted benzene. Use these expressions to find dipole moments of ortho, meta and para dichloro benzene given dipole moment of chloro benzene is 1.69 D.
7. a. Discuss molecular interpretation of paramagnetism. 3+4+3  
=10
- b. At  $25^\circ C$ , a coordinate compound ( $M = 200 \text{ g/mol}$ ) has density equal to  $3,24 \text{ g cm}^{-3}$ . If it contains three unpaired electrons, calculate the molar magnetic susceptibility and the magnetic susceptibility.
- c. Describe ferromagnetism and anti-ferromagnetism.
8. a. Describe briefly various types of electrodes which can be used for determining pH of a solution. 6+4=10
- b. Discuss the potentiometric titration of acid-base and precipitation.

== \*\*\* ==