8. Depict the conductometric titration plots for the titration of (i) Oxalic acid (aq) against NaOH (aq) and (ii) $MgSO_4$ (aq) against $Ba(OH)_2$. Give reason (s) in support of the plots.
4

9. Define solubility product of $BaSO_4$. A standard solution of $BaSO_4$ has the specific conductance $3.48\times10^{-6}$ $ohm^{-1}$ $cm^{-1}$ at 25°C. The specific conductance of water at 25°C is $5\times10^{-7}$ $ohm^{-1}$ $cm^{-1}$. Calculate the solubility and solubility product of $BaSO_4$. Given equivalent conductance at infinite dilution of $Ba^+$ and $SO_4^{2-}$ are 63.6 and 79.8 $ohm^{-1}$ $cm^2$g-eqv$^{-1}$ respectively. 1+3

10. On passing monochromatic light through a 0.04 mol $L^{-1}$ solution in a cell of 2 cm thickness, the intensity of the transmitted light was reduced to 50%. Calculate the molar extinction coefficient. What is the unit of molar extinction coefficient? 3+1



# B. Sc. Chemistry Examination, 2023

( 4th Semester )

## CHEMISTRY (CORE)

## Paper: CORE/Chem/TH/10

Time : Two Hours Full Marks : 40

**Use a separate answer script for each unit.**

### UNIT : 4101-P

1. Justify the statements: (***any three***) 2×3

   a) For a given concentration of solute, the freezing point depression is more than the elevation of boiling point.

   b) Colligative Properties of a given electrolytic solution are larger than the corresponding properties produced by the same concentration of a nonelectrolytic solution.

   c) In a binary solution, if one component behaves idealy the other will not.

   d) Nernst distribution law is in agreement with the phase rule requirements.

2. Answer ***any three*** questions : 3×3

   a) Compare the laws of osmotic pressure with equation of state for ideal gas.

b) Prove that expression of phase rule remains unchanged even if one of the components is missing in some of the phases present at equilibrium.

c) Derive the Konowaloff's statements from Duhem-Magules equation.

d) What effects do the pressure and impurities have on the CST?

e) Describe the phase diagram of a two-components system exhibiting simple eutectic behaviour.

3. a) The osmotice pressure of an aqueous solution of sucrose at 303 K is 2.47 atm. The molar volume of water at this temperature is 18.10 $cm^3$. Calculate the elevation of boiling point of this solution. Given $\Delta_{vap}H_1 = 539$ cal $g^{-1}$. 2

Or

Liquids A and B form an ideal solution. In a binary solution of A and B, mole fraction of A is 0.33. Calculate the composition of the vapour in equilibrium with the solution. Given: $P_A^0 = 75$ mm of Hg and $P_B^0 = 22$ mm of Hg. 2

b) Draw the Phase diagram of sulphur which exhibits the phenomenon of enantiotropy. How many triple points are possible at this phase diagram? 3



**UNIT : 4102-P**

Answer ***any five*** questions.

4. What should be the nature of the plot (with reason) of molar conductance ($\Lambda_m$) against concentration of HCl and $CH_3COOH$ in a particular cell? Does this plot give any information about the cell? 3+1

5. Write the evidences in favour of the Arrhenius theory of electrolytic dissociation. What are the limitations of the Arrhenius theory? 2+2

6. At 18°C, the resistance of 0.1 N KCl in a conductivity cell is 86.8 ohm and that of 0.05 N NaCl is 203 ohm. What is the equivalent conductivity of 0.05 N NaCl? (The specific conductance of 0.1 N KCl at 18°C is 0.011192 moh $cm^{-1}$). Write the mathematical representation of the Ostwald dilution law considering a sample binary electrolyte. 2+2

7. Write down the Debye-Hückel limiting law for any electrolyte clearly mentioning the significance of all the terms therein. Compare the plots of mean activity coefficients *vs.* ionic strengths for uni-univalent, uni-bivalent and uni-trivalent type electrolytes in aqueous solution at the same temperature. 3+1