

wavelength of light? If yes, how?

- iii) What's 'Inter System Crossing' or ISC? How is this forbidden process possible? 4
9. At 400 nm, absorbance of solutions I & II are A_I and A_{II} respectively. What will be the absorbance of the solution, obtained by mixing 1:2 volume ratio of I & II solutions, at the same wavelength? 4
10. Derive Stern-Volmer equation. Is Stern-Volmer constant an equilibrium constant? 4

B. SC. (CHEMISTRY) EXAMINATION, 2022

(2nd Year, 2nd Semester)

CHEMISTRY (CORE)

PAPER – CORE/CHEM/TH/10

Time : Two hours

Full Marks : 40

(20 marks for each unit)

Use a separate answer script for each Unit.

UNIT – 4101-P

1. Write brief notes on (*any three*): 2×3
- Ideal solution
 - Molal cryoscopic constant " K_f "
 - Lower critical solution temperature
 - Konowaloff's rule
2. Explain with diagram wherever necessary (*any three*): 3×3
- Lowering of vapor pressure of a liquid by a non-volatile solute is due to arrest of solvent molecules through solvation — Justify or criticize.
 - Gas pressure and osmotic pressure obey same type of equation (Ideality assumed in both cases) — Comment.
 - For a one component system like water, triple point is invariant whereas the freezing point is variable.

[2]

- d) At a certain external pressure, an azeotrope boils at a constant temperature, but it is not a chemical compound.
- e) Explain why a solution of NaCl in water has two components in spite of the fact that it has actually three species.
3. a) Liquid A and B form an ideal solution. In a binary solution of A and B the mole fraction of A is 0.33. Calculate the composition of the vapor in equilibrium with the solution. ($P_A^0=75$ mm of Hg and $P_B^0=22$ mm of Hg) 2

Or

What is the freezing point of a 0.01 molal solution of $K_3[Fe(CN)_6]$, which is 78% dissociated in water? [K_f for water = $1.85 \text{ K Kg mole}^{-1}$] 2

- b) Each of two phenol water mixtures with 30% and 70% by mass of phenol respectively becomes just homogeneous at the same temperature. Calculate the amounts of the two layers when a phenol water mixture containing 6g of each of components is equilibrated at this temperature. 3

[3]

UNIT – 4102-P

Attempt *any five* questions.

4. Discuss the effect of dilution (with reason) of an aqueous solution of acetic acid on the numerical values of (i) the degree of ionization (α) of acetic acid; (ii) pH of solution; (iii) conductivity of solution (κ); and (iv) thermodynamic ionization constant (pK_a). 4
5. How do conductivity (κ) and molar conductivity (Λ_m) of a strong electrolyte solution change with concentration? Give reason in support of your answer. 4
6. Depict the conductometric titration plots for the titration of (i) $AgNO_3$ (aq) against KCl (aq) and (ii) KCl (aq) against $AgNO_3$ (aq). Give reason(s) in support of the plots. 4
7. Draw the plots of $\log(\gamma_{\pm})$ versus \sqrt{I} for aqueous very dilute (i) 1-1 and (ii) 1-2 electrolyte solutions at 298 K. Indicate in each plot the values of ‘intercept’ and ‘slope’ (γ_{\pm} = mean ionic activity coefficient of the electrolyte and I = ionic strength of the electrolyte solution). 4
8. i) What are the relationships between ‘one quantum of energy of light (ϵ)’ and ‘speed of light in vacuum (c)’?
ii) What’s the ‘einstein’? Does its value depend on

[Turn over