

(4)

Answer *any two* questions.

CO4

1. (a) Show that fugacity of a real gas can be expressed by the relation :

$$f = P \left\{ \exp \int_0^P \frac{z-1}{P} dP \right\}, \text{ where the}$$

symbols have their usual significance.

- (b) At constant temperature free energy increases with increase in pressure - justify or criticize. 3+2=5

2. (a) Show that, any extensive property, J , of a thermodynamic system follows the additivity rule, $J = \sum_i n_i \bar{J}_i$, where $\bar{J}_i$ is the partial molar quantity.

- (b) Vapour pressure of water at 25 °C is 24 mm of Hg. In a solution of 0.2 molal glucose, the vapour pressure is found to be 23.90 mm of Hg. Calculate the activity coefficient of water and comment on the nature of the solution. 3+2

3. (a) Show that the chemical potential of an ideal system can be expressed in the form, $\mu_i = \mu_i^0(T) + RT \ln p_i$, where the symbols have their usual significance.

- (b) Write an expression of activities for components in an ideal liquid solution. How does the expression become modified for components in non-ideal liquid solution? 3+2

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BACHELOR OF SCIENCE EXAMINATION, 2025

(2nd Year, 1st Semester)

CHEMISTRY - IV

PAPER : CHEM/UG

Time : Two Hours

Full Marks : 40

(20 marks for each Unit)

Use a separate answer script for each Unit.

UNIT—304 I-a

Answer *any five* questions :

CO1

1. (a) What are Alkalides and Electrides? Draw the structure of [2, 2, 2] Cryptand.
- (b) Give the structure of dibenzo-18-crown-6. What is its biological importance?
- (c) To an aqueous solution of borax when phenolphthalein is added, the solution becomes pink. To this pink solution if glycerin is added in excess, then the solution turns colourless. Explain.

(2)

- (d) Sn(II) is strongly reducing but Pb(IV) is strongly oxidizing. Explain.
- (e) How would you prepare potassium perxenate? Perxenate and Perchromate both have the same geometry or different. Comment.
- (f) What are clathrate compounds of noble gases? Why does the boiling point increase from Helium to Xenon.
- (h) How does a silica garden form? Why does it have beautiful structure and coloration when colored salts are added? $2+2+2+2+2=10$

CO2

Answer *all* the questions.

2. (a) Explain the differences between N_2H_4 and H_2O_2 .
- (b) Aqueous solution of sodium thiosulphate turns turbid on exposure to water. Explain.
- (c) Fluorides cannot be oxidized chemically but can be oxidized electrochemically. Explain.
- (d) Freons deplete ozone layer in upper atmosphere. Explain.
- (e) Write a short note on 'Interhalogen Compounds' or 'Tetrasulfur tetranitride'. $2+2+2+2+2=10$

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[Continued]

(3)

Answer *all* the questions.

CO3

1. What is meant by the integral enthalpy of solution of a solute at a particular concentration? Enthalpy of neutralization of HCl by NaOH is $-57.32 \text{ kJ mol}^{-1}$ and by NH_4OH is $-51.34 \text{ kJ mol}^{-1}$. Calculate the enthalpy of dissociation of NH_4OH . $1\frac{1}{2}+1\frac{1}{2}$
2. What happens to the melting point of ice on increasing the pressure? Justify your answer through derivation of the appropriate equation for fusion equilibrium ($s \rightleftharpoons l$) mentioning all the assumption(s) and approximation(s).

(OR)

Consider a general reaction $\nu_1 A_1 + \nu_2 A_2 \rightleftharpoons \nu_3 A_3 + \nu_4 A_4$ and explain what will happen to the position of equilibrium subsequent to addition of an inert gas when $\Delta \nu \neq 0$. 4

3. Starting from the necessary thermodynamic proof of Le Chatelier's principle, show what will happen to the advancement ξ (xi) of an exothermic reaction at equilibrium and at constant pressure when the temperature is decreased.

(OR)

Show that for gaseous equilibrium $\frac{d \ln K_c^\circ}{dT} = \frac{\Delta U^\circ}{RT^2}$ where

$$K_p^\circ = K_C^\circ \left(\frac{C^\circ RT}{P^\circ} \right)^{\Delta \nu} \quad 3$$

CHEM-1064

[Turn Over]