

[23/A-3]

SARDAR PATEL UNIVERSITY

M. Sc. FIRST SEMESTER Examination 2016

Wednesday, 26th October 2016, 10.00 a.m. to 1.00 p.m.

Course – PS01CCHE03, Physical Chemistry

N.B. Figures to the right of each of the question indicate marks.

Total Marks: 70

1. Choose appropriate answer of the followings (ONLY CODE)

[08]

- (i) Fugacity in pure gas utilizes.
 (a) Temperature (b) Pressure
 (c) Chemical Potential (d) Free energy
- (ii) The value of α for high pressure is
 (a) $-V + RT/P$ (b) $-V + P/RT$ (c) $-V - RT/P$ (d) $-V - P/RT$
- (iii) For dilute solution Henry's obey by _____ and Raoult's law obey by _____
 (a) solvent, solute (b) solvent, solvent (c) solute, solvent (d) solute, solute
- (iv) In open system exchange of
 (a) only energy (b) mass & energy (c) only mass (d) pressure
- (v) The rotational partition function is given by
 (a) $Q_{rot}^0 = b I / \sigma$ (b) $Q_{rot}^0 = b \sigma / I$ (c) $Q_{rot}^0 = \sigma I / b$ (d) $Q_{rot}^0 = b I / m$
- (vi) $\int_{V^*}^V \frac{RT}{V-b} dV$ equal to
 (a) $RT \ln \frac{V-b}{V^*-b}$ (b) $RT \ln \frac{V+b}{V^*+b}$ (c) $RT \ln \frac{V+b}{V^*-b}$ (d) $RT \ln \frac{V+b}{V^*+b}$
- (vii) The value of $C \cdot \frac{d\rho}{dc}$ is equal to
 (a) $V \frac{d\rho}{dV}$ (b) $-V \frac{dV}{d\rho}$ (c) $-V \frac{d\rho}{dV}$ (d) $\frac{d\rho}{dV}$
- (viii) When ΔG is ----- then reaction is feasible
 (a) Zero (b) Negative (c) Positive (d) positive and negative

(1)

2.

Attempt any SEVEN

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- (i) Define the term Thermodynamic and derive the equation $dF = Vdp$
- (ii) Write short note on fugacity of solid.
- (iii) Derive the equation for free energy function.
- (iv) Prove that "there no heat change upon mixing the components of ideal solutions"
- (v) Justify that the nature of the standard state is of no thermodynamic significance.
- (vi) What is dilute solution? Discuss its characteristics.
- (vii) Discuss the thermodynamic significance of partial molar properties.
- (viii) Derive the equation $\bar{G}_2 = n_2 \left(\frac{d\Phi_G}{dn_2} \right)_{T,P,n} + \Phi_G$
- (ix) For a gas at 0°C $PV = RT (1 - 9.93 \times 10^{-4} P + 2.19 \times 10^{-6} P^2)$ calculate the fugacity at 10 atm. pressure

3.

- (a) Derive the various relations for chemical potential for mixture of ideal gas. 06

OR

- (a) Derive the equation $\ln f = \frac{b}{V-b} - \frac{2a}{RTV} - \ln \frac{(V-b)}{RT}$ 06

- (b)
 1. The fugacity of NH_3 gas at 200°C and 100 atm. Is 82.2 atm. Find out the fugacity for NH_3 gas at 225°C and 100 atm. The value of ΔH is 621 cal/mole
 2. Derive the equations for the variation of fugacity of a gas in a mixture with temperature

4.

- (a) What is thermodynamic equilibrium? Derive the equation for various forms law of equilibrium. 06

- (b)
 1. Derive the equation $K'_N = \frac{C_L^l \times C_M^m}{C_A^a \times C_B^b} \left(\frac{M_o}{1000\rho_o} \right)^{\Delta n}$ 06

2. Derive the equation for general form of reaction isotherm and discuss the significance from chemical point of view.

OR

- (b) Derive the various forms reaction isochore. 06

②

5. (a) Discuss the freezing point method for determination of molecular weight of dilute solution. [06]
- (b) 1. Discuss the convenient standard state and reference state for solute. [06]
2. Derive the equation for determination of activity of solid using EMF method.

OR

- (b) The boiling point elevation of a solvent is observed to be 2.3 K, when 13.86 gm of solute is added to 100 gm of solvent. Calculate λ and ΔH_{vap} of the solvent. Molar mass of solvent is 78 g/mole its boiling point is 80°C and molar mass of solute is 154 g/mole. [06]
6. (a) What is electrolyte? Derive the equation for mean ionic activity for strong electrolyte. [06]
- (b) Derive the equation for determination of partial molar property from density measurements. [06]

OR

- (b) For one mole of solution of ethanol in water at 25°C in which $X_{\text{EtOH}} = 0.375$ and density is 0.8859 g/ml and partial molar volume of ethanol is 57.4 ml/mole. Find out partial molar volume of water and apparent molar volume in this solution. $M_{\text{H}_2\text{O}} = 18.02$ g/mole and $M_{\text{EtOH}} = 46.7$ g/mole [06]

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