

[48]

SEAT No. _____

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SARDAR PATEL UNIVERSITY

M.Sc Chemistry, First Semester Examination

Friday, Date: 22-11-2019

Time: 10:00 am to 01:00 pm

Subject: Physical Chemistry-I Paper: PS01CCHE03

N.B. (1) Figures to the right indicate marks.

(2) Attempt all questions.

[Total marks: 70]

Q.1 Choose the correct option from the following.

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- If the internal energy of an ideal gas decreases by the same amount as the work done by the system then the process is ____
(a) cyclic (b) isothermal
(c) adiabatic (d) isolated
- When heat is supplied to an ideal gas in an isothermal process the ____
(a) gas will do positive work
(b) gas will do negative work
(c) kinetic energy of gas will increase
(d) gas will not obey the law of conservation of energy
- The equilibrium of the reaction $N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$
(a) $K_p > 1$ (b) $Q < K_p$
(c) $Q = K_p$ (d) $Q < 2K_p$
- For any chemical reaction to be spontaneous
(a) $\Delta G > 1$ (b) $\Delta G < 1$
(c) Reaction should be in equilibrium (d) $\Delta G = 0$
- According to Raoult's law the relative decrease in solvent vapour pressure over the solution is equal to
(a) vapour pressure of solvent
(b) mole fraction of solute
(c) the number of moles of solute
(d) "i" times the mole fraction of solute which undergoes dissociation or association in the solvent
- The azeotropic solution of two miscible liquids
(a) can be separated by simple distillation
(b) may show positive or negative deviation from Raoult's law
(c) are super saturated solution
(d) are saturated solution
- The partial molar property is an
(a) Extensive property
(b) Intensive property
(c) Bulk property
(d) All of these
- The molar volume of water at 25 °C is
(a) 18.068 (b) 17.962
(c) 18.00 (d) 18.150

①

CP:TO

Q.2 Answer the following questions. (Any seven)

14

1. Explain the Graphical method for determining fugacity.
2. Write a note on fugacity of solids and liquids.
3. Derive an expression: $F_2 - F_1 = RT \ln f_2/f_1$
4. Give the confirmation for the 3rd Law of Thermodynamics.
5. State thermodynamics significance of reaction isotherm.
6. Mention the application of free energy function.
7. Explain the Ideal form of Henry's Law.
8. Define: Apparent molar property and derive the expression for it.
9. Derive an expression for mean ionic activity coefficient.

Q.3 A What is fugacity? Derive an expression $\ln f = \ln P - \frac{1}{RT} \int_0^P \alpha dp$

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

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OR

B Discuss the Lewis Randall rule for determination of fugacity of a gas in gaseous mixture.

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Q.4 A What is Metathesis? Derive an equation for equilibrium constant for Metathesis reaction.

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B Write Van't Hoff equation and integrate this equation without limits of integration.

06

OR

B Explain thermodynamic equilibrium. Derive the equation for various forms law of equilibrium.

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Q.5 A Discuss the osmotic pressure method for determination of activity of solution.

06

B What is non ideal solution? Discuss about the solution exhibiting positive and negative deviation from ideal behavior.

06

OR

B Derive the Duhem-Margulas equation. Explain its use in understanding the positive and negative deviations of binary solutions from ideal behavior.

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Q.6 A Discuss method of intercept for determining partial molar properties.

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B Derive the following equation, $\bar{V}_2 = \frac{M_2}{1000 (\rho - C \frac{d\rho}{dC})}$

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OR

B Using the expression for V as a function of m for aqueous NaCl at 25° C,

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$$V = 1002.94 + 16.40m + 2.140 \cdot m^{3/2} + 0.027 m^{5/2}$$

Find V_{NaCl} and V_{H_2O} in a 1 molal solution.

($V_1 = 180.6$ ml/mole, molecular mass of water = 18.02 gm/mole)

