PARUL UNIVERSITY
PARUL INSTITUTE OF APPLIED SCIENCES
MID SEMESTER INTERNAL EXAMINATION, MARCH 2020
M. Sc Semester II/ IMSC semester VIII
Subject: Chemistry

Paper Code: 11205153 | **Title of the paper: Physical Chemistry II**
Date: 4/03/2020 | **Time: 1 hrs 30 min**
Maximum Marks: 40

Instructions:
1. **All questions are compulsory and options are given in first and second question only**
2. **Numbers to the right of question indicate the marks of respective question**

Q. 1 Attempt any **ONE** question of the following: **(08)**

(i) Discuss the Raoult's law for ideal solutions and it's deviations for non ideal solutions.

(ii) (a) State the procedure of the Apparent molar properties method for determining the value of the $\overline{G}_2$ for the case of solution whose concentration is expressed in terms of molality.

(b) Using the expression for V as a function of m for aqueous NaCl solution at 25°C:

$V = 1002.94 + 16.40\ m + 2.140\ m^{3/2} + 0.0027\ m^{5/2}$ ml

Find $\overline{V}_{NaCl}$ and $\overline{V}_{H_2O}$ in a 1 molal solution

[Given: Molecular weight of water. is 18.069].

Q. 2 Attempt any **THREE** questions of the following: **(12)**

(i) Define the term mean ionic activity coefficient and derive the equation of it for electrolytes.

(ii) A solution of A and B with 30 mole percent of A is in equilibrium with its vapor which contains 60 mole percent of A. Assuming ideality of the solution and the vapor, calculate the ratio of the vapor pressure of pure A to that of pure B.

(iii) What is the experimental procedure for determining the value of $\overline{V}_i$ from density measurements?

(iv) Calculate the fugacity of one mole of ethane gas at 25°C and 200 atm pressure. Given the integral value $\int_0^P (V - \frac{RT}{P})\, dP$, evaluated graphically is -20 under this condition of temperature and pressure.

(R = 1.9872 cal K^{-1} mol^{-1}, R = 0.082054 lit. atm. deg^{-1} $mole^{-1}$)

(v) How one can determine the fugacity of a gas present in the gaseous mixture which is formed with volume change upon mixing the gases?

Do as directed. Attempt all **FIVE** questions.

(i) Give the two names of methods for determination of mean ionic activity coefficient.

(ii) Define the term tie line.

(iii) Why the concept of Fugacity has been introduced?

(iv) Define the term: Partial Molal Property

(v) State the thermodynamic significance of partial molar properties.

Write correct option in your answer sheet for following 15 multiple choice questions. (15)

1 A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one is the correct statement for the behavior of the solution?

(A) The solution is an ideal solution
(B) The solution is non-ideal showing +ve deviation
(C) The solution is non-ideal showing -ve deviation
(D) n-heptane shows +ve deviation while ethanol shows -ve deviation

2 For NaCl electrolyte the value of mean ionic activity is....

(A) $m^2\gamma_{\pm}^2$
(B) $m^1\gamma_{\pm}^1$
(C) $m^3\gamma_{\pm}^3$
(D) $m^4\gamma_{\pm}^4$

3 For a 0.5 molal solution of Na_2SO_4 the value of ionic molality is...

(A) 0.5
(B) 0.25
(C) 0.94
(D) 0.79

4 For an ideal solution the value of γ will be.....

(A) 0
(B) 1
(C) > 1
(D) None of them

5 According to Raoult's law the value of P_{total} is .....

(A) $P_{total} = P_2^s - N_1(P_1^s - P_2^s)$
(B) $P_{total} = P_1 + P_2$
(C) Both A and B
(D) None of the above

6 The system which shows positive deviations from Raoult's law is....

(A) Ethanol-Acetone
(B) Cyclohexane- Carbon tetrachloride
(C) Acetone- Chloroform
(D) Water- Nitric acid

7 The concept of partial molar property is applicable to only....

(A) closed system
(B) isolated system
(C) open system
(D) none of the above

8 The value of the extensive property, G, of the homogeneous system is a function of the variables such as....

(A) temperature only
(B) pressure only

(C) amounts of various constituents only

(D) temperature, pressure and amounts of various constitutents

MCQ 9 According to the Generalized method, the value of the fugacity can be evaluated by the use of…

(A) generalized fugacity curves

(B) generalized compressibility curves

(C) generalized (H*-H)/T curves

(D) none of the above

MCQ 10 The Lewis-Randall rule is based on the consideration that…

(A) there is a volume change when the gases are mixed

(B) there is a double volume change when the gases are mixed

(C) there is no volume change when the gases are mixed

(D) none of the above

MCQ 11 The concept of fugacity is based on the use of …

(A) entropy functions

(B) free energy functions

(C) enthalpy functions

(D) none of the above

MCQ 12 The unit of apparent molar volume is…

(A) $ml.atm^{-1}.deg^{-1}$

(B) $ml.mole^{-1}$

(C) $ml.mole^{-1}.deg^{-1}$

(D) none of the above

MCQ 13 *For a solution having a definite composition the value of the apparent molar property may be determined graphically by the….*

(A) slope of the tangent

(B) slope of the chord

(C) slope of the both

(D) none of the above

MCQ 14 For a real gas, at higher values of pressure, the value of the ~~ration of~~ f/P is…

(A) constant

(B) zero

(C) not costant

(D) none of the above

MCQ 15 The value of the molar volume (V) of a real gas is…

(A) $\frac{RT}{P} - \alpha$

(B) $\frac{RT}{P} + \alpha$

(C) $\frac{RT}{P}$

(D) none of the above

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