Roll No. ....

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337202

May, 2019

B.Sc. (CHEMISTRY), II SEMESTER

PHYSICAL CHEMISTRY-II (BCH-202)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Log tables and non-programmable calculators are allowed.*

PART–A

1. (a) What are colligative properties? Explain. (1.5)

(b) Write the criteria for a system to be in thermodynamic equilibrium. (1.5)

(c) Define partial molar quantities. (1.5)

(d) Explain inversion temperature. (1.5)

(e) Define enthalpy of formation. (1.5)

(f) Differentiate between intensive and extensive properties with examples. (1.5)

(g) What are path functions? Explain with example. (1.5)

(h) State the second law of thermodynamics. (1.5)

(i) Explain Henry's law with one application. (1.5)

(j) What is Van't Hoff factor? What does it signifies if it value is less than 1. (1.5)

PART–B

2. (a) Explain Joule-Thomson effect in detail. Derive an expression for the Joule-Thomson coefficient and give its significance. (10)

(b) Derive an expression for the work done by an ideal gas in reversible isothermal expansion. (5)

3. (a) Derive the Kirchhoff's equation and give its physical significance. (5)

(b) Explain in detail chemical potential? Derive Gibbs-Duhem equation. (10)

4. (a) Derive the Gibb's-Helmholtz equation. (5)

(b) Give the thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. (10)

5. (a) Differentiate between reaction quotient and equilibrium constant of a reaction and derive a relation between K_p, K_c and K_x. (5)

(b) Explain in detail the Le Chatelier's Principle. Write the favorable conditions for the following reaction to proceed in forward direction :

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$
$$\Delta H = +59.0 \text{ kJ/mol}$$
(10)

6. (a) What is osmotic pressure? Derive an expression for the molar mass of the non-volatile solute dissolved from osmotic pressure measurements. (5)

(b) 1.20 g of a non volatile solute was dissolved in 100 g of acetone at 20°C. The vapour pressure of the solution was found to be 182.5 torr. Calculate the molar mass of the substance (vapour pressure of acetone at 20°C is 185.0 torr). (5)

(c) Explain Raoult's Law. What are positively and negatively deviatiating solutions from ideal behavior. (5)

7. Define heat capacity of substances and derive a relation between the two types of heat capacities of ideal gases. The heat capacity at constant volume of an ideal gas is found 12.47 J K^{-1}. Calculate the heat capacity at constant pressure for the gas. (15)