BACHELOR OF Engineering (FTBE)SUPPLEMENTARY EXAMINATION, 2017

(1^{ST} Year,1^{ST} Semestar)

PHYSICAL CHEMISTRY

Time : Three Hours Full Marks : 100

(50 marks for each part)

Use a separate Answer-Script for each part

PART – I

Answer Question number 1 and any three from the rest

1. Define the following terms (any three) : 3x4 =12

(i) Entropy

(ii) Isomorphism in crystals

(iii) Enthalpy

iv) Unit cell in crystalline solids

(v) Internal energy

vi) Gibbs free energy

(Vii) Ideal solution

2.a) Efficiency of Carnot heat engine $h = T_1 - T_2/T_1$, where T_1 and T_2 are the temperature of source and sink respectively. 7

b) For isothermal reversible expansion of one mole of an ideal gas at 300 K from 2 litres to 20 litres, what is the work done? 5

3.a)Define thermodynamic systems with examples . 7

b) The boiling point of a liquid at 1 atm is 323K and heat of vaporization is 17 $KJmol^{-1}$. Calculate the pressure of vaporization of liquid at 298K. 5

4. a) Deduce Gibbs-Duhem relations for a non-volatile solute dissolved in a solvent at constant temperature and pressure. 7

b) A heat engine operating between 100^0C (source) and 50^0C(sink). What is the efficiency of the engine? 5

5. a)Derive Duhem-Margules equation for two component system. 7

b) A sample of gas initially at 25^0C is compressed from 25 litres to 5 litres adiabatically and reversibly. Calculate the final temperature ($C_v = 2$ cal mol^{-1}). 5

6. a) Define crystalline solids and amorphous solids? 5

b) What is Bravais lattices in a crystal system ? 3

c) Define atomic heat of solids. 2

B. FTBE 1st Year 1st Sem Supplementary Exam- 2017

Physical Chemistry **Full marks: 50**

Part – II

Instructions: Use *separate answer scripts* for Part-II questions

Answer *Q.1* and *any two* from the rest

1. Write short notes on: (Answer *any four*): $4 \times 4^{1}/_{2} = 18$

i. Boyle's Law

ii. Ideal gas equation

iii. Hydrogen bonding

iv. Colligative properties

v. Dispersed phase and dispersion medium

vi. Faraday-Tyndall Phenomenon

2 (a) Draw representative curves for an isotherm, an isobar and an isochore.

(b) Write down four important assumptions of Kinetic Molecular Theory for discussing the behavior of ideal gases.

(c) Two vessels separately contain two ideal gases *A* and *B* at the same temperature. The pressure of *A* is twice that of *B*. Under these conditions, density of *A* is found to be 1.5 times the density of *B*. Find the ratio between the molecular weights of *A* and *B*.

(d) Write down the vander Waal's Equation of state for *n* moles of a real gas. Define all the terms involved in this particular equation.

$4 + 4 + 4 + 4 = 16$

3(a) From our daily life, provide examples of two different phenomenon, which works on the basis of surface tension. Mention four important factors which influence the surface tension of a liquid.

(b) Write down the equation for Stoke's law and define the terms involved.

(c) What do you mean by velocity gradient? Write down the dimension and unit of velocity gradient.

(d) Provide one example for each category of the solutions mentioned below:

(i) a solution of a gas (solute) in a liquid (solvent)

(ii) a solution of a solid (solute) in a liquid (solvent)

(iii) a solution of a solid (solute) in a gas (solvent)

(iv) a solution of a liquid (solute) in a liquid (solvent)

$(2+2) + (2+2) + (2+1+1) + (1+1+1+1) = 16$

4(a) Provide one example for each category of the colloidal solutions mentioned below:

(i) Where dispersed phase is solid and dispersion medium is liquid
(ii) Where dispersed phase is solid and dispersion medium is gas
(iii) Where dispersed phase is liquid and dispersion medium is liquid
(iv) Where dispersed phase is liquid and dispersion medium is gas

(b) 30 gm of urea is dissolved in water to produce a 2 lit. aqueous urea solution. The molar mass of urea is 60 gm per mole. Determine the concentration of the solution in % weight/volume and calculate the molarity of the solution.

(c) Suppose two volatile liquids *A* and *B* are mixed to prepare a solution which behaves ideally. Write down the expression of the total vapor pressure (P_{soln}) of the resulting solution using Raoult's Law and explain the terms involved. Provide two examples where this equation is maintained.

(d) What will be the boiling point of :

(i) 4 molal aqueous glucose solution

(ii) 4 molal aqueous NaCl solution.

Given boiling point of pure water is 100°C, molal elevation constant of water is 0.5^0C molal^{-1} and van't Hoff factor (i) for NaCl is 2

$(1+1+1+1) + (2+2) + (2+2) + (2+2) = 16$