BACHELOR OF ENGINEERING IN FOOD TECHNOLOGY AND BIOCHEMICAL

EXAMINATION, 2018

(1st Year, 1st Semester)

PHYSICAL CHEMISTRY

Time : Three hours Full Marks : 100

(50 marks for each part)

Use Separate Answer scripts 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 and its physical significance

(ii) Enthalpy and its physical significance

(iii) Unit cell and Miller indices

(iv) Thermodynamic systems

(v) Gibbs free energy and its physical significance

(vi) Rational intercepts and Bravais lattice

2. a) No heat engine is more efficient than a Carnot heat engine – justify 7

b) For isothermal reversible as well as for irreversible expansion of three moles of an ideal gas at 300 K from 2 litres to 10 litres, what are the work done? 5

3. a)Define First law of thermodynamics and justify the need of second law. 7

b) The boiling point of a liquid at 5 atm is 323K and heat of vaporization is 50 $KJmol^{-1}$. Calculate the pressure of vaporization of liquid at 300K. 5

4. a) Define chemical potential and hence deduce Duhem -Marguels relations for two component solvent systems . 7

b) A heat engine operating between 175^0C (source) and 127^0C(sink). What is the efficiency of the engine? If the temperature of the source is increased by 15^0C, and the sink by 10^0C what will be the efficiency? 5

5. a)Derive Clapeyron-Clausius equation for two phase system . 7

b) An ideal gas initially at 300K is compressed from 15 litres to 5 litres adiabatically and reversibly. Calculate the final temperature (C_v = 3 cal mol^{-1}).5

6. a) Distinguish crystalline solids and amorphous solids? 4

b) Define isomorphism in a crystal system and give relations between inter atomic spacing and glancing angle in a crystal system using Bragg equation. 3

c) Define atomic heat of solids. 1

d) If the Weiss indices of a plane be 110, what are its Miller indices? 1

e) Calculate C_v for Al at 4K using Debye equation (θ= 389). 3

For neatness and cleanness -2

PART II

Answer ***Q.7*** and any ***two*** from the rest.

7. Answer ***any six*** :

   i) Write down Van der Waal's Equation for 'n' moles of a real gas, mentioning the units of the constants 'a' and 'b'.

   ii) Gold number of Albumin is 0·2 - explain.

   iii) Explain the terms Surface Tension and Surface Energy.

   iv) What is Boyle Temperature ?

   v) What is the Van't Hoff factor 'i' ?

   vi) What is Joule-Thomson cooling ?

   vii) Distinguish between, fog, smoke, soap foam, milk, pumice stone, curd.

   viii) What is reverse osmosis ?

   ix) Carbon dioxide gas cannot be liquified by applying high pressure above 31·1^{o}C - explain.

   x) State and explain the Law of Rectilinear Diameters. (6×3=18)

8. a) From the equation $PV = \frac{1}{3} mnc^2$, derive

   (i) Boyle's Law (ii) Avogadro's Law.

   b) Distinguish between the properties of Lyophilic and Hyophobic colloids.

   c) Write a short note on Beckmann Thermometer.

   d) State the Laws of osmotic Pressure.

   A stream of dry air was passed through a bulb containing a solution of 7·50 gm of an aromatic Compound in 45.0 gm of water and then through another bulb containing pure water. the loss in weight of the first globe was 2·810 gm and in the second globe it was 0·054 gms.

   Calculate the molecular weight of the aromatic compound. 4+4+4+4=16

9. a) Define ''coefficient of viscosity''. How is it determined using the ostwald viscometer ?

b) What are the major inadequacies of Van der Waal's Equation in explaining Andrew's curves.

c) State the Hardy-schulze rule and explain with examples.

d) Calculate, (i) r.m.s. velocity. (ii) average velocity (iii) most probable velocity, of CO_2 molecules at 1000^oC.

e) What minimum pressure must be applied to a 0.4M aqueous potassium nitrate solution at 30^oC to initiate reverse osmosis ? 4+4+3+3+2=16

10. a) Describe an efficient process for the liquifaction of gases. What principles are applied to increase the efficiency ?

b) How are molecular velocities distributed in a gas ? What is the effect of temperature on the distribution ?

c) Describe the preparation of a colloid by :

(i) condensation method (ii) dispersion method.

d) At 20^oC, 20 ml of water gave 58 drops and the same volume of ether gave 172 drops in the same stalagmometer. The density of ether is 0.7 pa/cc and the surface tension of water is 72 dynes/cm. Calculate the surface tension of ether. 5+4+4+3=16