Seat No. : _____

DP-113

December-2013

M.Sc. Sem. I

CHE-403 : CHEMISTRY

(Physical Chemistry)

Time : 3 Hours] [Max. Marks : 70

Instruction : (1) All questions carry equal marks.
(2) Necessary constants.

$N = 6.022 \times 10^{23}$ mole^{-1}

$k = 1.38 \times 10^{-16}$ ergs. K^{-1} = 1.38×10^{-23} J.K^{-1}

$h = 6.626 \times 10^{-27}$ ergs. sec. = 6.626×10^{-34} J.sec.

$c = 2.998 \times 10^{10}$ cm. sec^{-1} = 2.998×10^{8} m. sec^{-1}.

$R = 8.314 \times 10^{7}$ ergs. K^{-1}.M^{-1}

= 8.314 J K^{-1}.M^{-1}

= 1.987 Cal. K^{-1}.M^{-1}

F = 96500 C.

1. (A) Derive an equation for the approximate calculation of the fugacity of a gas. 7

OR

State the third law of thermodynamics. Show how the absolute entropy of a substance can be determined with the help of this law.

(B) Derive Gibbs-Duham equation. 7

OR

(B) (I) The activity of 2.5 moles of substance changes from 0.05 to 0.35. What would be the change in it's free energy at 300 °K ? 4

(II) What is fugacity of gas when its activity coefficient is 0.930 at 20 atmosphere pressure ? 3

2. (A) Discuss Lindemann theory of unimolecular reactions. 7

OR

Explain the mechanism and kinetics of chain reaction between hydrogen and bromine.

P.T.O.

(B) (I) Derive theory of absolute reaction rate. 4

(II) At 350 °K, the frequency factor (A) has value of 1.20×10^{10} second^{-1} for a reaction.

$$1/2\ Cl_2 + H_2 \rightleftharpoons HCl + 1/2\ H_2$$

Calculate the entropy of activation (ΔS^*) 3

OR

(B) (I) Write a note on enzyme catalyzed reaction. 4

(II) Calculate the frequency factor (A) for the unimolecular decomposition of an organic substance at 285 °C. The value of entropy of activation (ΔS^*) is 13.15 Cal. Mol^{-1}.deg^{-1} (e.u.) 3

3. (A) Derive an equation to calculate number of Schottky defects in solids. 7

OR

Discuss defects in Solids.

(B) Discuss super conductivity. 7

OR

Classify materials into conductors, Semiconductors and insulators. Explain on what basis this classification is made.

4. (A) Derive Gibbs adsorption isotherm equation and explain positive and negative surface activity from it. 7

OR

Discuss any two methods for determining the surface area of adsorbents.

(B) What is micelles ? Explain critical miceller concentration. 7

OR

(B) (I) Give the difference between Physical adsorption and Chemical adsorption. 4

(II) In the study of adsorption of nitrogen gas on Fe-Al_2O_3 at 77 °K, the area occupied by a molecule of nitrogen is 16.2 $\AA^2$. If specific area of Al_2O_3 is 12.46 meter^{-2} $\cdot$gm^{-1}. Calculate the value of V_m in BET isotherm. 3

14

5. Answer in brief (one mark each) :

(1) What is fugacity ?

(2) Define ideal solution.

(3) Define activity coefficient.

(4) What is chain reactions ?

(5) Define order of the reaction.

(6) Define chain length.

(7) Define Unit cell.

(8) Define Schottky defects.

(9) If the Miller indices are 1.10, then to which axis the given plane is parallel ?

(10) Define Detergents.

(11) What is Sorption ?

(12) Define Absorption.

(13) Define Adsorption isotherm.

(14) What is Enzyme ?