Exam Seat No:_____ **Enrollment No:**_____

C.U.SHAH UNIVERSITY

WADHWAN CITY

University (Winter) Examination -2013

Course Name : M.Sc Sem-I **Subject Name: - Physical Chemistry**

Duration :- 3:00 Hours **Date : 6/12/2013**

Instructions:-

(1) Attempt all Questions of both sections in same answer book / Supplementary.
(2) Use of Programmable calculator & any other electronic instrument is prohibited.
(3) Instructions written on main answer Book are strictly to be obeyed.
(4) Draw neat diagrams & figures (If necessary) at right places.
(5) Assume suitable & Perfect data if needed.

SECTION-I

Q-1 **Answer the following short questions (Compulsory)** (07)

1. Which scientist has introduced the concept of fugacity?
2. Write down the definition of Phase space.
3. Give the expression for Gibb's free energy (F).
4. What is the activity (a)?
5. Write down the definition of fugacity.
6. Give the definition of microstates.
7. Define the term: Ideal gas

Q-2
1. Determine the fugacity by using Graphical Method. (05)
2. Discuss the Bose–Einstein Statistics in detail. (05)
3. Define four Laws of the thermodynamics. (04)

OR

Q-2
1. Derive the fugacity by equation of state method. (05)
2. Discuss the mixture of real gases. (05)
3. Explain the thermodynamic functions such as the Helmholtz energy and the pressure. (04)

Q-3
1. Derive the Boltzmann-Maxwell equation. (05)
2. Discuss the Fermi–Dirac derivation. (04)
3. A thermodynamic assembly consists of five independent particles having access to two energy levels. A particular particle distribution for this system and the associated degeneracies for each energy level are as follows: (05)
(1) $N_1 = 2$, $g_1 = 4$; (2) $N_2 = 3$, $g_2 = 6$. Determine the number of microstates for this macrostate if the particles are (a) bosons and (b) fermions.

OR

Q-3
1. Explain the generalized method for the determination of fugacity. (05)
2. Discuss the variation of fugacity with pressure and temperature. (05)
3. Define the partition function and express the approximate method for the fugacity equation. (04)

SECTION-II

Q-4 Answer the following short questions (Compulsory) (07)

1. Define the homogeneous and heterogeneous system.
2. What is the chemical equilibrium?

3. Define the terms: Solute, Solvent
4. Give the definition of enthalpy.
5. Define: Entropy
6. Give the definition of fractional distillation.
7. What is the mole fraction (N)?

Q-5 1. Explain the Duham-Margules equation. (05)

2. Explain the effect of temperature on vapour liquid equilibrium of ideal solution. (05)

3. Calculate the Free energy ($\Delta F°$) for the following reaction: (02)

$\frac{1}{2} H_{2\,(g)} + \frac{1}{2} Cl_{2\,(g)} \rightarrow H^{+}_{(aq)} + Cl^{-}_{(aq)}$

Where, $\Delta H° = -39{,}940$ Cal., $S_{H_2\,(g)} = 31.21$ E.U. mole^{-1}, $S_{Cl_2\,(g)} = 53.31$ E.U. mole^{-1}, $S_{Cl^-\,(aq)} = 13.5$ E.U. mole^{-1} and $S_{H^+\,(aq)} = 0$.

4. From the measurements of the Std. entropy change $\Delta S°$ is found to be -4.61 E.U.mole^{-1} at 25 °C. The Std. entropy of solid zinc $S_{Zn(s)}$ is 9.95 E.U.mole^{-1} of hydrogen gas $S_{H_2\,(g)} = 31.21$ E.U. mole^{-1} at 25 °C. Calculate the Std. entropy of the zinc ion $S_{Zn^{+2}\,(aq)}$? (02)

OR

Q-5 1. Express the dissociation constant of water. (05)

2. Prove that there is no heat and volume change upon mixing composition of an ideal solution. (05)

3. Calculate the equilibrium constant (K) for the $Sn/Sn^{++}/Pb/Pb^{++}$ cell where, $\Delta E°$ is 0.821. (02)

4. Calculate the equilibrium constant (K) for the $Pt/Sn^{+2}/Sn^{+4}/Fe^{+3}/Fe^{+2}/Pt$ cell where, oxidation potential ($E_{Sn^{+2}/Sn^{+4}}$) is -0.15 and $E_{Fe^{+3}/Fe^{+2}}$ is -0.771 Volt at 25 °C. (02)

Q-6 1. Calculate the values at 25 °C of $\Delta F°$, $\Delta S°$ and $\Delta H°$ for the reaction, (04)

$2NO_{(g)} + 3/2\ O_{2(g)} + H_2O_{(l)} \rightarrow 2H^{+}_{(aq)} + 2NO_3^{-}{}_{(aq)}$

	$NO_{(g)}$	$O_{2(g)}$	H_2O	$H^{+}_{(aq)}$	$NO_3^{-}{}_{(aq)}$
Free Energy (Kcal)	20.66	0	-56.70	0	-26.25
Heat content (Kcal)	21.60	0	-68.32	0	-49.50
Entropy (E.U.)	50.34	49.00	16.75	0	35.0

2. Write on the dissociation constant of weak acid. (05)

3. Write the application of Rault's law to both constituent of an ideal solution. (05)

OR

Q-6 1. Discuss the vapour pressure curves for the ideal solution and show that total vapour pressure varies in a linear manner with the mole fraction of other component. (05)

2. Prove that $P = \frac{P_1^o P_2^o}{P_1^o + N_1^l (P_2^o - P_1^o)}$ composition of liquid and vapour in equilibrium. (05)

3. Explain the Van't Hoff Equation. (04)

******6********


C U SHAH UNIVERSITY
VARDHMAN BHARTI TRUST
EMPOWERING YOUR DESTINATION