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Total number of printed pages – 3

B. Tech
BS 1103

First Semester Regular Examination – 2014

CHEMISTRY – I

BRANCH : B. TECH

QUESTION CODE : H 454

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.*



1. Answer the following questions :

2 × 10

- Show that δG for any phase change transition is always Zero.
- What are the condition that wave function must satisfy ?
- What do you mean by Eutectic temperature and Critical temperature ?
- Calculate Free energy change when 5 mole of oxygen at 300K and 5 bar pressure expand isothermally to 1 bar pressure.
- How much heat evolved when 266gm of white P_4 burn in air ?
- Write down cell reaction of Dry cell .and Fuel cell.
- If $K < 1$ then what is the condition of reactant and product at equilibrium.
- What do you mean by enzyme catalyst ? Give an example of enzyme catalytic reaction.
- Sodium crystallizes in a body centered cubic lattice with cell edge = 4.29 \AA . What is the radius of sodium atom ?
- The kinetics of second order reaction changes in to first order when one of the reactions is taken in large excess. Why ?

P.T.O.

2. (a) Make a Sketches representing schematically (Name each curve) each of following :
- (i) A temperature and pressure Diagram for one component system involving more than one triple point. 2.5
- (ii) A temperature – composition phase Diagram for a binary system having Eutectic point. 2.5
- (b) Two second order reaction have identical pre exponential factor and activation energy differ by 20.01 kJ/mol. Calculate ratio of their rate constant at (a) 0°C and (b) 1000°C 5
3. (a) Justify the paramagnetic behavior of NO, O₂ and O₂⁻ with help of Molecular orbital Diagram. 5
- (b) Prove that $E = -\frac{\partial H}{nF} + T\left\{\left(\frac{\partial E}{\partial T}\right)_P\right\}$ 2.5
- (c) Writing $V = f(T, P)$ Prove that ∂V is exact differential 2.5
4. (a) What do you mean by the Lattice energy ? How can you lattice energy with help of Born-Haber cycle explain with help of example ? 5
- (b) The P^H of solution in cell
Pt/H₂(g)/HCl(g)/AgCl(s)/Ag is 0.65 calculate the EMF of cell
 $E^\circ \text{Cl}^-/\text{Ag}, \text{Ag} = 0.2224\text{V}$. 5
5. (a) If $\partial U = T \partial S - P \partial V$ Then Prove that $\left\{\frac{\partial T}{\partial V}\right\}_S = -\left\{\frac{\partial P}{\partial S}\right\}_V$ 2.5
- (b) (i) Consider the reaction, $\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2 \text{HCl}(\text{g})$ 5
How does the value of ΔG change when the pressures of the gases are altered as follows at 25°C ? $\text{H}_2 = 0.25 \text{ atm}$; $\text{Cl}_2 = 0.45 \text{ atm}$; $\text{HCl} = 0.30 \text{ atm}$ ΔG° for HCl = -95.27KJ/mol
- (ii) Write down the condition for overlapping of atomic orbital. 2.5
6. (a) How can you find the P^H Of solution with help of the Quinhydrone Electrode ? Discuss it merit and demerits. 5
- (b) What do you mean by Defects in crystal ? Discuss various types of Defects with example. 5
7. (a) Prove that $C_p - C_v = R$ 2.5

- (b) Titanium metal has Density 4.54gcm^{-3} and Edge length of 412.6 pm . Determine the unit cell where titanium crystallize. 2.5
- (c) At 25°C $[\partial E^\circ/\partial T]_p = -1.25 \times 10^{-3}\text{ VK}^{-3}$
 $E^\circ = 1.96\text{V}$ for cell $\text{Pt}/\text{H}_2(\text{g})/\text{HCl}(\text{aq})/\text{Cl}_2(\text{g})/\text{pt}$
Calculate the Enthalpy, entropy change for cell reaction. 5
8. Write short notes on any two of the following : 5 × 2
- (a) Standard Hydrogen electrode
 - (b) Collision theory of reaction Rate
 - (c) Micro constituents of Iron and Steel
 - (d) Theory of Heterogeneous catalyst.

