

BACK PAPER

Registration No. :

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Total number of printed pages – 3

B.Tech
BS 1103

Second Semester Examination – 2012

CHEMISTRY – I

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
- (a) What is the De-broglie wavelength of an electron travelling at 1% of the speed of light.
 - (b) What is the maximum number of phases that can exist in one component system at constant temperature and pressure ?
 - (c) Identify the crystal system in following cases :
if $a = 6.5 \text{ nm}$, $b = 6.5 \text{ nm}$, $c = b \text{ nm}$, and $\alpha = \beta = 90^\circ$
 - (d) How is the theory of absolute rate superior to collision theory ?
 - (e) What is the order of reaction if half-life period and units of K depend inversely on concentration ?
 - (f) What is the value of ∂G for liquid water vaporizing at 337 K and 1 atm pressure ?
 - (g) Write down the Nerst equation for the electrode reaction
$$Mn + (aq) + ne \rightarrow M(S)$$
 - (h) Write down electrode reaction of quinhydrone electrode.
 - (i) Write down the Gibbs's Helmholtz equation and define term involved there in.
 - (j) What do you mean by the term eutectic point and triple point ?

BTQ

2. (a) Draw the molecular orbital configuration of O_2 , O_2^- , O_2^+ . Compare between them in reference to magnetic behaviour and bond length. 6
- (b) On basis of the uncertainty principle explain why electron cannot exist within nuclei of atom. 4
3. (a) The standard reduction potentials for $Sn^{+2} + 2e \rightarrow Sn$ and $Sn^{+4} + 2e \rightarrow Sn$ are $-0.136 V$ and $1.05 V$ respectively. Calculate E^0 and ΔG for $Sn^{+4} + 2e \rightarrow Sn^{+2}$ 4
- (b) Discuss how can Ph of an unknown solution be measured with glass electrode. 4
- (c) Out of Zn, Ni, Zn^{+2} which is the strongest oxidizing agent and reducing agent. Given E^0 of $Zn^{+2} / Zn(s) = -0.763 V$ and of $Ni^{+2} / Ni(s) = -0.25 V$. 2
4. (a) How is fuel cell different from battery? What are advantage? 2
- (b) What is a storage cell? Write the reactions occurring during charging of lead storage. 1+3
- (c) Born-Haber cycle is a thermo chemical cycle that relates the lattice energy to the heat of formation. Explain. 4
5. (a) What do you mean by defects in crystal? Discuss Frenkel defects and Schottky defects with example. 4
- (b) Discuss the characteristics of a good catalyst. 3
- (c) For a reaction, the energy of activation is zero. What is the value of rate constant at 300 K, if $1.6 \times 10^6 S^{-1}$ at 280 K? 3
6. (a) Draw neat diagram and discuss the water equilibrium system. 4
- (b) Eutectic mixture has definite composition and a sharp melting point but it not a compound explain. 2
- (c) Answer the following : 4
- (i) bcc is not a closed packed array
- (ii) Estimate the interionic distance in bcc lattice of CsCl
- (iii) Discuss the packing of non uniform spheres.

7. (a) Given $G = H - TS$ show that the change in free energy of system with temperature is the measurement of decrease in entropy of the system at constant pressure. 3
- (b) Using Gibbs-Helmholtz equation show that $E = -(\partial H/nf) + T(\partial E/(\partial T))_p$ where E is the emf and ∂H is the change in enthalpy of the system. 4
- (c) At what temperature will the entropy of one mole of an ideal gas occupying 5 dm^3 at 300 K on expanding to 500 dm^3 increase by 38.294 JK^{-1} ? 3
8. (a) What is the miller indices if the plane intersects the crystal axis at $2a$, b and $2c$? 2
- (b) What is the metallic bonding? Explain the properties of metals on the basis of electron-sea model. 3
- (c) If the wavelength of an electron is 0.5 nm calculate the velocity of electron. 3
- (d) Explain why order of a reaction cannot be predicted from overall stoichiometry. 2