Registration No. :

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) Write down the time independent Schrodinger wave equation defining each term involved therein.

    (b) What are the conditions for a wave equation to satisfy ?

    (c) Molecular oxygen is a paramagnetic substance. Explain

    (d) Why four phases of sulphur cannot co-exist together ?

    (e) The unit cell of gold has a fcc structure, calculate the mass of a gold unit cell (M_{Au} = 197g/mol).

    (f) The half life period for the decomposition of a compound is 50 min, the initial concentration is 0.04 M. If the initial concentration is 0.08 M, the half-life becomes 100 min. What is the half-life if the concentration is 0.02 M ?

    (g) What is the role of a catalyst in a chemical reaction ?

    (h) Differentiate between a galvanic cell and an electrolytic cell.

    (i) Predict the sign for ΔS in $Br_2(g) \rightarrow Br_2(l)$ and justify.

    (j) State and explain Hess's law.

P.T.O.

2. (a) Write down the MO configurations of O_2, N_2 and F_2 and compare their bond dissociation energies and magnetic properties. 6

(b) Calculate the de-Broglie wavelength of an electron travelling with a speed equal to 10% of the speed of light. 4

3. (a) Sketch the phase diagram of Bi-cd system labelling all the phases, curves and points. 8

(b) Why the freezing point curve of ice has a negative slope in the phase diagram of water system ? 2

4. (a) What is the distance between Na^+ and Cl^- in NaCl crystal, if its density is 2.165 g cm^{-3}? NaCl has fcc structure, (Atomic mass of Na = 23 amu, Cl = 35.5 amu). 4

(b) Explain the Schottky defects in stoichio-metric crystals. What are the consequences of Schottky and Frenkel defects in crystals ? 6

5. (a) How is the order of a reaction determined by graphical method ? 4

(b) Give the basic concept of the transition state theory. 2

(c) The values of the rate constants for a reaction at 356°C and 443°C are 3×10^{-5} $mol^{-1}dm^3s^{-1}$ and 2.5×10^{-3} $mol^{-1}dm^3s^{-1}$ respectively. Calculate E_a for the forward and backward reaction of ΔH is 16.32 $KJmol^{-1}$. 4

6. (a) Describe the use of standard hydrogen electrode and a SCE has a voltage of 0.4 V when placed in a solution at 298 K. Calculate p^{++} of the solution. (E^0 of SCE at 298 K = 0.2415 V). 5

(b) Write the reactions involved in a dry cell. Discuss the application of hydrogen-oxygen fuel cell. 5

7. (a) Calculate the standard enthalpy of formation of n-butane given that the standard enthalpies of combustion of n-butane, C (graphite) and $H_2(g)$ are -2878.5 KJ, -393.5 KJ and -285 KJ respectively. 5

(b) Show that : $\qquad$ 2.5+2.5

(i) $\left(\dfrac{\partial T}{\partial P}\right)_s = \left(\dfrac{\partial V}{\partial S}\right)_P$

(ii) $\left(\dfrac{\partial S}{\partial P}\right)_T = -\left(\dfrac{\partial V}{\partial T}\right)_P$

8. (a) Derive Gibbs-Helmholtz equation. $\qquad$ 5

(b) Discuss the criterion of spontaneity of an equilibrium reaction in terms of ΔG, ΔH and ΔS. $\qquad$ 5