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Total number of printed pages – 3

B. Tech  
BS 1103 (New)

**Second Semester (Back) Examination – 2013**

**CHEMISTRY – I**

**BRANCH : ALL**

**QUESTION CODE : B479**

**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) If the wavelength of an electron is one nm, what is the velocity of the electron ? [Mass of the electron =  $9.1 \times 10^{-31}$  kg]
- (b) What is Condensed or Reduced Phase rule and where it is applicable ?
- (c) Explain Redox electrode with suitable examples.
- (d) Arrange Atomic Packing Fraction (APF) of crystals crystallizing in P-type (simple cubic), F-type (FCC) and I-type (BCC) in increasing order.
- (e) Write the half cell as well as the net cell reaction for Fuel Cell.
- (f) The plot of  $\ln K$  Vs  $\frac{1}{T}$  gave a straight line and the slope was found to be  $-1.2 \times 10^4$  K, Calculate the Activation Energy.
- (g) The half life of a reaction is halved as the initial concentration of the reactant is doubled, what is the Order of the reaction ?
- (h) What is a Promoter ? Can it alone act as Catalyst ?
- (i) In the Phase diagram of Water System, which Curve has a negative Slope and Why ?

P.T.O.

- (j) What are the conditions for Spontaneity of a reaction at constant Volume and at constant Pressure ?
2. (a) Define Phases, Components and Degrees of freedom. Give appropriate examples to support the definition. 6
- (b) Discuss the phase diagram of Bi-Cd system. 4
3. (a) Which one has more bond dissociation energy :  $O_2$  or  $O_2^+$  ? Discuss on the basis of MO theory. Also comment on the magnetic properties of  $O_2^-$  (Peroxide ion). 4
- (b) Explain the terms Conductor, Insulator and Semiconductor on the basis of molecular orbital diagrams. 6
4. (a) Silver crystallizes with FCC structure with a unit cell length (edge length) of  $4.085 \text{ \AA}$ , Calculate the Density and the atomic radius of Silver. [At mass Ag = 107 gm/mol] 5
- (b) For a reaction  $A + B \rightleftharpoons C + D$ , doubling the concentration of both the reactants increases the reaction rate by eight times and doubling the initial concentration of only B simply doubles the reaction rate. Find the Order of the Reaction. 5
5. (a) For the reaction  $2NO + Cl_2 \leftrightarrow 2NOCl$ , the following mechanism has been proposed : 5



Show that the overall rate of reaction is :  $K [NO]^2 \cdot [Cl_2]$ , where  $K = \frac{k_1 k_2}{k_{-1}}$   
 [Assume that  $k_2 [NO] \ll k_{-1}$ ].

- (b) Differentiate between Order and Molecularity of a Reaction. 5

6. (a) Show that: 5

$$C_p - C_v = \left[ V - \left( \frac{\partial H}{\partial P} \right)_T \right] \left( \frac{\partial P}{\partial T} \right)_V ?$$

- (b) Write down the cell reaction of a storage cell during both Charging and discharging mode. 5

7. (a) From the standard reduction potentials :



Calculate the reduction potential for the half cell Pt / Ce, Ce<sup>4+</sup>. 5

- (b) Show that: 5

$$\left[ \frac{\partial \left( \frac{G}{T} \right)}{\partial T} \right]_P = -\frac{H}{T^2}$$

8. Write short notes on any **two** : 5×2

- (a) Maxwell Relations
- (b) Born-Haber Cycle
- (c) Significance of Schrodinger's wave Equation and the terms related to it
- (d) Primary and Secondary Reference Electrodes.

