Registration No. :

Total number of printed pages – 3

Second Semester Regular Examination – 2014
CHEMISTRY - I
BRANCH(S) : ALL
QUESTION CODE : F 461
Full Marks – 70
Time : 3 Hours

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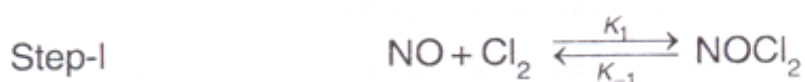*The figures in the right-hand margin indicate marks.*

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 -1.2×10^4 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 ?

   (j) What are the conditions for Spontaneity of a reaction at constant Volume and at constant Pressure ?

P.T.O.

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 A^0, 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 $2NO + Cl_2 \leftrightarrow 2\,NOCl$, the following mechanism has been proposed

Step-I $\qquad NO + Cl_2 \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} NOCl_2$

Step-II $\qquad NO + NOCl_2 \xrightarrow{K_2} 2NOCl.$

Show that the overall rate of reaction is: $K\,[NO]^2.\,[Cl_2]$, where $K = \dfrac{K_1 K_2}{K_{-1}}$ [Assume that $K_2\,[NO] << K_1$]. 5

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

6. (a) Show that $C_p - C_v = \left[V - \left(\dfrac{\partial H}{\partial P} \right)_T \right] \left(\dfrac{\partial P}{\partial T} \right)_v .$ 5

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

7. (a) From the standard reduction potentials :

$$Ce^{3+} + 3e \rightarrow Ce, \qquad\qquad E^0 = -2.48 \text{ V}$$

$$Ce^{4+} + e \rightarrow Ce^{3+}, \qquad\qquad E^0 = +1.61 \text{ V}$$

Calculate the reduction potential for the half cell Pt / Ce, Ce^{4+}. 5

(b) Show that $\left[\dfrac{\partial\left(\dfrac{G}{T}\right)}{\partial T}\right]_p = -\dfrac{H}{T^2}$. 5

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.

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