B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

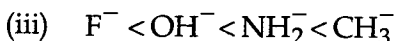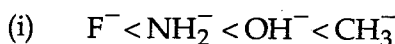### December, 2011

01172

ET-105(B) : CHEMISTRY

Time : 3 hours   *Maximum Marks : 70*

Note :   *Question no. 1 is compulsory. Answer any five questions from the remaining. Use of scientific calculator is permitted.*

1. (a) Total number of atoms per unit cell in F.C.C   **2** structure is :

   (i)   1   (ii)   2

   (iii)   3   (iv)   4

   (b) Hybridisation in XcF_2 molecule is :   **2**

   (i) sp^2 (ii) sp^3

   (iii) sp^3d (iv) sp^2d

   (c) Acidity among halo acids follows the   **2** order :

   (i)   HF <HCl <HBr <HI

   (ii)   HI <HBr <HCl <HF

   (iii)   HBr <HI <HF <HCl

   (iv)   HCl <HF <HI <HBr

(d) The correct sequence for the increasing basic   **2**
    character for the given ions is :

(i) $F^- < NH_2^- < OH^- < CH_3^-$

(ii) $NH_2^- < OH^- < CH_3^- < F^-$

(iii) $F^- < OH^- < NH_2^- < CH_3^-$

(iv) $< OH^- < CH_3^- < NH_2^- < F^-$

(e) For an ideal gas :   **2**

(i) $\left(\dfrac{\partial E}{\partial v}\right)_T > 0$ (ii) $\left(\dfrac{\partial E}{\partial v}\right)_T < 0$

(iii) $\left(\dfrac{\partial E}{\partial v}\right)_T = 0$ (iv) $\left(\dfrac{\partial E}{\partial v}\right)_T = 1$

(f) The coefficient of performance of a   **2**
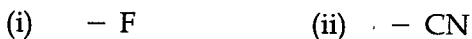   refrigerator working reversibly is given by :

(i) $C = \dfrac{T_2}{T_2 - T_1}$ (ii) $C = \dfrac{T_1}{T_2 - T_1}$

(iii) $C = \dfrac{T_1}{T_2 + T_1}$ (iv) $C = \dfrac{T_2}{T_1 + T_2}$

T_2 = higher temperature

T_1 = lower temperature

(g) Which of the following has activating effect   **2**
   on electrophilic aromatic substitution
    reaction ?

(i) $- F$ (ii) $- CN$

(iii) $- COOR$ (iv) $- OH$

(h) Water gas is :   2

   (i) $CO + H_2$

   (ii) $CO_2 + H_2$

   (iii) $CH_4 + H_2O$

   (iv) $CO + H_2O + CH_4$

(i) $CaC_2 + H_2O \rightarrow X + Ca(OH)_2$, The product   2
     'X' formed is :

   (i) CO_2 (ii) CH_4

   (iii) $CH \equiv CH$ (iv) $HCOOH$

(j) Which of the following amino acid contain   2
     sulphur ?

   (i)   Methionine   (ii) Isolencine

   (iii) Histidine   (iv) Serine

2. (a) Define degree of freedom.   2

   (b) Calculate the number of components in a   2
       system containing three solids Fe_3O_4, FeO
       and Fe_2O_3.

   (c) Draw schematic phase diagram for water.   6

3. (a) The freezing point of Benzene is 278.6 K and   2
       its latent heat of fusion is $9.83 kJ\ mol^{-1}$
       calculate the value of K_f for benzene.

   (b) Write the expression for the equilibrium   6
       constant K_P in terms of the degree of
       dissociation "α" and the total pressure "P"
       for the reaction $N_2O_4\ (g) \rightleftharpoons 2\ NO_2\ (g)$.

   (c) Define Le Chatelier Principle.   2

4. (a) Define molar conductance. 2

   (b) What is Kohlraush law ? 2

   (c) Write the Henderson-Hasselbach equation. 2

   (d) For the galvanic cell $Cd \mid Cd^{2+}(0.05M)$ 4
   $\mid\mid Cl^-(0.1M) \mid Cl_2$ (1atm) $\mid$ Pt, calculate the
   EMF at 298 K if $E° = 1.76$ V.

5. (a) What are plasticizers and stabilizers ? Give 3
   an example of stabilizer.

   (b) What are condensation polymers ? Give two 3
   examples of condensation polymers.

   (c) Name different kinds of chlorophylls. Give 4
   two characteristic features of each.

6. (a) Draw the typical growth pattern for a 4
   bacterial population in batch culture.

   (b) What do you understand by 4
   micropropagation ? What are the basic steps
   required during micropropagation ?

   (c) What are monoclonal antibodies ? 2

7. (a) Show the mechanism of nitration on 6
   benzene.

   (b) Write the IUPAC name of : 2
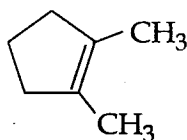
   (c) Complete the reaction sequence 2

   $$CH_3-C\equiv C-H + H_2O \xrightarrow[H_gSO_4]{H_2SO_4} X$$
   $$\downarrow$$
   $$Y$$
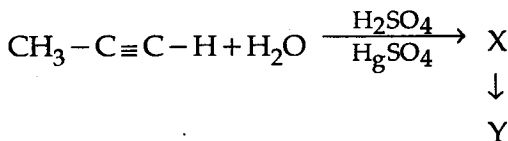
8. (a) Draw the d-orbital energy diagram for square-planar complex. 5

(b) What are the factors that affect magnitude of Δo ? 3

(c) What is spectrochemical series ? 2

9. (a) Calculate the uncertainty in the position of a particle when the uncertainty in the momentum is : 3

(i)   zero

(ii) 1×10^{-7} kg msec^{-1} [h = 6.62×10^{-34} J sec]

(b) Which state of the triply ionized Beryllium (Be^{3+}) has the same orbital radius as that of the ground state of Hydrogen atom ? 3

(c) Calculate the ratio of U^{238} to Ra^{226} atom in natural Uranium. 4

$$T_{1/2} \text{ of } U^{238} = 4.49 \times 10^9 \text{ years}$$

$$T_{1/2} \text{ of } Ra^{226} = 1622 \text{ years}$$

10. (a) For the dissociation of O_3, the proposed mechanism is $O_3 \xrightarrow[K_2]{K_1} O + O_2$ 8

$$O + O_3 \xrightarrow{K_3} 2O_2$$

Obtain the rate law consistant with it.

(b) The first order rate constant for the decomposition of N_2O_5 is 6.2×10^{-4} s^{-1}. Determine the half-life for this decomposition. 2