ET-105(B)

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

Term-End Examination

⊏1215   **December, 2014**

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 π electrons in pyrrole is   *2*

     (i) 4π

     (ii) 6π

     (iii) 8π

     (iv) 2π

(b) Write the IUPAC name of $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH$ *2*

(c) The coefficient of isothermal compressibility is given by 2

(i) $\left(\dfrac{\partial V}{\partial P}\right)_T = -KV$

(ii) $\left(\dfrac{\partial V}{\partial P}\right)_T = KV$

(iii) $\left(\dfrac{\partial V}{\partial P}\right)_T = K/V$

(iv) $\left(\dfrac{\partial V}{\partial P}\right)_T = V/K$

(d) For an ideal gas undergoing adiabatic changes 2

(i) $\dfrac{P^{\gamma-1}}{T^\gamma} = \text{constant}$

(ii) $\dfrac{P^{1-\gamma}}{T^\gamma} = \text{constant}$

(iii) $\dfrac{P^\gamma}{T} = \text{constant}$

(iv) $\dfrac{P^{1-\gamma}}{T^{\gamma-1}} = \text{constant}$
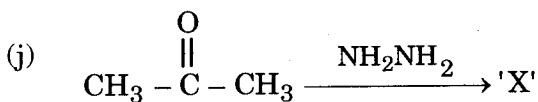
(e) Unit of entropy is 2

(i) J

(ii) $JK^{-1}L^{-1}$

(iii) JK^{-1}

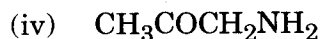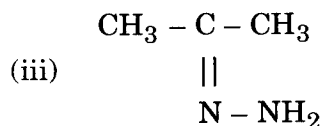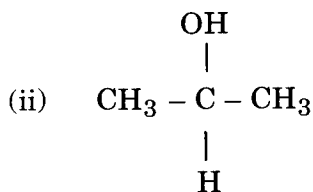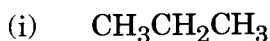(iv) JKL^{-1}

(f) X_eF_4 has geometry   *2*

    (i)   Tetrahedral

    (ii)   Square planar

    (iii) Bipyramidal

    (iv) Pyramidal

(g) Total number of atoms per unit cell in B.C.C. structure is   *2*

    (i)   1

    (ii)   2

    (iii) 3

    (iv) 4

(h) Geometry of the complex formed by transition metal ions using dsp^2 hybridization is   *2*

    (i)   Tetrahedral

    (ii)   Octahedral

    (iii) Square planar

    (iv) Trigonal

(i) Among the following hydrocarbons which one has highest boiling point :   *2*

    (i)   2, 3-dimethyl butane

    (ii)   n-hexane

    (iii) 2, 2-dimethyl butane

    (iv) 2-methyl pentane

(j)

$$CH_3 - \overset{\overset{\displaystyle O}{\displaystyle \|}}{C} - CH_3 \xrightarrow{\quad NH_2NH_2 \quad} 'X'$$

Compound 'X' is   2

    (i) $CH_3CH_2CH_3$

    (ii) $CH_3 - \overset{\overset{\displaystyle OH}{\displaystyle |}}{\underset{\underset{\displaystyle H}{\displaystyle |}}{C}} - CH_3$

    (iii) $CH_3 - \underset{\underset{\displaystyle N - NH_2}{\displaystyle \|}}{C} - CH_3$

    (iv) $CH_3COCH_2NH_2$

2. (a) Write IUPAC name of compound :

$K_2 [CuCl_4]$ 2

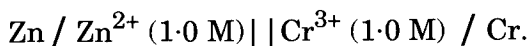   (b) Calculate the degree of freedom for the water system.   2

   (c) Draw the phase diagram for the water system.   6

3. (a) For the cell

$Zn / Zn^{2+} (1 \cdot 0 \text{ M}) | | Cr^{3+} (1 \cdot 0 \text{ M}) / Cr.$

The standard electrode potential of Zn^{2+}/ Zn and Cr^{3+}/ Cr are $- 0 \cdot 763$ and $- 0 \cdot 740$ V respectively. Write down the cell reactions.   2

(b) Calculate the e.m.f. under standard conditions for the above cell. *2*

(c) Calculate the ΔG° value corresponding to the cell reaction. *6*

4. (a) What is common ion effect ? *2*

(b) Write the Henderson equation used for calculating pH of buffer mixture. *2*

(c) What do you understand by the term "hydrolysis" ? *2*

(d) Write down the solubility product in terms of solubility (S mol/dm^3) of the electrolyte Sb_2S_3. *4*

5. (a) Write the equation relating microbial doubling time and specific growth rate. *2*

(b) What do you understand by the following : *4×2=8*
   (i) Antigen
   (ii) Central Dogma
   (iii) Ascites
   (iv) Trophophase

6. (a) Write the reactions and steps taking place during formation of Nylon (6). *6*

(b) What do you understand by the following : *1+1=2*
   (i) Vulcanization
   (ii) Ziegler Natta Catalyst

(c) What are foaming agents ? How do such agents help in producing foamed plastics ? *2*

7. (a) Draw the indicator diagram for Carnot cycle. Indicate all the adiabatic and isothermal steps. *6*

(b) A Carnot engine operates between 1000 K and a sink of 600 K. Calculate the

   (i) efficiency of the engine *2*

   (ii) heat absorbed from the source to do a work of 1000 J. *2*

8. (a) 2·94 moles of I_2 and 8·1 moles of H_2 are heated at 500°C until equilibrium is established, 5·64 moles of HI is formed. Find the equilibrium constant. *6*

(b) Define first order reaction and molecularity of a reaction. *2*

(c) Define third law of thermodynamics. *2*

9. (a) What are the assumptions for crystal field theory ? *3*

(b) Arrange the following ligands according to their increasing strength : *3*

$$I^{-1}, \ H_2O, \ CN^-, \ NO_3^-$$

(c) Write the IUPAC name of the following complexes : *2+2=4*

   (i) $[Cr(H_2O)_4 \ Cl_2] \ Cl$

   (ii) $[Cr(NH_3)_3 \ (NO_2)_3]$

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10. (a) Write the balance equation for the following reactions : $3\times2=6$

    (i) $Al_2\overset{.}{O}_3$ dissolved in basic NaOH solution

    Complete the equations :

    (ii) $CH_3CH_2OH + HCl \xrightarrow{\ \ ZnCl_2\ \ } ...... + H_2O$

    (iii) $CH_3CH = CH_2 + HBr \longrightarrow ....$

(b) Find 'X' and 'Y' in the following reaction : 2

    $^{238}_{92}U + \text{'X'} \longrightarrow {}^{239}_{92}U \xrightarrow{\ \ -\,Y\ \ } {}^{239}_{93}N_p$
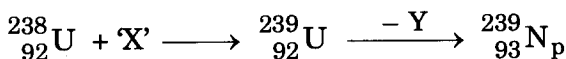
(c) Draw the structure of orthophosphoric and phosphorous acid. Give the number of ionizable hydrogens in each. 2

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