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ET-105(B)

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

Term-End Examination 01869

June, 2012

ET-105(B) : CHEMISTRY

Time : 3 hours *Maximum Marks : 70*

Note : *Question no. **1** is **compulsory**. Attempt **any five** questions from the remainings. Use of calculator is **permitted**.*

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1. (a) The relative stability of various conformation of ethane follows the order : **2**

(i) skew > staggered > Eclipsed

(ii) staggered > skew > Eclipsed

(iii) Eclipsed > skew > staggered

(iv) staggered > Eclipsed > skew

(b) During Sulphonation of Benzene the reacting electrophile formed is : **2**

(i) $HSO_4^{\oplus}$ (ii) SO_2

(iii) SO_3 (iv) $SO_3^{\oplus}$

(c) Hybridisation found in ClF_3 molecule is : **2**

(i) SP^2 (ii) SP^3

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

(d) Which one of the following is most thermal stable compound ? 2

(i) $MgCO_3$ (ii) $SrCO_3$

(iii) $CaCO_3$ (iv) $BaCO_3$

(e) The acidic character of oxyacids of chlorine increases in order : 2

(i) $HClO < HClO_2 < HClO_3 < HClO_4$

(ii) $HClO_2 < HClO_3 < HClO_4 < HClO$

(iii) $HClO > HClO_2 > HClO_3 > HClO_4$

(iv) $HClO_3 < HClO_2 < HClO < HClO_4$

(f) Bond order in O_2^- is : 2

(i) 1 (ii) 2

(iii) 1.5 (iv) 2.5

(g) Complete the reaction : 2

$$^{40}_{20}Ca + X = Y + {}^{37}_{18}Ar$$

(h) During isothermal expansion of an ideal gas the value of ΔV and ΔH are : 2

(i) $\Delta V > 0, \Delta H > 0$

(ii) $\Delta V < 0, \Delta H < 0$

(iii) $\Delta V = 0, \Delta H = 0$

(iv) $\Delta V > 0, \Delta H < 0$

(i) Which one of the following is correct for reversible adiabatic process ? 2

(i) $TP^{1-\gamma/\gamma} = \text{constant}$

(ii) $TP^{\gamma-1/\gamma} = \text{constant}$

(iii) $TP^{\gamma/1-\gamma} = \text{constant}$

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

(j) When 3 moles of an ideal gas at 200°C are subjected to an increase of pressure from 1 bar to 10 bar, what is ΔG ? 2
($R = 8.314\ JK^{-1}mole^{-1}$)

2. (a) Calculate the ground state energy of the electron (in ev) for Li^{2+} ion. 3

(b) Calculate the short and long wavelength limits of Lyman series in the spectrum of Hydrogen atom. [$R_H = 109{,}677\ cm^{-1}$] 4

(c) A ball having weight 100 g is to be located within 0.1 A°. What is the uncertainty in its velocity ? 3

3. (a) Calculate the number of atoms contained within : 6

(i) A primitive cubic unit cell

(ii) A Body-centered cubic unit cell

(iii) A Face-centered cubic unit cell

(b) Atomic Aluminium Al(At.wt = 26.98g/mol) crystallizes into a FCC structure with a density of 2698 kg/m^3. When X-rays of wavelength 0.1537 nm diffracted from the (111) planes of this lattice, gave a maximum intensity at an angle of 19.2°. Calculate the Avogadro number using the above information sin(19.2) = 0.328866. 4

4. (a) A Zinc rod is dipped into O.M solution of $ZnSO_4$ at 25°C. Assuming that the salt is 95% dissociated at this dilution, calculate the potential of the electrode at the given temperature. $E^{\circ}_{(Zn^{2+}, Zn)} = 0.76$ V. 5

(b) The standard EMF of the Daniell cell involving the cell reaction $Zn(s) + Cu^{2+}(aq) \rightleftharpoons Zn^{2+}(aq) + Cu(s)$ is 1.10 V. Calculate the equilibrium constant of the cell reaction at 25°C. 5

[$R = 8.314\ JK^{-1}\ mol^{-1}$]

5. (a) What is Phase rule ? 2

(b) What is eutectic mixture ? 2

(c) Draw Phase diagram for a two component system forming a compound. 6

6.	(a)	What is Raoult's law ?	2
	(b)	What is common ion effect ?	2
	(c)	What is Buffer action and Buffer solution ?	2
	(d)	Define equivalent conductance.	2
	(e)	What is order of a reaction ?	2
7.	(a)	Name the monomers required for the synthesis of Nylon-6, 6. Write down the reaction involved.	3
	(b)	Name the monomers required for the synthesis of Terylene. Write down the reaction involved.	3
	(c)	What is natural rubber ?	1
	(d)	Name the reaction center Chlorophylls of Photosystem I and Photosystem II.	1
	(e)	What are hybridoma cells ? Give one important benefit of monoclonal antibody.	2
8.	(a)	Name any two aromatic amino acids.	2
	(b)	Outline different strategies applied during genetic engineering.	4
	(c)	What are the advantages of immobilized enzymes over raw enzymes.	4
9.	(a)	Show the splitting of d-orbitals energies in octahedral and tetrahedral crystal field.	4
	(b)	Calculate the CFSE for d^4 configuration in a weak ligand octahedral environment.	2
	(c)	Draw the possible geometrical isomers formed by [Pt $(NH_3)_2Cl_2$]	2
	(d)	Write the IUPAC name for $[Co(en)_3]Cl_3$.	2

10. (a) Complete the reaction sequence : 2

$$CH_3CH_2Br \xrightarrow[\text{ether}]{Mg} X \xrightarrow[(2)\ H_2O]{(1)\ CH_3CHO} Y$$

(b) Draw the Newman projection of Butane using the C-2 to C-3 bond as reference in the eclipsed forms. 2

(c) Complete the reaction sequence : 2

$$\begin{matrix} H_3C \\ \diagdown \\ \quad C=O \\ \diagup \\ H_3C \end{matrix} + NH_2NH_2 \longrightarrow X \xrightarrow{-H_2O} Y$$

(d) Complete the reaction sequence : 2

$$H_3C-\underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}}-\underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}}-H \xrightarrow{KOH/C_2H_5OH} X \xrightarrow{NaNH_2} Y$$

(e) Write the IUPAC name of 2

$$H_3C-\overset{\overset{O}{\|}}{C}-N\begin{matrix}\diagup CH_3 \\ \diagdown CH_3\end{matrix}$$