

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

Term-End Examination

December, 2015

ET-105(B) : CHEMISTRY

Time : 3 hours

Maximum Marks : 70

Note : *Question no. 1 is compulsory. Attempt any five questions from questions no. 2 to 10. Use of calculator is allowed.*

1. Write the correct choice for the following :

- (a) When heat is evolved during a process, the process is _____ and ΔH is _____. 2
- (i) endothermic, +ve
(ii) exothermic, +ve
(iii) exothermic, -ve
(iv) endothermic, -ve
- (b) A reaction in which the reaction rate is determined by only one concentration variable, raised to the power one is 2
- (i) Second order rx^n
(ii) First order rx^n
(iii) Third order rx^n
(iv) Zero order rx^n

- (c) Which of the following is meta directing electrophilic aromatic substitution ? 2
- (i) -CHO, -OH
 - (ii) -NO₂, -OH
 - (iii) -NO₂, -CH₃
 - (iv) -NO₂, -CHO
- (d) Nitrogenous, often basic compounds obtained from plants e.g. quinine, morphine are called 2
- (i) Alkaloids
 - (ii) Essential oils
 - (iii) Polymers
 - (iv) Free fatty acids
- (e) Silicon oils are synthesized by adding a requisite amount of _____ to poly (dimethylsiloxane). 2
- (i) tribromomethylsilane
 - (ii) trichlorosilane
 - (iii) trichloromethylsilane
 - (iv) None of the above
- (f) DNA fragments are separated by 2
- (i) chemical technology
 - (ii) idiophase
 - (iii) gas chromatography
 - (iv) gel-electrophoresis

(g) The energies for $n = 1$ state of a particle of mass $9 \cdot 108 \times 10^{-31}$ kg confined to a one-dimensional box of length of 0.1 nm will be

2

(i) $6 \cdot 024 \times 10^{-18}$ J

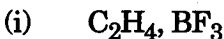
(ii) $6 \cdot 024 \times 10^{-10}$ J

(iii) $3 \cdot 012 \times 10^{-8}$ J

(iv) $3 \cdot 012 \times 10^{-10}$ J

(h) The sp^2 hybridization with trigonal shapes are shown by

2



(i) Electrodes (such as those of Zn + Mg) used for protecting a metal (iron), wherein they act as the anode in the place of iron, since they have a more negative E° value than that of a Fe are called

2

(i) Cathodic inhibitor

(ii) Sacrificial anode

(iii) Galvanic corrosion

(iv) None of the above

(j) The relative stability of various conformations of ethane follow the order

2

(i) Skew > Staggered > Eclipsed

(ii) Staggered > Skew > Eclipsed

(iii) Eclipsed > Skew > Staggered

(vi) Staggered > Eclipsed > Skew

2. (a) Draw a simplified flow diagram to illustrate the liquefaction of air by combined Linde and Claude process and its fractional distillation. 5
- (b) What is Crystal Field theory? 1
- (c) Draw molecular orbital energy level diagram in an octahedral ML_6 complex. 4
3. (a) Write a short note on inert gas compounds of Fluorine. 2
- (b) Sea water contains 16,600 kg of chlorine (Cl^-), 9200 kg of sodium and 1180 kg of magnesium per million litres of sea water. What is the molarity of each? What concentration of charge is unaccounted for? The unaccounted charge is balanced by other anions (At. wt. : $Cl = 35.5$, $Na = 23.0$, $Mg = 24.3$). 4
- (c) Why are diaphragm cells, rather than mercury cells recommended for the manufacture of chlorine, $NaOH$ and hydrogen? 2
- (d) Brine is purified before being used in the manufacture of soda ash. Give reason. 2

4. (a) 50 gm of an acid A is dissolved in a litre of solution. The distribution ratio for the partition of the acid between ether and water is 5. If one litre of ether is available for use, how much acid will be extracted if
- 200 cm³ of ether is used each time ?
 - all the ether is used in a single extraction ?
- (b) Derive the relationship between k_c , k_p , k_x and k_n for the reaction
- $$aA + bB + \dots \rightleftharpoons Pp + Qq + \dots$$
- (c) Define Le Chatelier principle in the formation of NH₃.
5. (a) Define Faraday's law of Electrolysis and Electrolytic conduction with significance.
- (b) At 298 K, the Δ° value of NH₄Cl; $\frac{1}{2}$ BaCl₂ and $\frac{1}{2}$ Ba(OH)₂ in ohm⁻¹ cm² are 149.9, 139.9 and 262.2 respectively. Calculate Δ° of NH₄OH.
- (c) What is a fuel cell ? Draw and explain schematic representation of a H₂ - O₂ fuel cell using an alkaline electrolyte.
6. (a) What is the Heisenberg's uncertainty principle ?
- (b) Derive the expression of energy in Bohr's atomic model.

(c) What is the maximum number of electrons which can possess the following set of quantum numbers ?

6

(i) $n = 2$ (ii) $n = 4, l = 3$ (iii) $n = 5, l = 3, m = +1$.

7. (a) Calculate the number of atoms contained within

(i) A primitive cubic unit cell

(ii) A body-centred cubic unit cell

(iii) A face-centred cubic unit cell

6

(b) Atomic Al (at. wt. = 26.98 g/mol) crystallizes into an FCC structure with a density of 2698 kg/m³. X-ray of wavelength, 0.1537 nm, when diffracted from the (III) planes of this lattice, give a maximum intensity at an angle of 19.2°. Calculate the Avogadro number.

4

8. (a) Draw the Newman projections of butane using the C - 2 to C - 3 bond as reference in the staggered form.

2

(b) Arrange the following hydrocarbons in the order of increasing boiling point :

(i) 2, 3-dimethyl butane

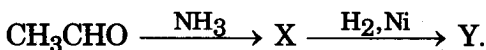
(ii) n-hexane

(iii) 2, 2-dimethyl butane

(iv) 2-methyl pentane

2

(c) Complete the reaction sequence



2

- (d) What is the angle between two sp^3 hybrid orbitals and two sp hybrid orbitals? 2
- (e) Write all possible isomers of C_5H_{10} and give their IUPAC names. 2
9. (a) What is Phase Rule? 1
- (b) Draw the phase diagram of one component system. 5
- (c) Calculate the degree of freedom in each
- (i) $H_2(g) + O_2(g) \rightleftharpoons H_2O(l)$
- (ii) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
- (iii) Aqueous solution of NaOH
- (iv) $N_2(g) + H_2(g) \rightleftharpoons NH_3(g)$ 4
10. (a) What do you understand by tissue culture? 3
- (b) Name the reaction centre chlorophylls of Photosystem I and Photosystem II. 1
- (c) Name the monomers required for the synthesis of Nylon-6,6. Write down the reaction involved. 3
- (d) What is the basic disadvantage of a photocatalytic process to remove carcinogenic material from drinking water? 2
- (e) Why is natural rubber called as polyisoprene? 1
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