

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

00406

Term-End Examination**June, 2010****ET-105(B) : CHEMISTRY***Time : 3 hours**Maximum Marks : 70*

Note : Question number 1 is compulsory. Attempt five more questions from question numbered from 2 to 10. Use of calculator is allowed.

1. (a) In a salt solution, H_2S gas is passed in presence of excess NH_4Cl and NH_4OH , the metal ion that will precipitate will be : 2
- (i) Na^+
 - (ii) Zn^{2+}
 - (iii) Sr^{2+}
 - (iv) Ca^{2+}
- (b) Which of the compound(s) has/have only one type of hybridization for carbon ? 2
- (i) $CH_2=CH-CH=CH_2$
 - (ii) $CH_3-CH_2-CH_2-CH_3$
 - (iii) $CH_3-C\equiv C-CH_3$
 - (iv) $HC\equiv C-C\equiv H$

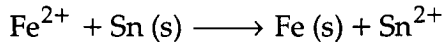
- (c) The IUPAC name for the compound : 2
- $$\text{CH}_3 - \underset{\text{Br}}{\underset{|}{\text{CH}}} - \underset{\text{OH}}{\underset{|}{\text{CH}}} - \underset{\text{O}}{\underset{||}{\text{C}}} - \text{CHO}$$
- (i) 3-Hydroxy-2-keto-4-bromo-1-pentanal
- (ii) 2-keto-3-hydroxy-4 bromopentanaldehyde
- (iii) 4-Bromo-3-hydroxy-2-ketopentanal
- (iv) 1-Formyl-3-hydroxy-4-bromo-2-pentanone
- (d) An isomer of ethanol is : 2
- (i) Methanol (ii) Diethyl ether
- (iii) Acetone (iv) Dimethyl ether
- (e) Which of the following series contains only nucleophiles ? 2
- (i) $\text{NH}_3, \text{H}_2\text{O}, \text{AlCl}_3$
- (ii) $\text{NH}_3, \text{ROH}, \text{H}_2\text{O}$
- (iii) $\text{H}_2\text{O}, \text{H}_3\text{O}^+, \text{SO}_3$
- (iv) None of these
- (f) The units of heat are : 2
- (i) Degree and calorie
- (ii) Calorie and Joule
- (iii) Degree and Joule
- (iv) Degree and ergs
- (g) The rate of reaction is doubled for every 10° rise in temperature. The increase in reaction rate as a result of temperature rise from 10° to 100° is : 2
- (i) 112 (ii) 400
- (iii) 512 (iv) 614

(h) An atom at the corner of a simple cubic unit cell (*uc*) is shared by : 2

(i) 2 *uc* (ii) 4 *uc*

(iii) 8 *uc* (iv) 1 *uc*

(i) E_{RP}° for Fe^{2+}/Fe and Sn^{2+}/Sn are -0.44 volt and -0.14 volt respectively. The standard e.m.f. for the cell 2



is :

(i) 0.30 V (ii) -0.58 V

(iii) 0.58 V (iv) -0.30 V

(j) The oxidation state of the most electronegative element in the products of the reaction between $BaO_2 + H_2SO_4$ are : 2

(i) 0 and -1 (ii) -1 and -2

(iii) -2 and 0 (iv) -2 and $+1$

2. (a) Explain 5

(i) Heisenbergs uncertainty principle

(ii) Aufbau principle

(b) According to Bohr's theory, the electronic energy of hydrogen atom in n^{th} Bohr orbit is given by 5

$$E_n = \frac{-21.76 \times 10^{-19} \times Z^2}{n^2},$$

where Z is the nuclear charge. Calculate the longest wavelength of light that will be needed to remove an electron from the third Bohr orbit of the He^+ ion.

Given : Planck's constant = 6.626×10^{-34} Js

Speed of light, $c = 3.0 \times 10^8$ ms^{-1}

3. (a) Fraction of the total volume occupied by atoms in simple cubic unit cell is : 4

(i) $\frac{\pi}{2}$ (ii) $\frac{\sqrt{3} \pi}{8}$

(iii) $\frac{\sqrt{2} \pi}{6}$ (iv) $\frac{\pi}{6}$

Justify your answer.

- (b) Metallic gold crystallizes in the FCC lattice. The length of the cubic unit cell, $a = 4.07 \text{ \AA}$. Calculate the closest distance between gold atoms and the density of gold. 6

Atomic mass of Au = 197 amu

and $1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$

4. (a) The difference between heat of reaction at constant pressure and constant volume for the reaction, 5



at 25°C in kJ is :

(i) -7.43 (ii) $+3.72$

(iii) -3.72 (iv) $+7.43$

(Given : $R = 8.314 \text{ JK}^{-1} \text{ mole}^{-1}$)

Justify your answer.

- (b) The bond dissociation energy of gaseous H_2 , Cl_2 and HCl are 104, 58 and 103 kcal/mole respectively. Calculate the enthalpy of formation of HCl gas. 5

5. (a) If the rate constant, k of a reaction is $1.6 \times 10^{-3} \text{ mole lit}^{-1} \text{ min}^{-1}$, the order of reaction is : 3

- (i) 0 (ii) 2
(iii) 1 (iv) 3

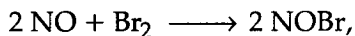
Justify your answer.

- (b) If a reaction with $t_{\frac{1}{2}} = 69.3$ second, has a rate constant value of 10^{-2} per second, the order is : 3

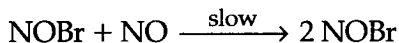
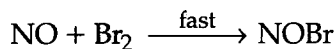
- (i) 0 (ii) 1
(iii) 2 (iv) 3

Justify your answer

- (c) The possible mechanism for the reaction : 4



is



Establish the rate law.

Justify your answer.

6. (a) Enumerate the postulates of Bohr's atomic models. Deduce the expression for atomic radius and energy. 4

- (b) Five mole of oxygen at 127°C undergoes isothermal compression from 2 atm to 10 atm. What is the entropy change of the system ? The system actually gave up 24.7693 kJ of heat during the transformation. Is the transformation reversible or irreversible ? 6

Given : $R = 8.314 \text{ JK}^{-1} \text{ mole}^{-1}$

7. (a) In which mode of expression, the concentration of solution remains independent of temperature ? 2

- (i) Molarity (ii) Normality
(iii) Formality (iv) Molality

Justify your answer.

- (b) Which of the following 0.1 M aqueous solution will have the lowest freezing point ? 3

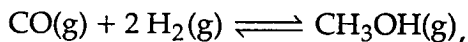
- (i) K_2SO_4 (ii) NaCl
(iii) $(NH_2)_2CO$ (iv) $C_6H_{12}O_6$

Justify your answer.

- (c) The vapour pressure of pure benzene at a certain temperature is 640 mmHg. A nonvolatile nonelectrolyte solid weighing 2.175 g is added to 39 g of benzene. The vapour pressure of the solution is 600 mm Hg. What is the molecular weight of the solid substance ? 5

8. (a) Calculate the approximate pH of a 0.1 M H_2S (aq) solution. The first and second dissociation constants of H_2S are 1×10^{-7} and 1.3×10^{-14} respectively. 5

- (b) For the reaction, 5



$K_p = 0.1147 \text{ atm}^{-2}$ at 327°C . What will be the value of K_c at 327°C ?

$R = 0.0821 \text{ JK}^{-1}\text{mol}^{-1}$.

9. (a) Describe in detail the function of lead storage battery. 4
- (b) Explain the following bonds with example (any three) : 6
- (i) Ionic bond
 - (ii) Covalent bond
 - (iii) Metallic bond
 - (iv) Hydrogen bond
10. (a) Ce(58) is a member of : 1
- (i) s-block
 - (ii) p-block
 - (iii) d-block
 - (iv) f-block
- (b) Which metal cannot be obtained by electrolysis ? 1
- (i) Ag
 - (ii) Mg
 - (iii) Cu
 - (iv) Cr
- (c) The volume of '10 vol' of H_2O_2 required to liberate 500 ml of O_2 at STP is : 1
- (i) 50 ml
 - (ii) 25 ml
 - (iii) 100 ml
 - (iv) 125 ml
- (d) The metallic lustre exhibited by sodium is explained by : 1
- (i) Diffusion of sodium ions
 - (ii) Oscillation of loose electrons
 - (iii) Excitation of free protons
 - (iv) Existence of body centred cubic lattice
- (e) Which of the following is the strongest acid ? 1
- (i) $\text{SO}(\text{OH})_2$
 - (ii) $\text{SO}_2(\text{OH})_2$
 - (iii) $\text{ClO}_2(\text{OH})$
 - (iv) $\text{ClO}_3(\text{OH})$

- (f) In compound Buta-1, 2-diene, the state of hybridizations exist are : 1
- (i) sp, sp^2, sp^3
- (ii) sp^2, sp^3, sp^3d^1
- (iii) sp, sp^3, sp^3d^1
- (iv) sp^3, sp^3d^1, sp^3d^2
- (g) The enolic form of acetone contains : 1
- (i) 9 sigma bonds, 1 pi bond and 2 lone pairs
- (ii) 8 sigma bonds, 2 pi bonds and 1 lone pair
- (iii) 10 sigma bonds, 1 pi bond and 1 lone pair
- (iv) 9 sigma bonds, 2 pi bonds and 1 lone pair
- (h) Which of the following will have least hindered rotation about carbon-carbon bond ? 1
- (i) Ethane (ii) Ethylene
- (iii) Acetone (iv) Hexachloroethane
- (i) The helical structure of proteins is stabilised by : 1
- (i) Peptide bonds
- (ii) Dipeptide bonds
- (iii) Hydrogen bonds
- (iv) van der Waal's forces
- (j) n-propyl alcohol and isopropyl alcohol are : 1
- (i) Position isomerism
- (ii) Chain isomerism
- (iii) Tautomerism
- (iv) Geometrical isomerism