B.Sc. (Part—II) Semester—III Examination
CHEMISTRY

Time : Three Hours] [Maximum Marks : 80

Note :— (1) Question No. 1 is compulsory.

(2) Solve **ONE** question from each unit.

(3) Draw diagrams and give equations wherever necessary.

(4) Use of calculator is allowed.

1. (a) Fill in the blanks :

(i) The combination of atomic orbitals to form molecular orbitals takes place by _____ approximation.

(ii) The process of determining the strength of the solution of an acid by titration with a standard solution of an alkali is called as _____.

(iii) The various structural arrangements adopted by a molecule due to rotation about a C – C single bond are known as _____.

(iv) The apparatus used to determine surface tension of liquid is _____. 4×½=2

(b) Choose the correct alternatives :

(i) The property of metals to form thin sheets on hammering is called :

(a) Metallic character (b) Ductility

(c) Malleability (d) Metallic luster

(ii) Phenolphthalein is suitable indicator for pH range of _____.

(a) 3.2 – 4.5 (b) 4.4 – 6.5

(c) 5.5 – 7.5 (d) 8.4 – 10.5

(iii) Which of the following is not the type of structural isomerism ?

(a) Chain isomerism (b) Optical isomerism

(c) Functional group isomerism (d) Position isomerism

(iv) Free energy is _____ property.

(a) Extensive (b) Intensive

(c) Colligative (d) Addive 4×½=2

(c) Answer the following in **one** sentence each :

(i) Define Indicator.

(ii) What is α-hydrogen atom ?

(iii) What is asymmetric carbon atom ?

(iv) Write down CGS unit of surface tension. 1×4=4

UNIT—I

2. (a) On the basis of molecular orbital diagram of O_2 molecule, explain :
   (i) Bond order of O_2 and
   (ii) Whether O_2 is paramagnetic. 4

   (b) What is meant by a band ? Explain the nature of conductor on the basis of band theory. 4

   (c) Explain geometry of BCl_3 molecule on the basis of VSEPR theory. 4

OR

3. (p) Draw Coulson's MO diagram of CO molecule and explain following properties :
   (i) Bond order and
   (ii) Non polar nature. 4

   (q) Discuss malleability and ductility of metal on the basis of free electron theory. 4

   (r) With the help of VSEPR theory, explain the structure and geometry of CH_4 molecule. 4

UNIT—II

4. (a) What are the requirements of primary standards in Volumetric analysis ? 4

   (b) Give the difference between co-precipitation and post-precipitation. 4

   (c) Explain how you will select proper indicator for the titration of strong acid against strong base on the basis of Neutralization curve. 4

OR

5. (p) Calculate weight of oxalic acid to be dissolved in 1000 ml of water to get 0.5 N solution (equivalent wt. of oxalic acid = 63). 4

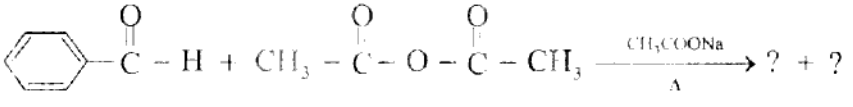
   (q) Give the steps involved in Gravimetric Analysis of Ba^{2+} as $BaSO_4$. 4

   (r) Explain the following terms :
   (i) Iodimetry and
   (ii) Redox titration. 2×2=4

UNIT—III

6. (a) Explain the effect of electron with drawing group, $-NO_2$, on acidity of benzoic acid. 4

   (b) Complete the following reactions :

   (i) 

   (ii) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + 4[H] \xrightarrow[\text{Reflux}]{Zn\ \ Hg\ 4HCl} ?$ 2×2=4

   (c) How will you convert :
   (i) Salicylic acid to Aspirin
   (ii) Pyruvic acid to Lactic acid ? 2×2=4

OR

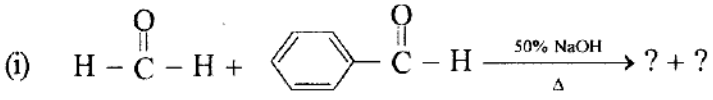
7. (p) Discuss the structure of carbonyl group in aldehyde and ketone. 4

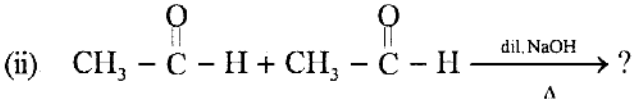
(q) What happens when :

(i) Oxalic acid is heated with NH_3

(ii) Benzoic acid reacts with ethyl alcohol in presence of con. H_2SO_4 ? 2×2=4

(r) Complete the following reactions :

(i) 

(ii) 

2×2=4

UNIT—IV

8. (a) Draw Sawhorse and Newman projection formulae for eclipsed and staggered conformations of ethane. 4

(b) Differentiate between Enantiomers and diastereoisomers. 4

(c) Arrange the following groups in proper priority order according to R – S nomenclature system :

(i) — CHO, — COOH, — NH_2, — OH

(ii) — H, — OH, —C_2H_5, — Cl. 2×2=4

OR

9. (p) Chair form of cyclohexane is more stable than the boat form. Explain. 4

(q) Define the following terms :

(i) Position isomerism

(ii) Chirality. 2×2=4

(r) Explain E – Z system of nomenclature with example. 4

UNIT—V

10. (a) Derive the equation :

$$dG = V.\ dP - S.\ dT$$ 4

(b) Define the following terms :

(i) Distribution coefficient

(ii) Chemical potential. 2×2=4

(c) The equilibrium constant K_p for the reaction,

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_3$$

is 1.64×10^{-4} atm at 673 K. What will be the equilibrium constant at 773 K, if the heat or reaction in this temperature range is – 105185.8 J ? 4

OR

11. (p) Discuss the physical significance of Gibb's free energy. 4

(q) Explain Phenol-Water system. 4

(r) A solid added to a mixture of CCl_4 and water. After shaking well and allowed to stand 15 ml of CCl_4 layer was found to contain 0.18 g of solute and 80 ml of water layer contained 0.25 g of solute. Calculate value of distribution co-efficient. 4

UNIT—VI

12. (a) What is conductometric titration ? Explain the conductometric titration between CH_3COOH and NaOH. 4

(b) Define the term coefficient of viscosity and write its SI unit. What is the effect of temperature on it ? 4

(c) Define :

(i) Specific conductance

(ii) Transport number. 2×2=4

OR

13. (p) How Kohlrausch's law is used to determine dissociation constant of weak electrolyte ? 4

(q) The surface tension of toluene at 293 K is 0.028 $N.m^{-1}$ and its density at this temperature is 0.866×10^3 $Kg.m^{-3}$. If the surface tension of water is 0.07275 $N.m^{-1}$ and density 0.9982×10^3 $Kg.m^{-3}$, calculate the ratio of number of drops of liquid to that of water ? 4

(r) Define :

(i) Equivalent conductance

(ii) Cell constant. 2×2=4