AS–1403

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 scientific calculator is allowed.

1. (a) Fill in the blanks :
(i) The atomic orbital's combine to give rise to a new set of orbitals is called as _____.
(ii) Maleic and fumaric acids are _____ isomers of each other.
(iii) The carbon and oxygen in carbonyl group are _____ hybridized.
(iv) The SI Unit of surface tension is _____. 2

(b) Select the correct alternative :
(i) The geometry of SF_6 molecule is :
(a) Tetrahedral (b) Octahedral
(c) Trigonal bipyramidal (d) Linear
(ii) O-Hydroxy benzoic acid is commonly called as :
(a) Succinic acid (b) Benzoic acid
(c) Salicylic acid (d) Cinnamic acid
(iii) Which of the following conformations of n-butane is least stable ?
(a) Gauche (b) Anti
(c) Eclipsed (d) Fully Eclipsed
(iv) Free energy is ____ property.
(a) Intensive (b) Additive
(c) Colligative (d) Extensive 2

(c) Answer in **one** sentence :
(i) Define semiconductor.
(ii) What is transport number of an ion ?
(iii) Write Clausius-Clapeyron equation for phase transition.
(iv) What is racemisation ? 4

UNIT—I

2. (a) Explain the formation of N_2 molecule on the basis of MOT. Discuss its magnetic nature and calculate bond order. 4

   (b) Discuss following properties of metal on the basis of free electron theory :

   (i) Electrical conductivity

   (ii) Metallic lustre. 4

   (c) With the help of VSEPR theory explain the structure of PCl_5 molecule. 4

OR

3. (p) Give the similarities and differences between VBT and MOT. 4

   (q) Explain the properties of metals and non-metals on the basis of band theory. 4

   (r) Discuss the structure of BF_3 molecule on the basis of VSEPR theory. 4

UNIT—II

4. (a) Explain the terms :

   (i) Normality

   (ii) Mole fraction. 4

   (b) Calculate the mole fraction of ethanol and water, if solution contains 9 moles of ethanol and 6 moles of water. 4

   (c) Discuss the modern theory of acid-base indicator. 4

OR

5. (p) What is redox titration ? Calculate the equivalent weight of $KMnO_4$ and $K_2Cr_2O_7$ in acidic medium. 4

   (q) Discuss the following steps of gravimetric analysis of estimation of barium as barium sulfate :

   (i) Precipitation

   (ii) Incineration. 4

   (r) Define :

   (i) Molarity

   (ii) Molality. 4

UNIT—III

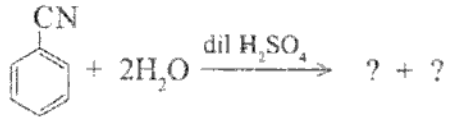
6. (a) Explain the following reactions with suitable examples :

   (i) Benzoin condensation

   (ii) Mannich reaction. 4

   (b) What is the effect of electron releasing group – OH on acidity of benzoic acid ? Discuss. 4

(c) Complete the following reactions :

(i) 

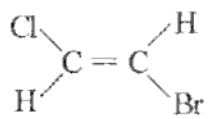
(ii) $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - COOH \xrightarrow{H_2O_2} ? + ?$ 4

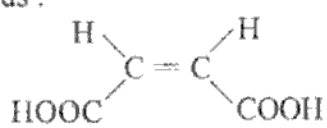
OR

7. (p) What happens when :
   (i) Benzaldehyde is treated with amalgamated Zn + HCl
   (ii) Lactic acid is treated with HI at 126°C ? 4
   (q) How will you prepare :
   (i) Acetone from propyne
   (ii) Salicylic acid from phenol ? 4
   (r) How will you convert :
   (i) Oxalic acid to formic acid
   (ii) Lactic acid to acetic acid ? 4

UNIT—IV

8. (a) Assign priorities to the following groups :
   – CH3, – OH, – CHO, – COOH. 4
   (b) Give E–Z nomenclature to the following compounds :

(i) 

(ii)  4

(c) Explain conformational analysis of ðn-butane with energy level diagram. 4

OR

9. (p) What is resolution ? Explain chemical method of resolution. 4
   (q) What is n-fold simple axis of symmetry ? Give its example. 4
   (r) Explain conformational analysis of cyclohexane with energy level diagram. 4

UNIT—V

10. (a) Explain physical significance of work function. 4
   (b) Derive Gibbs-Duhem equation, $\sum n_i du_i = 0$. 4
   (c) State and explain Nernst distribution law and state the conditions of its validity. 4

OR

11. (p) Define :

(i) Chemical potential

(ii) Lower critical solution temperature. 4

(q) The distribution co-efficient of an alkaloid between chloroform and water is 30 in favour of chloroform. Compare the weights of the alkaloid remaining in 100 ml aqueous solution containing 1 gram when shaken with (a) 100 ml chloroform and (b) two successive 50 ml portions. 4

(r) Derive Van't Hoff equation $\frac{d(\ln K_p)}{dT} = \frac{\Delta H^\circ}{RT^2}$ for temperature dependence of equilibrium constant (K_p). 4

UNIT—VI

12. (a) How the surface tension of a liquid is determined by drop number method ? 4

(b) What is conductometric titration ? Explain the conductometric titration of strong acid Vs Strong base. 4

(c) Discuss Kohlrausch's law of independent migration of ions. 4

OR

13. (p) What is the effect of temperature on surface tension and viscosity of liquid ? Explain. 4

(q) The equivalent conductance of HCl, CH_3COONa and NaCl at infinite dilution is 415, 95.5 and 120.5 Sm^2equi^{-1} respectively.

(i) Calculate the equivalent conductivity of acetic acid at infinite dilution.

(ii) If the degree of dissociation of 0.1 N acetic acid is 0.001, find the equivalent conductance at this concentration of acetic acid. 4

(r) Give the brief description of moving boundary method for transport number determination. 4