B.Sc. (Part—III) Semester—V 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 ligand that has four donor atoms for bonding is called _____.

(ii) Pyridine is _____ membered heterocyclic compound.

(iii) A chromogen without _____ can never act as a dye.

(iv) The reactions taking place in presence of light are called _____ reactions. 2

(b) Select the correct alternative :

(i) Which of the following complex ion has highest crystal field splitting Δ_0 value :

(a) $[Co(H_2O)_6]^{2+}$ (b) $[Ni(H_2O)_6]^{2+}$

(c) $[Rh(NH_3)_6]^{3+}$ (d) $[Ir(NH_3)_6]^{3+}$

(ii) Tea tree oil can be used as :

(a) Insecticide (b) Herbicide

(c) Fungicide (d) Rodenticide

(iii) Photosynthesis of carbohydrates in plants from CO_2 and H_2O is example of :

(a) Fluorescence (b) Phosphorescence

(c) Photosensitized reactions (d) Dark reaction

(iv) Which of the following molecule shows highest force constant ?

(a) C = C (b) C – C

(c) C ≡ C (d) C – H

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

(i) What is coordination number ?

(ii) What is Laporte orbital selection rule ?

(iii) What is Chinchibabin reaction ?

(iv) Define quantum yield. 4

2. (a) Discuss geometrical isomerism exhibited by $[Ma_2b_2]$ and $[M(AA)_2b_2]$ complexes. 4

(b) Discuss optical isomerism exhibited by [Mabcd] and $[M(AA)_3]$ complexes. 4

(c) Explain the following terms with suitable examples :

(i) Effective atomic number

(ii) Ligand. 4

OR

3. (p) Discuss Sidwick's electronics interpretation of co-ordination complexes. 4

(q) Calculate EAN in the following :

(i) $[Fe(CN)_6]^{4-}$

(ii) $[Cr(NH_3)_6]^{3+}$. 4

(r) On the basis of VBT discuss structure of $[Co(NH_3)_6]^{3+}$. 4

UNIT—II

4. (a) Write different postulates of crystal field theory. 4

(b) Explain Russell–Saunders (L–S) Coupling Scheme. 4

(c) Calculate CFSE for $[Cr(H_2O)_6]^{2+}$ High Spin Complex if Δ_o = 13900 cm^{-1} and P = 23500 cm^{-1}. 4

OR

5. (p) Explain crystal field splitting of d orbitals in octahedral complexes. 4

(q) Discuss Orgel diagram for d^1 and d^9 Octahedral complexes. 4

(r) Write different types of absorption spectra. 4

UNIT—III

6. (a) Write method of synthesis of pyrrole from :

(i) Succinimide

(ii) Furan. 4

(b) Discuss orientation of nucleophilic substitution in Pyridine. 4

(c) How will you prepare Ethane and 1-Butene from methyl magnesium bromide. 4

OR

7. (p) Describe acidic and basic nature of pyrrole. 4

(q) Write synthesis of methyl lithium and how it reacts with (i) water (ii) formaldehyde. 4

(r) How will you convert pyridine to the following :

(i) 3-nitropyridine

(ii) Pyridine 3-sulphonic acid ? 4

8. (a) Give preparation and uses of methyl orange. 4

(b) Describe synthesis and uses of phenylbutazone. 4

(c) Give method of preparation of Thiram. 4

OR

9. (p) Give the classification of dyes on the basis of their mode of application. 4

(q) Write synthesis and uses of chloroquine. 4

(r) Give method of synthesis of Malathion and its uses. 4

UNIT—V

10. (a) Give statement of Lambert's law and derive its equation. 4

(b) Explain phenomena of fluorescence and phosphorescence with the help of Jablonski diagram. 4

(c) A substance when dissolved in water at 10^{-3} M concentration absorbs 10% of an incident radiation in a path of 1 cm length. What should be the concentration of the solution in order to absorb 90% of the same incident radiation ? 4

OR

11. (p) Explain kinetics of photochemical decomposition of HI. 4

(q) Write difference between thermal and photochemical reactions. 4

(r) Light of intensity 3.2×10^{-6} einstein/sec falls on the surface of a crystal whose absorption coefficient is 3×10^{6} cm^{-1} at the certain wavelength of light. Calculate the intensity of light at a depth of 100 Å below the surface of the crystal. 4

UNIT—VI

12. (a) Explain energy level diagram for a simple harmonic oscillator. 4

(b) Explain rotational Raman spectrum of diatomic molecule. 4

(c) The pure rotational spectrum of gaseous HCl contains a series of equally spaced lines separated by 20.80 cm^{-1}. Calculate the internuclear distance of the molecule. The atomic masses of H and Cl are 1.673×10^{-27} kg and 58.06×10^{-27} kg respectively. ($h = 6.626 \times 10^{-34}$ JS). 4

OR

13. (p) What is electromagnetic radiation ? Give its different parameters. 4

(q) Derive an expression for moment of inertia of diatomic molecule. 4

(r) Calculate rotational and vibrational degree of freedom for CO_2 and H_2O. 4