

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) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ | (b) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ |
| (c) $[\text{Rh}(\text{NH}_3)_6]^{3+}$ | (d) $[\text{Ir}(\text{NH}_3)_6]^{3+}$ |

(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) $\text{C} = \text{C}$ | (b) $\text{C} - \text{C}$ |
| (c) $\text{C} \equiv \text{C}$ | (d) $\text{C} - \text{H}$ |

 (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 $[Ma_4b_2]$ and $[M(AA)_2b_2]$ complexes. 4
- (b) Discuss optical isomerism exhibited by $[Mabcd]$ and $[M(AA)_2]$ 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 $\Delta_0 = 13900 \text{ cm}^{-1}$ and $P = 23500 \text{ cm}^{-1}$. 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 $3 \times 10^6 \text{ cm}^{-1}$ at the certain wavelength of light. Calculate the intensity of light at a depth of 100 \AA 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 $1.673 \times 10^{-27} \text{ kg}$ and $58.06 \times 10^{-27} \text{ kg}$ respectively. ($h = 6.626 \times 10^{-34} \text{ JS}$). 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

