

13. (p) Derive $I = \mu r^2$ for diatomic rigid rotator. 5
- (q) Show that spacing between two successive lines in rotational spectrum of diatomic molecule is always constant. 6
- (r) State the selection rule for pure vibrational transition. 1

AP-491

B.Sc. (Part-III) Semester-V Examination

CHEMISTRY (Old)

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 whenever necessary.
 (4) Use of calculator is allowed.

1. (A) Fill in the blanks :

- (i) The distance travelled by the wave in one second is called _____ of the wave.
- (ii) The co-ordination number of central metal ion in $[\text{Cu}(\text{NO}_2)_6]^{3+}$ is _____.
- (iii) Pyrrole is a _____ membered ring compound.
- (iv) For a molecule to be microwave active, it must possess _____ dipole moment. 2

(B) Select the correct alternative :

- (i) Raman effect is based on phenomenon of :
 (a) Reflection (b) Refraction
 (c) Diffraction (d) Scattering

(ii) Which of the following is Einstein photoelectric effect equation :

(a) $E = Nh\nu$

(b) $\frac{1}{2}mv^2 = h\nu - h\nu_0$

(c) $E = Nh\nu_0$

(d) $\nu = C/\lambda$

(iii) The oxidation state of central metal ion in $[\text{Co}(\text{NO}_2)_6]^{3-}$ is :

(a) +3

(b) -3

(c) +2

(d) Zero

(iv) The monomer unit of polymer polyvinyl chloride is :

(a) 1,4-Butadiene

(b) Isoprene

(c) Ethylene

(d) Vinyl Chloride

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(C) Answer in **one** sentence :

(i) Name the chromophore present in the methyl orange dye.

(ii) Write the Schrodinger wave equation in one dimension.

(iii) What is effective atomic number ?

(iv) Define Chelate.

4

(b) What is Compton effect ? State the expression for Compton shift. 4

(c) What is the product of uncertainty in position and velocity for an electron of mass 9.11×10^{-31} kg according to Heisenberg uncertainty principle. 4

OR

11. (p) Derive Schrodinger wave equation in one dimension. 5

(q) What is photoelectric effect ? Give the observations of photoelectric experiment. 4

(r) Calculate de-Broglie's wavelength of electron moving with a velocity of $1.20 \times 10^5 \text{ ms}^{-1}$. 3

UNIT—VI

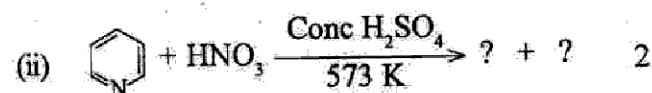
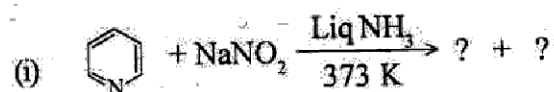
12. (a) Explain formation of Stokes and anti-Stokes lines on the basis of quantum theory. 4

(b) Draw energy level diagram of a molecule indicating electronic, vibrational and rotational transitions. 4

(c) The microwave spectrum of HI molecule consists of a series of equidistant lines with spacing of 12.8 cm^{-1} . Calculate the bond length for HI ($m_{\text{H}} = 1 \text{ amu}$, $m_{\text{I}} = 127 \text{ amu}$). 4

OR

(s) Complete the following reaction :



UNIT—IV

8. (a) What is natural rubber ? Explain vulcanisation process. 4
- (b) Give preparation and uses of crystal violet. 4
- (c) Define with example :
- (i) Analgesic
- (ii) Antipyretic. 4

OR

9. (p) Give preparation and uses of Nylon 6,6. 4
- (q) Give preparation and uses of sulphaguanidine. 4
- (r) What are insecticides ? How does it differ from pesticide ? 4

UNIT—V

10. (a) What do you mean by Black body radiation ? How does the wavelength of black body radiation depend on temperature ? 4

UNIT—I

2. (a) Calculate EAN of Ni in $[\text{Ni}(\text{en})_3]^{2+}$ ion.
(Given : At. no. of Ni = 28) 2
- (b) Write geometrical isomers of complex type $[\text{Ma}_2\text{b}_2\text{c}_2]^{n\pm}$. 2
- (c) Calculate unpaired electron and magnetic moment of following complex ion :
- (i) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
- (ii) $[\text{Co}(\text{NO}_2)_6]^{3-}$. 4
- (d) Discuss the application of chelates in :
- (i) Gravimetric analysis
- (ii) Colorimetric analysis. 4

OR

3. (p) Write the correct formulae of the following complexes :
- (i) Pentammine nitrito (N) Cobalt (III) chloride
- (ii) Tetracyanoargentate (III) ion. 4
- (q) Explain hybridisation and structure of $[\text{Fe}(\text{CN})_6]^{3-}$ ion on the basis of VBT. 4
- (r) Write geometrical and optical isomer of complex type $[\text{M}(\text{AA})_2\text{a}_2]$ and explain optically active and inactive isomer of same type complex. 4

UNIT—II

4. (a) Explain crystal field splitting in square planer complex. 4
- (b) Explain different selection rule for d-d transitions. 4
- (c) How electrons are distributed in t_{2g} and e_g orbitals in octahedral complex with following configuration :
- (i) d^6 (high spin complex)
- (ii) d^6 (low spin complex). 4

OR

5. (p) Calculate CFSE of octahedral complex with following configuration :
- (i) d^4 (strong ligand field)
- (ii) d^4 (weak ligand field). 4
- (q) Calculate ground state term symbol of following complex ion :
- (i) $[\text{Fe}(\text{CN})_6]^{4-}$
- (ii) $[\text{Cr}(\text{NH}_3)_6]^{3+}$. 4
- (r) Explain crystal field splitting in tetrahedral complex. 4

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(Contd.)

UNIT—III

6. (a) How can you synthesise pyrrole from :
- (i) Acetylene
- (ii) Succinaldehyde. 4
- (b) Why pyridine is more basic than aniline ? 4
- (c) Complete the following reaction :
- (i) $\text{CH}_3 - \text{Mg} - \text{Br} + \text{Cl} - \overset{\text{O}}{\parallel} \text{C} - \text{O} - \text{C}_2\text{H}_5 \rightarrow ? + ?$
- (ii) $\text{CH}_3\text{Mg} - \text{I} + \text{Cl} - \text{CN} \rightarrow ? + ?$ 4

OR

7. (p) Define the following :
- (i) Synthons
- (ii) Synthetic equivalence. 2
- (q) How can you synthesise the following from methyl lithium :
- (i) Acetic acid
- (ii) n-propyl alcohol. 4
- (r) Why pyrrole undergoes electrophilic substitution reaction at position 2 rather than 3. 4

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(Contd.)