

2 0 2 1

(July)

CHEMISTRY

(Elective/Honours)

**[General Chemistry—IV
(Inorganic, Organic and Physical)]**

[Chem-EH-401]

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks
for the questions

SECTION—A**(Inorganic)**

(Marks : 18)

Answer **one** question from each Unit**UNIT—I**

1. (a) What is meant by -bonded organo-metallic compounds? Give one example. Write one method of its preparation and one important chemical application. 3

(b) What are silicones? How are they obtained? Why are they considered valuable?

3

(c) What are pseudohalides? Give some examples. Write the similarities in chemical properties of Cl⁻ and CN⁻.

3

2. (a) What are Grignard reagents? Give one method of its preparation. Write one chemical reaction to show its use in organic chemistry.

3

(b) Describe one method of preparation of tetrasulphur tetranitride. What happens when S₄N₄ is treated with (i) BrF₃ and (ii) SnCl₂ in presence of ethanol?

3

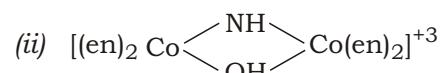
(c) Explain why interhalogen compounds are more reactive than the halogens. Write one method of preparation of BrF₃. Draw its structure and mention one of its uses.

3

UNIT—II

3. (a) Write the IUPAC nomenclature of the following : 1+1=2

(i) [Pt(NH₃)₂(en)]⁺⁴



where en ethylenediamine.

(3)

- (b) What are the essential features of Valence Bond Theory? Explain the bonding in $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ in terms of VBT. What are its limitations?
 $2+1\frac{1}{2}+1\frac{1}{2}=5$
- (c) How many geometrical isomers are possible for the complex $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$? Draw their structures and IUPAC names of the isomers.
 $1+1=2$
4. (a) What is effective atomic number rule? Calculate the effective atomic number of the central metal atom in the following complexes and write their IUPAC names :
 $1+1\frac{1}{2}+1\frac{1}{2}=4$
- (i) $[\text{Fe}(\text{CN})_6]^-$
(ii) $[\text{Cu}(\text{NH}_3)_4]^2-$
- (Atomic number of Cu 29 and Fe 26)
- (b) Draw the structures of the geometrical isomers of the complex ion, di-chloro-bis-(ethylenediamine) cobalt (III) ion. Which of the two isomers shows optical isomerism?
2
- (c) Draw the diagram indicating the splitting of the d -orbitals in tetrahedral field. Justify the splitting pattern considering the shapes of the d -orbitals.
3

(4)

- SECTION—B
(Organic)
(Marks : 19)
5. (a) What happens when fructose is heated with excess of phenylhydrazine? 1
- (b) Write down the Gabriel synthesis of glycine. $1\frac{1}{2}$
- (c) Starting from D-glucose, how will you convert to—(i) D-arabinose and (ii) D-mannose? $1\frac{1}{2}+1\frac{1}{2}=3$
- (d) Write down the zwitterionic structure of phenylalanine. 1
- (e) What happens when urea is heated with HNO_2 ? 1
- (f) Describe the following with suitable examples :
 $1+1=2$
- (i) Antiviral drugs
(ii) Analgesic drugs
- OR**
6. (a) What happen when—
(i) fructose reacts with HCN;
(ii) glucose reacts with Br_2 water? $1+1=2$

(5)

- (b) What are reducing sugars? Give examples. $1\frac{1}{2}$
- (c) Define isoelectric point of amino acid. 1
- (d) Write down the formation of biuret. 1
- (e) Write the synthesis of paracetamol. Give its uses. $1\frac{1}{2} + \frac{1}{2} = 2$
- (f) Starting from fructose, how will you convert to glucose? 2
7. (a) Draw the molecular orbital structure of pyrrole or furan. $1\frac{1}{2}$
- (b) Discuss the aromatic characters of (i) pyrrole, (ii) furan and (iii) thiophene. $1 \times 3 = 3$
- (c) Compare the basicity of pyrrole with pyridine. 1
- (d) What are nondrying oils? Give example. 1
- (e) What is iodine value of fats and oils? 1
- (f) What are chromophores and auxochromes? Give one example of each. $1 + 1 = 2$

OR

8. (a) Write down the Friedel-Crafts reaction of pyrrole with benzoyl chloride. 1

(6)

- (b) Starting from pentose, how will you synthesize furan? 1
- (c) Write down the nucleophilic substitution reaction of pyridine with sodamide. 1
- (d) Which is more basic between pyrrole and pyrrolidine? Justify. $1\frac{1}{2}$
- (e) Differentiate between soap and detergents with respect to their behaviour in hard water. $1\frac{1}{2}$
- (f) What is saponification value? 1
- (g) Write down the synthesis of methyl orange. $1\frac{1}{2}$
- (h) Give the structure of malachite green. 1

SECTION—C

(Physical)

(Marks : 19)

9. (a) Derive Ostwald's dilution law. What are its use and limitations? $3 + 1 = 4$
- (b) Define common ion effect and explain its applications in analytical chemistry. 3

(7)

- (c) Calculate the equivalent conductivity at 20 °C of NH₄OH at infinite dilution. 2½

Given :

$$\sigma_0(\text{NH}_4\text{Cl}) = 130 \text{ sm}^2 \text{ mol}^{-1}$$

$$\sigma_0(\text{OH}^-) = 174 \text{ sm}^2 \text{ mol}^{-1}$$

$$\sigma_0(\text{Cl}^-) = 66 \text{ sm}^2 \text{ mol}^{-1}$$

OR

10. (a) Define hydrolysis of a salt. Why is aqueous solution of sodium acetate basic? Derive an expression for the hydrolysis constant of this solution.

$$1+1\frac{1}{2}+2=4\frac{1}{2}$$

- (b) Explain how equivalent conductance and specific conductance vary with dilution. 1½+1½=3

- (c) Mention the advantages of conductometric titrations. 2

11. (a) Derive Nernst equation for measuring the e.m.f. of a cell. 3

- (b) Differentiate between electrochemical cell and electrolytic cell. 2

(8)

- (c) Write a note on reference electrodes. 1½

- (d) Explain the following with examples : 1½+1½=3

(i) Critical solution temperature

(ii) Azeotropic mixtures

OR

12. (a) Give the labelled phase diagram of the water system and discuss the importance of various points, lines and areas. 4

- (b) Mention the different types of reversible electrodes. 3

- (c) What is a condensed system? Write the reduced phase rule equation. 2½

★ ★ ★