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 organometallic 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 S_4N_4 is treated with *(i)* BrF_3 and *(ii)* $SnCl_2$ in presence of ethanol? 3

(c) Explain why interhalogen compounds are more reactive than the halogens. Write one method of preparation of BrF_3. 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) $[Pt(NH_3)_2(en)]^{+4}$

(ii) $\left[(en)_2\,Co\begin{smallmatrix}\diagup NH \diagdown\\ \diagdown OH \diagup\end{smallmatrix}Co(en)_2\right]^{+3}$

where en ethylenediamine.

(b) What are the essential features of Valence Bond Theory? Explain the bonding in $[Co(NH_3)_6]Cl_3$ in terms of VBT. What are its limitations? 2+1½+1½=5

(c) How many geometrical isomers are possible for the complex $[Co(NH_3)_3Cl_3]$? 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+1½+1½=4

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

(ii) $[Cu(NH_3)_4]^{2}$

(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

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. 1½

(c) Starting from D-glucose, how will you convert to—*(i)* D-arabinose and *(ii)* D-mannose? 1½+1½=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

(b) What are reducing sugars? Give examples. 1½

(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. 1½+½=2

(f) Starting from fructose, how will you convert to glucose? 2

7. (a) Draw the molecular orbital structure of pyrrole or furan. 1½

(b) Discuss the aromatic characters of *(i)* pyrrole, *(ii)* furan and *(iii)* thiophene. 1×3=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

(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. 1½

(e) Differentiate between soap and detergents with respect to their behaviour in hard water. 1½

(f) What is saponification value? 1

(g) Write down the synthesis of methyl orange. 1½

(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

(c) Calculate the equivalent conductivity at 20 °C of NH_4OH at infinite dilution. 2½

Given :

$_{0}(NH_4Cl) \quad 130 \quad sm^2 \; mol^{\;1}$

$_{0}(\overline{O}H) \quad 174 \quad sm^2 \; mol^{\;1}$

$_{0}(Cl \;\;) \quad 66 \quad sm^2 \; mol^{\;1}$

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+1½+2=4½

(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

(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

★ ★ ★