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(April)

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—I

(Inorganic)

(Marks : 18)

Answer any one question from each Unit

UNIT—I

1. (a) What are pseudohalides and pseudohalogens? Draw a resemblance between pseudohalogens and halogens. 3
- (b) Describe any one method of preparation of ferrocene. Draw the staggered and eclipsed structure of ferrocene. Discuss Friedel-Crafts reaction and Mannich condensation reaction with ferrocene. 4

(2)

- (c) Describe the properties of silicones as silicone rubber and silicone resins. 3
2. (a) I_2 is usually insoluble in water. It dissolves readily in a solution of KI. Discuss the structure of the product in the solution. 2
- (b) Describe any one method of preparation of alkyl and aryl lithium, and also discuss their structures. 4
- (c) What are polyphosphonitrilic chlorides? Give one method of preparation. What happens when polyphosphazenes react with ammonia? 4

UNIT—II

3. (a) Discuss various reactions involved in acid rain due to NO_x pollution. 2
- (b) Discuss the advantages and problems associated with sanitary landfilling. 2
- (c) What are the main domestic water pollutions? Discuss any two methods of tertiary treatment processes for depollution of the domestic water pollutions. 4

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(Continued)

(3)

4. (a) What is smog? How does it cause pollution? 2
- (b) What are the major objectives of the secondary waste water treatment? Describe any one of the biological waste water treatment process. 4
- (c) Write a brief note on ozone hole and its effect. 2

SECTION—II

(Organic)

(Marks : 19)

5. (a) Starting from glucose, how will you prepare (i) gluconic acid and (ii) fructose? $1+1\frac{1}{2}=2\frac{1}{2}$
- (b) Point out one characteristic difference between glucose and fructose. 1
- (c) What is meant by essential amino acids? Write down the names and structures of two essential amino acids. $1+2=3$
- (d) Write down the chemical name of Aspirin. Describe a method of its preparation. (Give chemical equations.) $\frac{1}{2}+1\frac{1}{2}=2$

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(Turn Over)

- (e) What happens when urea is treated with NaOBr? 1

OR

6. (a) What is an osazone? How is it prepared? (Give chemical equations.) 1½

- (b) What products are obtained when periodic acid oxidation is carried out on D-glucose? How many moles of periodic acid are consumed in this oxidation? 1½

- (c) What types of ions are formed when glycine is treated with (i) aqueous NaOH and (ii) dilute HCl? 1

- (d) How is the —COOH group of an α -amino acid protected and also activated during peptide synthesis? Give reactions. 2½

- (e) Describe the following with suitable examples : 1×2=2

(i) Tranquilizer

(ii) Antiviral

- (f) Give one example of a dipeptide. 1

7. (a) Why pyrrole, furan and thiophene are classified as aromatics? 1½

- (b) What are the products formed from the reaction between pyrrole and CHCl_3 in the presence of NaOH? Give mechanisms of the formation of the products. 2½

- (c) Explain why phenolphthalein is colourless in acidic medium as well as in strongly alkaline medium. Explain with the help of chemical equations. 2½

- (d) What are fats and oils? How does oil structurally differ from fat? What structural changes take place when hardening of oil is carried out? 1+1+1=3

OR

8. (a) How can you carry out the synthesis of pyrrole-2-sulphonic acid using a pyridine derivative? (Mechanism not required.) 1

- (b) What is Chichibabin reaction? Is it an electrophilic or nucleophilic reaction? Give a plausible mechanism of the reaction. 1+½+1=2½

- (c) What do you mean by chromophores and auxochromes? Illustrate taking some suitable examples. 2

(6)

(d) Define soaps. What are hard soaps and soft soaps? What are the disadvantages of soaps? 2½

(e) Define azo dyes. Give one example of an azo dye. 1½

SECTION—III

(Physical)

(Marks : 19)

9. (a) What is a buffer solution? Discuss the buffer action of a mixture of sodium acetate and acetic acid. 3½

(b) Explain why an aqueous solution of NH_4Cl is acidic. 1

(c) Explain the following terms : 1½×2=3

(i) Ionic product of water

(ii) Solubility product

(d) A solution of 0.1 N acetic acid dissociates to an extent of 5% at 25 °C. Calculate the dissociation constant of acetic acid at 25 °C at the given concentration. 2

(7)

OR

10. (a) What is meant by conductance? Define specific conductance and equivalent conductance, and derive a relationship between them. 4

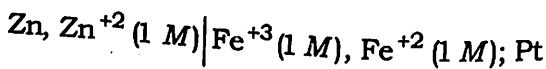
(b) Define transport number of ions. What are the factors that influence the transport number of ions? 2½

(c) The molar conductances of sodium acetate, hydrochloric acid and sodium chloride at infinite dilution are 91.0×10^{-4} , 426.16×10^{-4} and $126.45 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively at 25 °C. Calculate the molar conductance at infinite dilution for acetic acid. 3

11. (a) What is an electrochemical cell? What are the basic requirements for an electrochemical cell to be reversible? Give an example of such a cell. 4½

(b) What is meant by electrochemical series? Explain why zinc reacts with H_2SO_4 to give H_2 but silver does not. 2½

- (c) Write the cell reaction and calculate E° for the cell



Given,

$$E^\circ_{\text{Fe}^{+3}, \text{Fe}^{+2}} = +0.77 \text{ V}$$

$$E^\circ_{\text{Zn}^{+2}, \text{Zn}} = -0.76 \text{ V}$$

2½

OR

12. (a) What do you understand by degree of freedom or variance? Give examples each of univariant and invariant systems.

3

- (b) Draw a labelled phase diagram of KI-H₂O system and describe the main features.

3½

- (c) What are partially miscible liquids? Give example.

2

- (d) Give the expression for phase rule.

1

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