2021

(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—I

(Inorganic)

(*Marks* : 18)

Answer **one** question from each Unit

UNIT—I

1. *(a)* *(i)* Mention one method of preparation and application of organometallic compound of lithium. 1+1=2

(ii) NaC_5H_5 is more stable than NaC_5H_{11}. Explain. 1

(b) What are inorganic polymers? How are they classified? Discuss the general properties of inorganic polymers. 4

(c) Write few similarities in chemical properties between CN and Cl . Draw the structures of BrF_5 and IF_7. Mention their hybridization. 3

2. *(a)* What are organometallic compounds? Discuss their classification with examples on the basis of haplacity of ligands. 3

(b) Discuss the preparation, properties and uses of phosphonitrilic chlorides. 3

(c) What are pseudohalogens? Name two important pseudohalogens. How are they prepared? 4

UNIT—II

3. *(a)* How is photochemical smog formed in the atmosphere? What are its consequences? 2

(b) Discuss the primary and secondary treatment of polluted water. 3

(c) Discuss solid-waste disposal method by anaerobic digestion of biological waste. 3

4. *(a)* What is the role of O_3 in the stratosphere? Which pollutants are responsible for O_3 depletion? Write the chemical reactions and explain. 4

(b) Discuss the tertiary treatment of polluted water by reverse osmosis. 2

(c) What is radioactive waste? Explain the methods for the disposal of radioactive waste. 2

SECTION—II

(Organic)

(*Marks* : 19)

1. *(a)* What are glucosides? Draw the structure of methyl- -D-glucoside and indicate the glycosidic linkage. ½+1+½=2

(b) How is aldohexose converted to aldopentose? 2

(c) Glycine has isoelectric point at pH 6. What are its possible structures at pH 5 and pH 8? 1+1=2

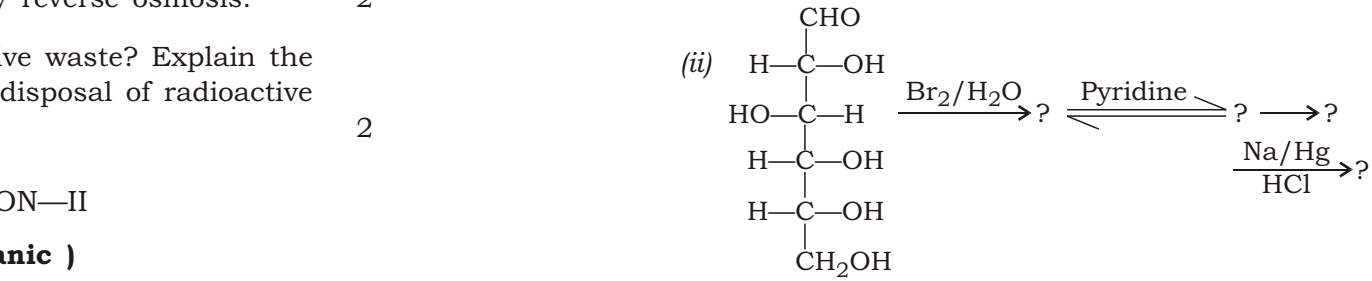
(d) What happens when urea reacts with *(i)* acetyl chloride and *(ii)* ethyl alcohol? Give the chemical equations. 1+1=2

(e) Give a method of preparation of barbituric acid. To which class of drugs does it belong? 1+½=1½

OR

2. *(a)* Complete the following reactions : 1+2=3

(i) 

(ii) 

(b) Account for the following observations : 1+1=2

(i) Glucose does not react with $NaHSO_3$.

(ii) Fructose gives two isomeric hexahydric alcohols on reduction.

(c) How is alanine synthesized by Gabriel phthalimide reaction? 2

(d) What are antibiotics? Briefly discuss their classification. 2½

3. *(a)* "Pyrrole is not only a weak base but also a very weak acid." Explain. 2

(b) Explain why pyridine is less reactive than benzene in electrophilic substitution. 2

(c) Give a method of preparation of methyl orange. Explain by giving appropriate structures how it acts as an indicator in acid-base titration. 1+2=3

(d) Write the structural difference between soaps and detergents. Discuss the mechanism of cleansing action of soaps. 1+1½=2½

OR

4. *(a)* How are the following conversions carried out? 1+1=2

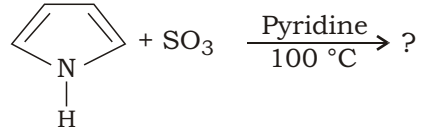
(i) Furan into pyrrole

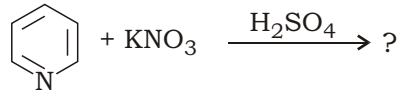
(ii) Succinaldehyde into furan

(b) How does pyridine react with $NaNH_2$ in liquid ammonia? Give the mechanism of the reaction. 1+1=2

(c) Define the iodine value of oils and indicate its significance. 1½

(d) Complete the following reactions and give the mechanism of each reaction : 2+2=4

(i) 

(ii) 

SECTION—III

(Physical)

(*Marks* : 19)

1. *(a)* What is Ostwald's dilution law? Why does the law fail in case of strong electrolytes? 2+½=2½

(b) Explain the term 'hydrolysis constant'. Derive the expression for the hydrolysis constant of a salt of a weak acid and a strong base in terms of dissociation constant of a weak acid and ionic product of water. 1½+2½=4

(c) Explain the term 'solubility product'. The solubility of silver chloride in water at 25 °C is 0·00179 g l^{1}. Calculate its solubility product at 25 °C. 1½+1½=3

OR

2. *(a)* Describe the moving boundary method for the determination of transport numbers. 3½

(b) State and explain Kohlrausch's law. How does this law help in determining the equivalent conductance of weak electrolyte at infinite dilution? 2+2=4

(c) The conductivity of a 0·01 *M* solution of acetic acid at 298 K is 1 65 10^{4} ohm ^{1} cm^{1}. Calculate the molar conductivity of the solution. 2

3. *(a)* Derive Nernst equation for the variation of EMF of a cell with the concentration of ions. 3½

(b) Describe the calomel electrode with a labelled diagram of electrode and give the relevant equations. 1½+1+1½=4

(c) Calculate the standard EMF of a cell which involves the following cell reaction : 2

Zn 2Ag Zn^{2} 2Ag

Given

$E^{\circ}_{Zn^{2}\ ,\ Zn}$ 0 76 V and

$E^{\circ}_{Ag\ ,\ Ag}$ 0 80 V

OR

4. *(a)* Draw a labelled phase diagram of water system and describe the main features. 3

(b) State and explain Nernst distribution law. What are the limitations of distribution law? 2+1=3

(c) What is steam distillation? Give the experimental details of the process and formula to calculate the composition of distillate. 1½+1½+½=3½

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