1 (Sem–4) CHE 2

2025

CHEMISTRY

Paper : CHE0400204

(Organic Chemistry–I)

Full Marks : 45

Time : 2 hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×5=5

(A) Find out the correct answers :

(a) Complete hydrolysis of proteins produces—

(i) NH_3 and CO_2

(ii) Glycogen and fatty acid

(iii) Urea and Uric acid

(iv) a mixture of amino acids

(b) Substances which reduce the rate of enzyme catalyzed reactions are known as :

(i) substrates

(ii) enzymes

(iii) products

(iv) inhibitors

(c) The heterocyclic diene employed in cyclo-addition reaction is—

(i) Furan

(ii) Pyrrole

(iii) Thiophene

(iv) 2, 5-dimethyl pyrrole

(B) Fill in the blank :

Hydroxy acids undergo intramolecular esterification in the presence of acid catalyst to yield _____.

(C) Write the structure of nicotine.

2. Answer the following : ***(any five)*** 2×5=10

(a) 'Thiophere is less reactive than furan'. Explain.

(b) Why the boiling point of ethylamine ($CH_3CH_2-NH_2$) is less than that of ethyl alcohol (CH_3CH_2OH).

(c) Arrange the following sets of compounds in increasing order of basicity. 1×2=2

Set I : (i) $CH_3CH_2-NH_2$

(ii) CH_3CONH_2

(iii) $C_6H_5CONH_2$

(iv) $C_6H_5NH_2$

Set II : (i) *p*-toluidine

(ii) *p*-nitroaniline

(iii) *N, N*-dimethyl-*p*-toluidine

(iv) aniline

(d) Give the different types of bonds responsible for the tertiary structure of proteins.

(e) How will you synthesize alanine from ethyl chloride ?

(f) How can you prepare mono-carboxylic acids from— 1×2=2

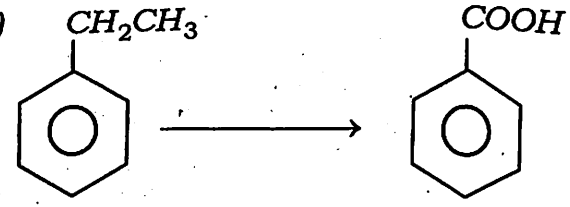
(i) a primary alcohol

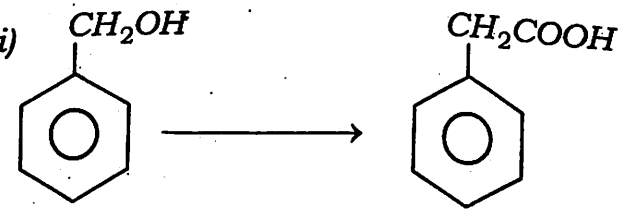
(ii) an aldehyde

(g) Explain briefly why ethyl benzoate (*Ph-COOEt*) can not undergo claisen condensation reaction.

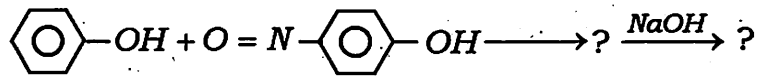
(h) How will you prepare lactic acid from acetylene ?

(i) Write chemical reactions for the following transformations— 1×2=2

(i) 

(ii) 

(j) Complete the following reaction—



3. Answer ***any four*** from the following : 5×4=20

(a) (i) How substituted pyridines can be prepared by Hantzsch synthesis ? 2

(ii) Explain the Fisher Indole synthesis with mechanism. 3

(b) (i) How will you establish the presence of pyridine nucleus in nicotine ? 2

(ii) What class of alkaloid does nicotine belongs to ? 1

(iii) What happen when aliphatic primary amine is diazotized ? 1

(iv) Mention one application of diazotization reaction. 1

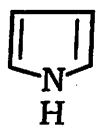
(c) (a) Give one method of preparation of each of— 1×3=3

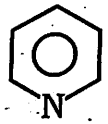
(i) Furan

(ii) Pyrrole

(i) Thiophene

(b) complete the following reactions— 1×2=2

(i)  $\xrightarrow[heat,\ \Delta]{CHCl_3\ ;\ KOH}$? 1

(ii)  $\xrightarrow[\Delta]{KOH}$? 1

(d) (i) Compare the basicities of furan, pyrrole and thiophene. 3

(ii) Explain briefly why furan is less reactive than pyrrole. 2

(e) Describe the following ***(any two)*** : 2½×2=5

(i) ISO-electric point of amino acid

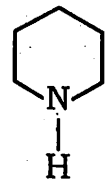
(ii) Denaturation of protein

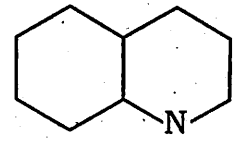
(iii) Enzyme inhibitors.

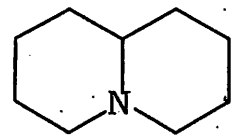
(f) Write a short note on the effect of ring substituents on the basicities of aromatic amines.

(g) (i) What is Hoffmann Exhaustive Methylation reaction ? 2

(ii) Identify the products of the following compounds by using Hoffmann Exhaustive Methylation reaction. 1×3=3

(i) 

(ii) 

(iii) 

(h) (i) Explain various types of electronic transmissions possible for organic compounds in *uv*-visible spectroscopy.

OR

(ii) In *IR* spectroscopy, absorption signals for molecular vibrations are recorded. What are these molecules vibrations ?

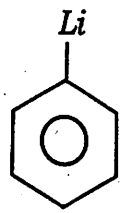
Show the types of molecular vibrations possible in a molecular of the type A_2x where '*x*' is called anchor atom.

4. Answer ***any four*** from the following : 1×10=10

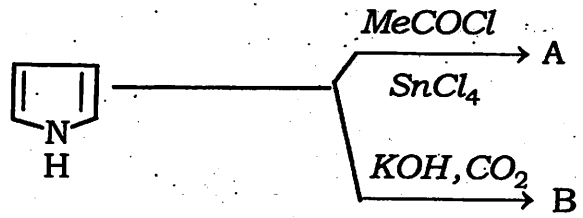
(A) Find out the products *A* and *B* in the following reactions : 2×5=10

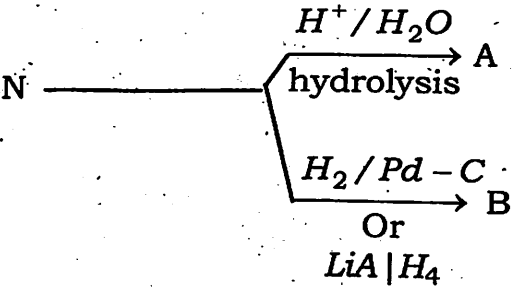
(i) $CH_3CH_2 - NO_2 \xrightarrow{Br_2/NaOH} A \xrightarrow{Br_2/NaOH} B$

(ii) $2RCH_2COOR' \xrightarrow[(ii)\ H^+/H_2O]{(i)\ NaOR''} A + B$

(iii) 

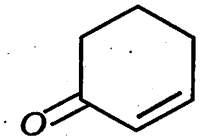
$+ CO_2 \longrightarrow A \xrightarrow{H_3O^{\oplus}} B$

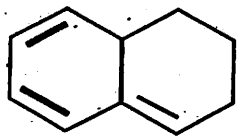
(iv) 

(v) 

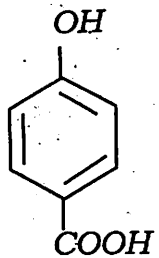
(B) (a) What is chromophore ? Give one example. 1

(b) Calculate the λ_{max} of the following compounds— 2×2=4

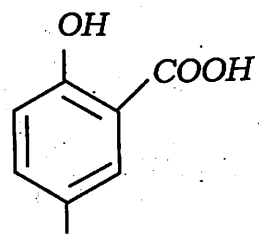
(i) 

(ii) 

(c) How will you distinguish between— 3

(i) 

and

(ii) 

by using *IR*-spectroscopy

(d) What is overtone and combination bond ? 2

(C) (a) Explain why carboxylic acids are much more acidic than alcohol, whereas phenols are weaker acids than carboxylic acids. 3

(b) Find out the correct answer—

(I) Which one of the following 5-membered heterocycle is most resonance stabilized ? 1

(i) Furan

(ii) Thiophene

(iii) Pyrrole

(iv) Pyridine

(II) In aquous solution, an amino acid exists as— 1

(i) cation

(ii) anion

(iii) dianion

(iv) Zwitter-ion

(c) Write the name of the optically inactive amino acid. 1

(d) Why the electrophilic substitution of furan usually takes place at C–2 position ? 2

(g) Write Paal–Knorr synthesis of furan. 2

(D) (a) What is Hinsberg reagent ? How will you distinguish between 1°, 2° and 3° amines by using Hinsberg reagent. 1+3=4

(b) Why aniline can not undergo Friedel Craft reaction and nitration reaction ? 4

(c) How will you prepare ethylamine by Gabriel synthesis ? 2