CHEM/V/CC/11

Student's Copy

2023

(CBCS)

(5th Semester)

CHEMISTRY

SIXTH PAPER

(Organic Chemistry-II)

Full Marks: 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A-OBJECTIVE)

(Marks: 10)

Tick (\checkmark) the correct answer in the brackets provided :

- 1. Carbon to which four different atoms or group of atoms is attached is called chiral carbon and such carbon-containing compound shows
 - (a) metamerism ()
 - (b) mesomerism ()
 - (c) enantiomerism ()
 - (d) functional isomerism ()

2. How many optically active stereoisomers are possible for butan-2,3-diol?

- (a) 1 ()
- (b) 2 ()
- (c) 3 ()
- (d) 4 ()

 $1 \times 10 = 10$

- 3. The number of conformational isomers of ethane is
 - (a) 4 ()
 - (b) 6 ()
 - (c) 2 ()
 - (d) infinite ()

4. The isomers converted into each other by rotation around a single bond are

- (a) conformers ()
- (b) enantiomers ()
- (c) diastereomers ()
- (d) position isomers ()
- 5. Which one of the following is most basic?
 - (a) Aniline ()
 - (b) Pyrrole ()
 - (c) Pyridine ()
 - (d) Piperidine ()
- 6. Skraup synthesis is used to prepare
 - (a) pyridine ()
 - (b) isoquinoline ()
 - (c) quinoline ()
 - (d) pyrrole ()

- 7. The structural isomers which differ in the relative positions of their atoms are known as
 - (a) conformers ()
 - (b) tautomers ()
 - (c) enantiomers ()
 - (d) resonance ()
- 8. A six-membered cyclic transition state is obtained in
 - (a) benzoin reaction ()
 - (b) Perkin reaction ()
 - (c) Cannizzaro reaction ()
 - (d) Wolff-Kishner reaction ()
- In Wolff rearrangement reaction, a highly reactive product is formed which is known as
 - (a) oxonium ()
 - (b) benzil ()
 - (c) ketene ()
 - (d) nitronium ()
- 10. The reaction of an aromatic aldehyde having no α -hydrogen atom with esters containing α -hydrogen atom in presence of sodium ethoxide gives α , β -unsaturated esters is known as
 - (a) Mannich reaction ()
 - (b) Claisen-Schmidt reaction ()
 - (c) Reformatski reaction ()
 - (d) Friedel-Crafts reaction ()

(SECTION : B-SHORT ANSWERS)

(Marks: 15)

Answer the following questions :

UNIT-I

 What is the essential condition for a compound to be chiral? Justify your answer with example.

OR

 Explain a stereogenic centre. Draw all the possible stereo-isomers of 3-chlorobutan-2-ol.

UNIT-II

3. Draw all the conformational isomers of ethane. Indicate the most stable and the least stable conformer.

OR

4. Differentiate between conformations and configurations.

Unit—III

5. Compare between the basicity of pyrrole and pyridine.

OR

6. Predict the product and write the mechanism for the given reaction :

$$= \frac{\text{liq. NH}_3}{\text{N}^2} + \text{NaNH}_2 \xrightarrow{\text{liq. NH}_3} ?$$

Unit—IV

7. Discuss about the keto-enol tautomerism with suitable example.

OR

8. Predict the product(s) with mechanism for the following reaction :



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4

[Contd.

UNIT-V

9. Discuss the acid catalyzed hydrolysis of esters.

OR

10. Predict the product with suitable mechanism for the following reaction :



(SECTION : C-DESCRIPTIVE)

(Marks : 50)

Answer the following :

UNIT-I

1. (a) Explain axis of symmetry with suitable example.

(b) Designate E or Z notation to the following molecules :



- (c) Write the difference between meso-compound and racemic mixture with suitable examples.
 4
- (d) Show the inversion of configuration in S_N^2 mechanism. 2

/112

Contd.

10×5=50

2

2. (a) Assign R and S configurations to the following :



- (b) Write down all possible stereoisomers of 3-chloro-2-butanol.
- (c) Explain the following with suitable examples :
 - (i) Diastereomers
 - (ii) Enantiomers
 - (iii) Sequence rules : D & L and R & S systems of nomenclature of configurations

Unit—II

- **3.** (a) Draw the Newman projection formula for boat and chair conformations of cyclohexane indicating all the hydrogens. Show the most stable conformations and justify.
 - (b) By drawing Newman projection formula, show the potential energy changes occur in *n*-butane when the molecule is rotated around its C_2 — C_3 bond axis through a complete cycle.
 - (c) Explain the stability of conformations of 1,2-disubstituted cyclohexane. 3

| Contd.

3

4

2

2

2×3=6

OR

- 4. (a) What are meant by angle strain, tortional strain and steric strain in a molecule?
 - (b) Write down the chair conformation of cis- and trans-1,3-dimethyl cyclohexane.
 - (c) Draw Newman and Sawhorse formulae for the different conformational isomers of ethane. Explain the stability.
 3

UNIT-III

- 5. (a) Complete the following reactions :
 - (i) $(i) \xrightarrow{\text{NH}_3, \text{Al}_2\text{O}_3} \xrightarrow{\text{steam}} ?$

$$(ii) \quad 2 \underset{CH}{\overset{CH}{\parallel}} + H_2 \overset{CH}{\overset{S}{\text{:}}} \xrightarrow{\Delta} ?$$

(iii)
$$(iii)$$
 (iii) (iii) (H_2O_3) (H_2O_4) (H_3O_3) (H_2O_3) $($

(b) Complete the following reactions with suitable mechanism : 3+4=7

7

(i)
$$(i)$$
 (i) (i)

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| Contd.

1×3=3

6. (a) Complete the following reactions :

(i) (i) + KNO₃ $\xrightarrow{H_2SO_4}$? (ii) (i) + NaNH₂ $\xrightarrow{Iiq. NH_3}$? (iii) (i) + NaNH₂ $\xrightarrow{Iiq. NH_3}$? (iii) (i) + NaNH₂ $\xrightarrow{H_2SO_4}$?

(b) Compare the basicity of pyridine and piperidine.

Ag₂SO₄

- (c) How can you prepare the following products as given below? Write down their structures : 2×2=4
 - (i) 3-Chloropyridine from pyridine
 - (ii) 2-Acetyl furan from furan

UNIT-IV

7. (a) Differentiate between tautomerism and resonance.
(b) What are active methylene compounds? Write two examples.
(c) Complete the given reaction, giving suitable mechanisms :



8

 $1 \times 3 = 3$

- **8.** (a) Explain the acidity of α -hydrogen in carbonyl compounds taking suitable example. 2
 - (b) Complete the following reactions with suitable mechanisms : 4×2=8

(i) CHO +
$$(CH_3CO)_2O \xrightarrow{CH_3CO_2Na}$$
?

 $\langle \rangle$ CHO + NH₂NH₂ \xrightarrow{OH} ? (ii)

UNIT-V

- 9. (a) Discuss Friedel-Crafts acylation reaction. Explain with reaction mechanism. 4
 - (b) Complete the following reactions with suitable mechanisms : 3×2=6



OR

- 10. (a) Discuss the following molecular rearrangement reactions with suitable example and mechanism : 3×3=9
 - (i) Pinacol-Pinacolone rearrangement
 - Wagner-Meerwein rearrangement (ii)
 - Dienone-phenol rearrangement (iii)
 - (b) What are ketals?

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9

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- OR 2. Explain a stereogenic centre. Draw all the possible stereo-isomers of 3-chlorobutan-2-ol.
 - UNIT—II
- Draw all the conformational isomers of ethane. Indicate the most stable and the least stable conformer.

OR

4. Differentiate between conformations and configurations.

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UNIT-IV

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8. Predict the product(s) with mechanism for the following reaction :



| Contd.

3×5≈15

UNIT-V

9. Discuss the acid catalyzed hydrolysis of esters.

OR

10. Predict the product with suitable mechanism for the following reaction :



(SECTION : C-DESCRIPTIVE)

(Marks : 50)

10×5=50

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Answer the following :

1. (a) Explain axis of symmetry with suitable example.

Designate E or Z notation to the following molecules : (b)



- (c) Write the difference between meso-compound and racemic mixture with 4 suitable examples.
- 2 (d) Show the inversion of configuration in $S_N 2$ mechanism.

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[Contd.

2. (a) Assign R and S configurations to the following :



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Unit—II

- **3.** (a) Draw the Newman projection formula for boat and chair conformations of cyclohexane indicating all the hydrogens. Show the most stable conformations and justify.
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 - (b) Write down the chair conformation of cis- and trans-1,3-dimethyl cyclohexane.
 - (c) Draw Newman and Sawhorse formulae for the different conformational isomers of ethane. Explain the stability.
 3

- 5. (a) Complete the following reactions :
 - (i) (i)

$$(ii) \quad 2 \underset{\text{CH}}{\overset{\text{CH}}{\parallel}} + \text{H}_2 \overset{\text{CH}}{\text{S}} : \xrightarrow{\Delta} ?$$

(iii)
$$(H_2O_3) \rightarrow (H_2O_4) \rightarrow (H_3O_3) \rightarrow (H_2O_3)$$

- (b) Complete the following reactions with suitable mechanism : 3+4=7
 - (i) (i)

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| Contd.

1×3=3

3

OR

6. (a) Complete the following reactions :

- (i) (1) + KNO₃ $\xrightarrow{H_2SO_4}$? (ii) (ii) + NaNH₂ $\xrightarrow{\text{liq. NH}_3}$? $\left(\begin{array}{c} Br_2 \\ H_2 SO_4 \end{array} \right) ?$ (iii)
- (b) Compare the basicity of pyridine and piperidine.

Ag₂SO

- How can you prepare the following products as given below? Write (c) down their structures : $2 \times 2 = 4$
 - 3-Chloropyridine from pyridine (i)
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- 7. (a) Differentiate between tautomerism and resonance. 3 (b) What are active methylene compounds? Write two examples. 3 (c) Complete the given reaction, giving suitable mechanisms : 4 $\downarrow \xrightarrow{?} \downarrow \checkmark$
- /112



| Contd.

1×3=3

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(b) Complete the following reactions with suitable mechanisms : $4 \times 2=8$

(i) CHO + $(CH_3CO)_2O \xrightarrow{CH_3CO_2Na}$? (ii) CHO + $NH_2NH_2 \xrightarrow{OH}$?

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- 9. (a) Discuss Friedel-Crafts acylation reaction. Explain with reaction 4 mechanism.
 - (b) Complete the following reactions with suitable mechanisms : $3 \times 2=6$



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9