CHEM/II/EC/03

Student's Copy

2025

(CBCS)

(2nd Semester)

CHEMISTRY

SECOND PAPER

(Organic Chemistry-I)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A-OBJECTIVE)

(Marks: 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. Resonance effect involves

- (a) delocalization of σ -electrons ()
- (b) delocalization of π-electrons()
- (c) partial displacement of electrons()
- (d) delocalization of π and σ -electrons ()
- The melting and boiling points of an organic compound having intramolecular H-bond
 - (a) will be decreased ()
 - (b) will be increased ()
 - (c) will remain the same ()
 - (d) None of the above ()

3. The halogenation of benzene ring at the basic carbon skeleton is called

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- (a) nuclear halogenation ()
- (b) aromatic halogenation ()
- (c) side-chain halogenation
- (d) primary halogenation ()

4. According to Hückel's rule, which of the following is not aromatic?



(c) III (

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(a) I

(b) П

- (d) IV (
- 5. The reaction between aldehyde and HCN to form cyanohydrin is an example of
 - (a) nucleophilic addition ()
 - (b) nucleophilic substitution ()
 - (c) addition elimination ()
 - (d) electrophilic addition ()

 Direct nitration of phenol with conc. HNO₃ gives poor yield of picric acid due to its

- (a) reduction ()
- (b) oxidation ()
- (c) hydrolysis ()
- (d) ring destruction ()
- 7. Carbylamine test is a diagnostic test for
 - (a) primary amine ()
 - (b) secondary amine ()
 - (c) tertiary amine ()
 - (d) quaternary ammonium salt ()

8. Both aliphatic and aromatic primary arylamines add to CS_2 to give

- (a) aniline ()
- (b) sulphanilic acid ()
- (c) p-nitroanline ()
- (d) dithiocarbamic acid ()

9. In $S_N 2$ reaction, the stereochemistry of the product molecule will result in

- (a) retention of configuration ()
- (b) racemic mixture ()
- (c) inversion of configuration ()
- (d) enantiomers ()

10. The major product of the following reaction

$$\begin{array}{ccc} CH_{3} \\ Ph & H \\ Ph & H \\ Ph & Br \\ CH_{3} \end{array}$$

is

(a)
$$\xrightarrow{Ph}_{CH_3}$$
 ()

(b)
$$\xrightarrow{Ph}_{H_3C} \xrightarrow{Ph}_{CH_3}$$
 ()

(c)
$$\stackrel{H_3C}{\xrightarrow{Ph}} \stackrel{Ph}{\xrightarrow{CH_3}}$$
 ()

$$\begin{array}{cccc} \text{(d)} & Ph \underbrace{H}_{C} \underbrace{H}_{C} \underbrace{H}_{C} \\ & \downarrow \\ & \downarrow \\ CH_{3} & OH \end{array} \begin{array}{c} \text{()} \\ \text{()} \end{array}$$

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(SECTION : B-SHORT ANSWERS)

(Marks: 15)

Answer the following questions :

UNIT-I

1. What are electrophiles and nucleophiles? Give example of each.

OR

2. What is inductive effect? How does inductive effect increase or decrease the acidic and basic characters of organic acids and bases?

Unit—II

3. Explain why cyclopentadienyl anion shows aromatic character.

OR

4. Draw the molecular orbital structure of benzene and explain it.

UNIT—III

5. Complete the following reaction with suitable mechanism :

$$CH_{3}CH=O + HCN \longrightarrow A \xrightarrow{2H_{2}O} B$$

OR

6. Explain the effect of substituent on acidity of carboxylic acids.

UNIT-IV

7. Complete the following reaction with suitable mechanism :

3×5=15

8. Arrange the following compounds in the order of increasing basic strength and explain :

Aniline, p-nitroaniline, m-nitroaniline

UNIT-V

9. Explain the mechanism of El reaction taking suitable example.

OR

10. Explain ambident nucleophile with suitable example.

(SECTION : C-DESCRIPTIVE)

(Marks: 50)

Answer the following questions :

UNIT-I

1.	(a)	Explain hyperconjugation taking a suitable example.	3
	(b)	Explain why alcohols have higher boiling points than isomeric ethers.	3
	(c)	What are hydrogen bonds? Explain why o-nitrophenol is steam volatile whereas p-nitrophenol is non-steam volatile.	4
OR			
2.	(a)	Arrange the following compounds in the decreasing order of acidity and explain :	3
		CH ₃ COOH, ClCH ₂ COOH, Cl ₂ CHCOOH, Cl ₃ CCOOH	
	(Ъ)	Arrange the following in order of their increasing stability and explain : $C_6H_5CH_2^+$, $(C_6H_5)_2CH^+$, $(CH_3)_3C^+$, $CH_3CH_2^+$, CH_3^+	3
	(c)	What are homolytic and heterolytic cleavages of a covalent bond? Describe the intermediate species formed by such cleavages.	4

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10×5=50

Unit—II

- 3. (a) Why is cyclohexene with 2π electrons not aromatic?
 - (b) Complete the following reaction with mechanism :

$$+ Cl_2 \xrightarrow{FeCl_3} ?$$

(c) State Hückel's rule of aromaticity and indicate whether the planar species are aromatic or not with explanation :



OR

4. (a) Complete the following reactions with mechanism : $3 \times 2 = 6$

(i) $(i) + HNO_3 \xrightarrow{Conc. H_2SO_4} ?$

(ii)
$$\bigcirc$$
 -Cl + CH₃Cl $\xrightarrow{\text{FeCl}_3}$?

(b) Aryl halides are less reactive than alkyl halides towards nucleophilic substitution. Explain.

Unit—III

5. (a) Which one of the following would you expect to be a stronger acid? Explain :

FCH₂COOH or FCH₂CH₂COOH

- (b) Write the chemical reaction to distinguish between acetaldehyde and acetone.
- (c) Write aldol condensation reaction with mechanism.

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OR

6. (a) Complete the following reactions and write the mechanism : $3 \times 2=6$

(i)
$$(i) \xrightarrow{1} Aq. NaOH \rightarrow ? \xrightarrow{H_2O/H^+} ?$$

(ii) $(i) \xrightarrow{0} + HCN \rightarrow ?$

(b) Reactivity of aldehydes and ketones towards nucleophilic addition is largely determined by steric and electronic factors. Explain.

UNIT-IV

- 7. (a) Write the Hinsberg test to distinguish among 1°, 2° and 3° amines. 3
 (b) "Aniline undergoes ring substitution primarily at ortho- and parapositions." Explain.
 3
 - (c) Complete the following reactions : 2×2=4
 - (i) $C_2H_5NH_2 + CH_3Br \rightarrow ?$
 - (ii) $C_6H_5NH_2 + CH_3CHO \rightarrow ?$

OR

8. (a) Complete the following reactions :

(i)
$$\swarrow$$
 NH₂ + aq. Br₂ \longrightarrow ?

(ii) CH_3CH_2 — $NH_2 + CHCl_3 + KOH \longrightarrow ?$

(iii)
$$\swarrow$$
 -NH₂ + H_{3C} -CH₃ \rightarrow ?

(b) By taking suitable examples, give the important factors which influence the basic strengths of alkylamines and arylamines.

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Contd.

2×3=6

UNIT-V

- 9. (a) Explain briefly how a solvent affects the rate of $S_N 1$ and $S_N 2$ reactions. 4
 - (b) Explain the influence of the following on substitution reaction : $3 \times 2=6$
 - (i) Structure of alkyl group
 - (ii) Nature of nucleophile

OR

- 10. (a) Discuss with suitable examples, Hofmann's rule of elimination.
 - (b) Complete the following reaction and predict the major product using Saytzeff's rule :

2-chloropentane $\xrightarrow{CH_3O^{\Theta}}$?

(c) Discuss the role of leaving group and structure of substrate in nucleophilic substitution reaction.

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