

2023

(CBCS)

(2nd Semester)

**CHEMISTRY**

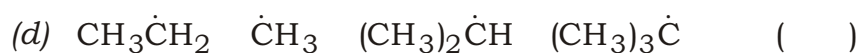
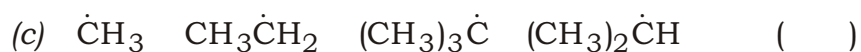
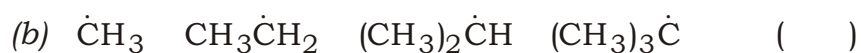
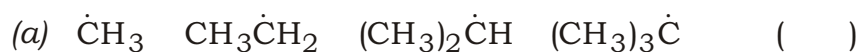
SECOND PAPER

**( 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. The order of stability of free radicals is



2. The boiling point of water is exceptionally high because
- (a) there is a covalent bond between H and O ( )
  - (b) water molecules are angular ( )
  - (c) water molecules associate due to hydrogen bonding ( )
  - (d) water molecules are linear ( )
3. The carbon atoms in a benzene ring are
- (a)  $sp$ -hybridized ( )
  - (b)  $sp^3$ -hybridized ( )
  - (c)  $sp^2$ -hybridized ( )
  - (d)  $dsp^2$ -hybridized ( )
4. Which of the following is the correct statement about resonance?
- (a) It decreases the energy of the system. ( )
  - (b) Resonance hybrid is more stable than any resonating structure. ( )
  - (c) The hybridization of atoms do not change due to resonance. ( )
  - (d) Resonating structures cannot be isolated at any temperature. ( )
5. The reaction between aldehyde and HCN to form cyanohydrin is an example of
- (a) nucleophilic substitution ( )
  - (b) nucleophilic addition ( )
  - (c) addition elimination ( )
  - (d) elimination ( )

6. Which of the following compounds is most reactive towards nucleophilic addition reaction?

- (a) Acetaldehyde ( )
- (b) Acetone ( )
- (c) Benzene ( )
- (d) Benzaldehyde ( )

7. Schiff's base can be obtained by reacting 1° amine with

- (a) cyanide ( )
- (b) alcohol ( )
- (c) carboxylic acid ( )
- (d) aldehyde ( )

8. Alkylation of amines with alkyl halides proceeds by

- (a) electrophilic addition ( )
- (b) electrophilic substitution ( )
- (c) nucleophilic substitution ( )
- (d) nucleophilic addition ( )

9. Select the correct statement.

- (a) S<sub>N</sub>2 reaction follows second-order kinetics. ( )
- (b) No intermediate is involved in S<sub>N</sub>2 mechanism. ( )
- (c) S<sub>N</sub>2 reactions are one-step reaction. ( )
- (d) All of the above ( )

10. The reactivity order of alkyl halide in S<sub>N</sub>2 reaction is

- (a) CH<sub>3</sub>X 1° 2° 3° ( )
- (b) CH<sub>3</sub>X 2° 1° 3° ( )
- (c) CH<sub>3</sub>X 3° 1° 2° ( )
- (d) CH<sub>3</sub>X 3° 2° 1° ( )

( SECTION : B—SHORT ANSWER )

( Marks : 15 )

Answer the following questions :

3×5=15

UNIT—I

1. What are carbanions? Why does alkyl group lower the stability of carbanions?

**OR**

2. What do you mean by hyperconjugation? Give example.

UNIT—II

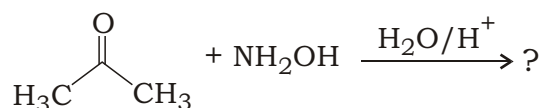
3. Explain resonance energy.

**OR**

4. What are nuclear and side chain halogenations? Give one example of each.

UNIT—III

5. Complete the following reaction with mechanism :



**OR**

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

UNIT—IV

7. How do you understand the basicity of amines? How does the electron-attracting group affect the basicity?

**OR**

8. Discuss the basicity of nitroaniline.

UNIT—V

9. Explain a regioselective reaction with suitable example.

OR

10. What is ambident nucleophile? Give two examples.

( SECTION : C—DESCRIPTIVE )

( Marks : 50 )

Answer the following questions :

10×5=50

UNIT—I

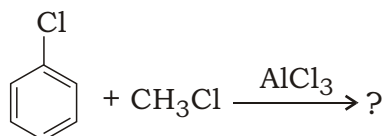
1. (a) Differentiate between transition state and intermediate with the help of energy profile. 4
- (b) What are singlet and triplet carbenes? Discuss their stability and geometry. 6

OR

2. (a) Discuss the structure and stability of carbocation and free radicals. 6
- (b) Why is acetic acid a weaker acid than formic acid? 2
- (c) "Ethanol has higher boiling point than dimethyl ether though both have the same molecular mass." Explain. 2

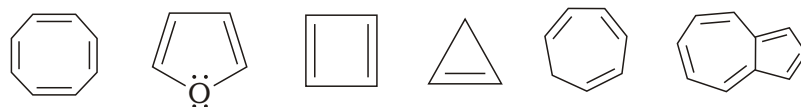
UNIT—II

3. (a) Explain why aryl halides are less reactive than alkyl halides towards nucleophile. 3
- (b) "The electrophilic substitution of toluene occurs at *ortho*- and *para*-position of the benzene ring." Explain. 3
- (c) Complete the following reaction with suitable mechanism : 4

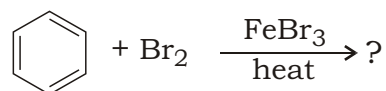


**OR**

4. (a) State Hückel's rule of aromaticity. Predict whether the following compounds are aromatic or not. Explain : 1+3=4

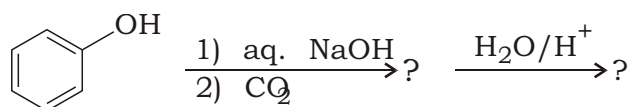


- (b) Why aryl halides do not react with nucleophilic reagents under normal laboratory conditions? 3
- (c) Predict the product and mechanism of the following reaction : 3



**UNIT—III**

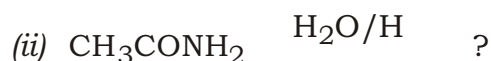
5. (a) Complete the following reaction with mechanism : 4



- (b) Propose the mechanism for the reaction of acetaldehyde with HCN. 3
- (c) How do aldehydes and ketones react with semicarbazide? Write the reaction. 3

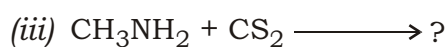
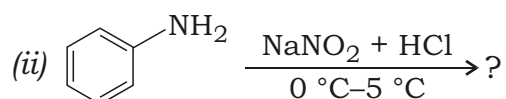
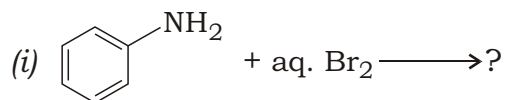
**OR**

6. (a) The reactivity of aldehydes and ketones towards nucleophilic addition is largely determined by steric and electronic factors. Explain. 4
- (b) How can you distinguish between aldehyde and ketone? 4
- (c) Complete the following chemical reactions : 2



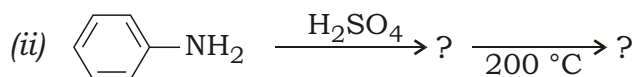
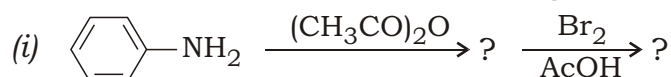
UNIT—IV

7. (a) Explain why aniline undergoes ring substitution at *ortho*- and *para*-positions. 4
- (b) Complete the following reactions : 6



**OR**

8. (a) How will you distinguish among primary, secondary and tertiary amines by Hinsberg's test? 4
- (b) Write the products of the following reactions : 3×2=6



UNIT—V

9. (a) Give the product, mechanism and stereochemistry of the following S<sub>N</sub>2 reaction : 6
- H<sub>3</sub>C—Br    H<sub>2</sub>O    ?
- (b) Explain Saytzeff's rule with suitable examples. 4

**OR**

10. (a) Discuss with suitable examples Hoffmann's rule of elimination. 3
- (b) Explain S<sub>N</sub>i reaction with suitable example. 3
- (c) Discuss the role of leaving group and structure of substrate in nucleophilic substitution reaction. 4

★ ★ ★