2025

(NEP—2020)

(3rd Semester)

CHEMISTRY (MAJOR/MINOR)

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

1. The order of hyperconjugative stabilization of carbocations is

(a) methyl > primary > secondary > tertiary ( )

(b) secondary > tertiary > primary > methyl ( )

(c) tertiary > secondary > primary > methyl ( )

(d) primary > tertiary > secondary > methyl ( )

2. The highest point in an energy profile diagram of a reaction corresponds to

(a) transition state ( )

(b) activation energy ( )

(c) reactants ( )

(d) products ( )

3. According to Cahn-Ingold-Prelog rules, the lowest priority group should be placed

(a) in the plane of the paper ( )

(b) in axial position ( )

(c) towards the observer ( )

(d) behind the plane (away from observer) ( )

4. Geometrical isomerism in oximes is due to

(a) restricted rotation about C=O bond ( )

(b) restricted rotation about C=N bond ( )

(c) restricted rotation about C—C bond ( )

(d) free rotation about N—O bond ( )

5. In S_N1 reactions, the rate-determining step involves

(a) attack of nucleophile ( )

(b) simultaneous bond making and bond breaking ( )

(c) formation of transition state with nucleophile ( )

(d) departure of leaving group to form carbocation ( )

6. The stereochemistry of S_N2 reactions is

(a) racemization ( )

(b) *cis-trans* isomerism ( )

(c) retention of configuration ( )

(d) inversion of configuration ( )

7. In comparison between S_N1 and E1, both share a common intermediate, that is

(a) free radical ( )

(b) carbanion ( )

(c) carbocation ( )

(d) carbene ( )

8. Which of the following is aromatic?

(a) Cyclobutadiene (4π-electrons) ( )

(b) Cyclopentadienyl anion (6π-electrons) ( )

(c) Cyclooctatetraene (8π-electrons, non-planar) ( )

(d) Benzyl radical ( )

9. In nitration of benzene, the electrophile is

(a) NO_2 ( )

(b) NO_2^- ( )

(c) NO_3^+ ( )

(d) NO_2^+ ( )

10. In Friedel-Crafts alkylation, the electrophile is

(a) carbanion ( )

(b) carbocation ( )

(c) radical ( )

(d) alkyl halide ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

Answer *five* questions, taking at least *one* from each Unit : 3×5=15

UNIT—I

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

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

UNIT—II

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

4. Differentiate between conformations and configurations.

UNIT—III

5. Differentiate between nucleophile and bases.

6. Write a note on S_Ni reaction taking suitable example.

UNIT—IV

7. Explain resonance energy.

8. Draw the molecular orbital structure of benzene.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer *five* questions, taking at least *one* from each Unit : 10×5=50

UNIT—I

1. *(a)* Differentiate between homolytic and heterolytic bond breakings. Give example. 4

(b) Discuss the structure and stability of carbocation and free radicals. 6

2. *(a)* Differentiate between transition state and intermediate with the help of energy profile diagram. 4

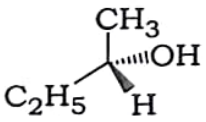
(b) What are singlet and triplet carbenes? Discuss their stability and geometry. 6

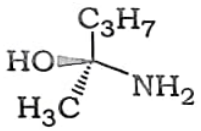
UNIT—II

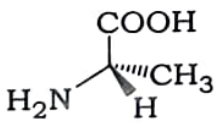
3. *(a)* Explain racemization with suitable example. 4

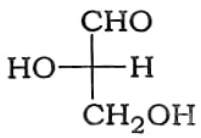
(b) Explain with examples geometrical isomerism in oximes. How is the configuration of aldoximes determined? 6

4. *(a)* Assign *R*- or *S*-configuration to the following isomers : 1×4=4

(i) 

(ii) 

(iii) 

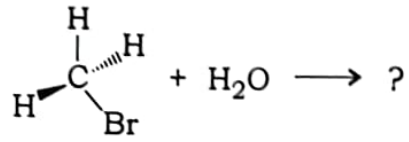
(iv) 

(b) Draw and explain all the possible conformations of *n*-butane. Draw its energy diagram showing energy differences between various conformations of *n*-butane. 6

UNIT—III

5. *(a)* Explain Hofmann's rule with suitable examples. 4

(b) Give the product, mechanism and stereochemistry of the following S_N2 reaction : 6



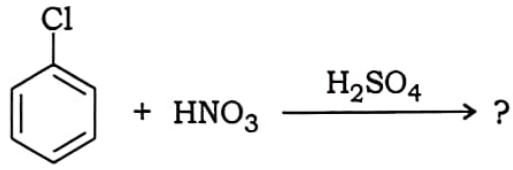
6. *(a)* Discuss the role of leaving group in nucleophilic substitution reaction. 4

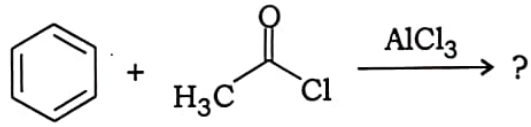
(b) Explain with example the reaction mechanism, kinetics and stereochemistry of the S_N1 reaction. 6

UNIT—IV

7. *(a)* Explain antiaromaticity and non-aromaticity with suitable examples. 4

(b) Complete the following reactions with suitable mechanisms : 3×2=6

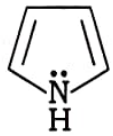
(i) 

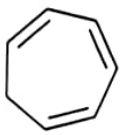
(ii) 

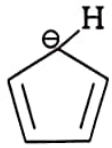
8. *(a)* *Ortho-* and *para*-substitution proceed faster than *meta*-substitution in alkyl benzenes. Explain. 4

(b) State Hückel's rule. Predict whether the following compounds satisfy Hückel's rule or not. Explain : 2+4=6

(i) 

(ii) 

(iii) 

(iv) 

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