2025

(NEP—2020)

(1st Semester)

CHEMISTRY (MAJOR)

(Organic Chemistry—I)

(Revised)

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 complete transfer of π-bonded electrons of a multiple bond towards one of the bonded atoms at the demand of attacking reagent is called

(a) hyperconjugation effect ( )

(b) electromeric effect ( )

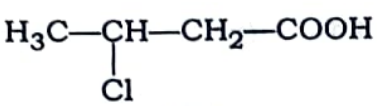
(c) mesomeric effect ( )

(d) inductive effect ( )

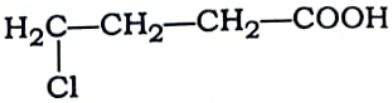
2. The order of acidity among the following compounds

(*I*)

(*II*)



(*III*)



(*IV*)

is

(a) *I* > *II* > *III* > *IV* ( )

(b) *IV* > *III* > *II* > *I* ( )

(c) *I* > *II* > *IV* > *III* ( )

(d) *II* > *III* > *IV* > *I* ( )

3. The boat conformation of cyclohexane is destabilized by

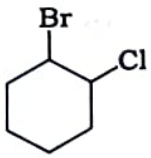
(a) flagpole hydrogen ( )

(b) axial hydrogen ( )

(c) equatorial hydrogen ( )

(d) None of the above ( )

4. The number of chiral carbon atoms in



is

(a) 3 ( )

(b) 4 ( )

(c) 1 ( )

(d) 2 ( )

5. S_N2 reaction is favoured by

(a) polar aprotic solvent ( )

(b) tertiary alkyl halide ( )

(c) polar protic solvent ( )

(d) weak nucleophile ( )

6. In elimination reaction, Hofmann product is generally formed when the

(a) base is small ( )

(b) base is bulky ( )

(c) base is strong ( )

(d) substrate is not sterically hindered ( )

7. Which of the following is not a type of conformational isomer?

(a) Eclipsed conformation ( )

(b) Staggered conformation ( )

(c) *Cis-trans* conformation ( )

(d) Gauche conformation ( )

8. Which of the following observations does not support Kekule's structure of benzene?

(a) Benzene resists addition reactions with bromine in CCl_4 ( )

(b) Benzene readily undergoes substitution reactions ( )

(c) All C—C bond lengths in benzene are equal ( )

(d) Benzene contains localized double bonds ( )

9. Which one of the following compounds undergoes nitration more readily?

(a) Toluene ( )

(b) Benzene ( )

(c) Chlorobenzene ( )

(d) Nitrobenzene ( )

10. Which one of the following groups is *ortho-* and *para*-directing but also acts as ring-deactivating group?

(a) $-CH_3$ ( )

(b) —OH ( )

(c) $-OCH_3$ ( )

(d) —Cl ( )

(SECTION : B—SHORT ANSWERS)

(*Marks* : 15)

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

UNIT—I

1. What are electrophiles and nucleophiles? Give examples.

2. "Chloroacetic acid is a stronger acid than acetic acid." Explain.

UNIT—II

3. Draw Newman projection formula for fully eclipsed, fully staggered and gauche conformation of *n*-butane. Which of them is the least stable?

4. What are *meso*-compounds? Give one example. Are *meso*-compounds optically active and why?

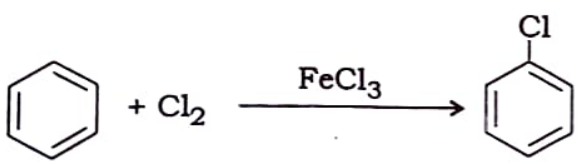
UNIT—III

5. What are ambident nucleophiles? Give examples.

6. Differentiate between nucleophiles and bases.

UNIT—IV

7. Write the mechanism of the given reaction :



8. Explain the stability of benzene ring.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

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

UNIT—I

1. *(a)* Draw the electron movement with suitable arrow for the following reactions :

(i) $H_3C-Br \longrightarrow \overset{+}{C}H_3 + Br^-$

(ii) $H_3C-CH_3 \longrightarrow 2\dot{C}H_3$

Indicate which one is heterolytic and homolytic bond breaking. 2

(b) Define hyperconjugation. Write the hyperconjugation structure of propylene. 3

(c) What are free radicals? Write a chemical reaction for their formation. Arrange different alkyl free radicals in their stability order and explain. 5

2. *(a)* Draw the PE diagram of concerted exothermic and endothermic reactions with proper labelling. 2

(b) Complete the given reaction with suitable mechanism : 3

$$CH_3CH=CH_2 + HBr \longrightarrow ?$$

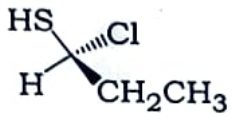
(c) What are carbanions? Write a chemical reaction for their formation. Arrange different alkyl carbanions in their stability order and explain. 5

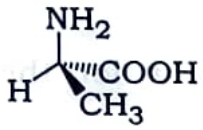
UNIT—II

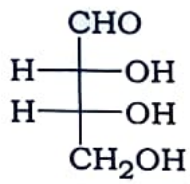
3. *(a)* Differentiate between conformations and configurations. 3

(b) Draw the conformation of 1,3-dimethylcyclohexane. Which one is the most stable and why? 3

(c) Assign *R* or *S* configuration of the chiral carbon in the given compounds : 1+1+2=4

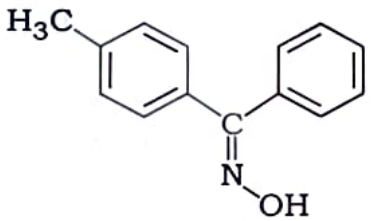
(i) 

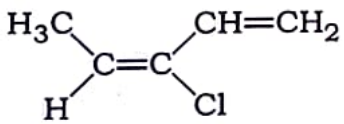
(ii) 

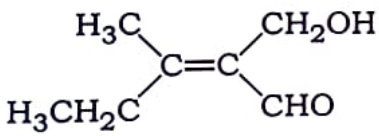
(iii) 

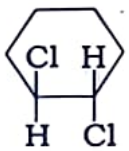
4. (a) Explain why equatorial conformation of methylcyclohexane is more stable than corresponding axial conformation. 3

(b) Indicate the appropriate *E*-, *Z*-, *cis*-, *trans*-, syn- and anti-configuration of the following : 1×4=4

(i) 

(ii) 

(iii) 

(iv) 

(c) Draw Fischer projections for the following : $1\frac{1}{2} \times 2 = 3$

(i) (*R*)-2-hydroxypropanoic acid

(ii) (*S*)-3-methylhexane

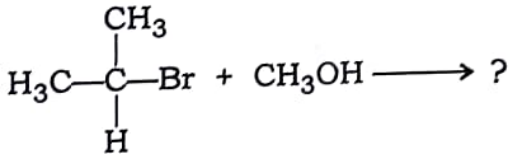
UNIT—III

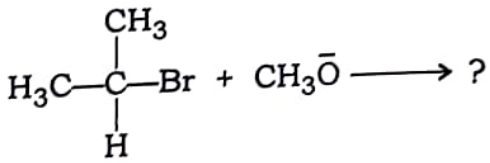
5. (a) The reaction of methyl bromide with hydroxide ion follows S_N2 reaction. Explain the mechanism, stereochemistry and kinetics of this reaction. 4

(b) *E*2 reaction is stereoselective. Explain by taking suitable example. 3

(c) Predict the product(s) of the following substitution reactions indicating whether it proceeds with S_N1 or S_N2 mechanism : $1 \times 3 = 3$

(i) $CH_3CH_2—Br + \bar{O}H \longrightarrow ?$

(ii) 

(iii) 

6. (a) Explain *E*1 mechanism with suitable example. 4

(b) Explain how solvent affects the mechanism of nucleophilic substitution reactions. 3

(c) State Saytzeff's rule and write the product(s) of the following reaction on the basis of this rule : 3

$$\text{2-Chlorobutane} \xrightarrow{CH_3O^-} ?$$

UNIT—IV

7. *(a)* Draw the MO picture of benzene with proper labelling. 3

(b) State Hückel's rule of aromaticity. How will you explain the aromatic character of pyrrole, furan and thiophene by this rule? 2+2=4

(c) Predict the major products in the following reactions : 1½×2=3

(i) Nitration of benzoic acid

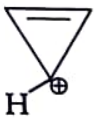
(ii) Chlorination of *m*-hydroxybenzoic acid

8. *(a)* Explain aromatic, anti-aromatic and non-aromatic compounds taking suitable examples. 3

(b) Explain Friedel-Crafts acylation reaction with suitable mechanism. 4

(c) Justify whether the following compounds are aromatic or not : 3

(i)



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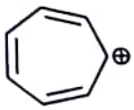

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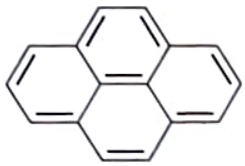

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