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MCH–012

MASTER OF SCIENCE IN

CHEMISTRY/MASTER OF SCIENCE IN

ANALYTICAL CHEMISTRY

(MSCCHEM/MSCANCHEM)

Term-End Examination

December, 2025

MCH-012 : STEREOCHEMISTRY AND

REACTIVE INTERMEDIATES

Time : 2 Hours *Maximum Marks : 50*

Note : *Answer any* ***five*** *questions. All questions carry equal marks.*

1. (a) What is meant by projection in representation of organic molecules in three dimensions ? Give examples. $2\frac{1}{2}$

   (b) Explain how to convert the Fischer projection of 2, 3-dibromobutane into its staggered sawhorse form. $2\frac{1}{2}$

   (c) Draw the *two* possible chair conformations for cis-1, 3-dimethyl cyclohexane. Explain which conformation is more stable and why. 5

2. (a) Define the term enantiomeric excess (ee). A sample of a mixture of R and S isomers of a compound is found to have a specific rotation of + 6.76. If the

specific rotation of the pure R-enantiomer is + 13.52, calculate the enantiomeric excess of the sample and explain the composition of the mixture. 5

(b) Draw the structure of (E)-1-bromo-1-chloropropene. Use the Cahn-Ingold-Prelog (CIP) rules to explain why it has E-configuration. 5

3. (a) Define a prochiral centre. Explain why the carbonyl carbon in acetophenone ($C_6H_5COCH_3$) is a prochiral centre, but the carbonyl carbon in acetone (CH_3COCH_3) is not. 5

(b) Give the mechanism and expected product in the following reaction :

$$(CH_3)_3C—CH(Cl)—C_6H_5 \xrightarrow{\text{hydrolysis}}$$

Mention whether this reaction will undergo rearrangement or not, and explain. 5

4. (a) What is the Helicity Rule ? Explain how this rule applies to conjugated dienes and α, β-unsaturated ketones, correlating the helical twist of the chromophore with the sign of the cotton effect. 5

(b) Define carbocation. Discuss its structure, hybridization and geometry. 5

5. Give the expected product and the mechanism in the following rearrangement reactions :

   (a) Reaction of 1-aminomethyl cyclohexanol with nitrous acid. 5

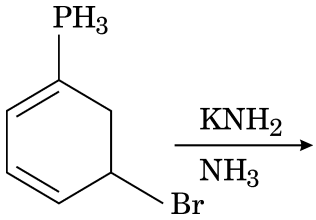
   (b) Acid catalysed reaction of 2-methyl, 1, 1-diphenyl propane-1, 2-diol. 5

6. (a) Explain the mechanism of free radical addition of HBr to propene. Why is it an abnormal addition that doesn't follow Markovnikov's rule ? 5

   (b) Explain the structure and stability of nitrenes. How are nitrenes generated from redox reactions ? 5

7. (a) Write the mechanism of Hofmann rearrangement and give its synthetic utility. 5

(b) Complete the following reaction and write its mechanism : 5



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