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MCH–012

MASTER OF SCIENCE IN CHEMISTRY/MASTER OF SCIENCE IN ANALYTICAL CHEMISTRY (MSCCHEM/MSCANCHEM)

Term-End Examination

June, 2025

MCH-012 : STEREOCHEMISTRY AND INTERMEDIATES

Time : 2 Hours *Maximum Marks : 50*

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

1. (a) For HOOCCHBr—CH(F)CH_3 molecule, draw the following projections : $2\frac{1}{2}$

   (i) Fischer projection

   (ii) Newman projection (eclipsed conformation)

(iii) Sawhorse projection (staggered conformation)

(b) For $HOOCCH(OH)–CH(OH)–CH_3$ molecule draw the following projections : $2\frac{1}{2}$

(i) Fischer projection

(ii) Newman projection (staggered conformation)

(iii) Flying wedge projection

(c) What is meant by Pseudoasymmetry ? Explain its concept with the help of an example. 5

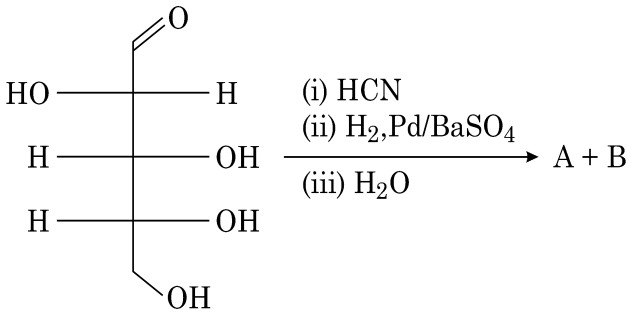
2. (a) Draw the wedge and dash structures indicating the chiral centre(s) for the following compounds and assign their R/S configuration : 5

(i) 1, 2-dibromopropane (both the isomers)

(ii) 2-bromo-4-chloropentane (in any two of the isomers)

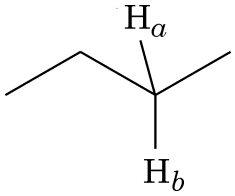
(b) Compare the chair and boat conformations of cyclohexane in terms of their structure and stability. Draw all the isomers of cyclohexane-1, 3-diol in its chair form. Which conformation will be more stable and why ? 5

3. (a) The chain lengthening reaction with HCN and then reduction of D-arabiaose leads to a mixture of products A and B under the conditions given below : 5



Assign the R/S configuration at any *two* of the stereocentres of products A and B. What type of isomers are A and B ?

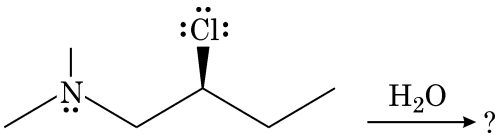
(b) Explain the terms topicity, enantiotopic and diastereotopic. Identify the H_a and H_b hydrogens as enantiotopic or diastereotopic in the following compound. Justify you answer using the substitution-addition criterion : 5



4. (a) Differentiate between stereospecific and stereoselective reactions with the help of a suitable example for each type. 5

(b) List various ways of predicting the mechanism of an organic reaction by the formation of an intermediate. Give an example to explain any *one* of these ways. 5

5. (a) Write the product formed in the following reaction : 5



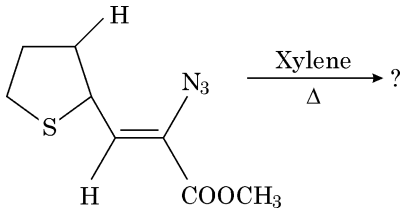
Give the mechanism and indicate the stereochemistry, configuration at the chiral carbon of the product formed.

(b) Compare the benzil-benzilic acid rearrangement with pinacol-pinacolone rearrangement taking an example in each case. 5

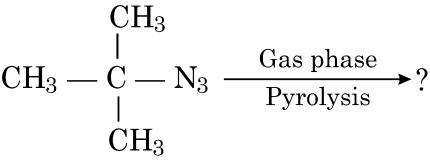
6. (a) Differentiate between a carbocation and a carbanion in terms of their hybridisation, geometry giving the structure, stability on the basis of inductive effect and the nature in a substitution reaction. 5

(b) What happens when an ether is stored for a long duration ? Write the mechanism involved and explain the process it undergoes. 5

7. (a) Write the products of the following reactions : 5

(i) 

(ii) $\overset{+}{N}_3 - \overset{-}{N} - COOC_2H_5 + C_6H_5C \equiv N \rightarrow ?$

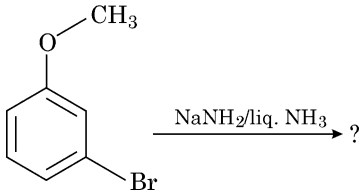
(iii) 

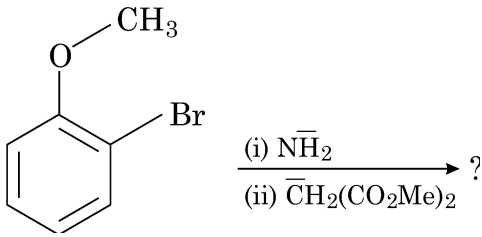
(iv) $RCO_2H + ClCOOC_2H_5 \rightarrow ?$

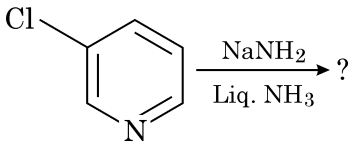
(v) $C_2H_5COOH \xrightarrow[\substack{(iii)\ HCl/NaNO_2 \\ (iv)\ \Delta}]{(i)\ PCl_5,\ (ii)\ NH_2NH_2} ?$

(b) Write the preferred products formed in any *two* of the following reactions and

the steps involved. Give reasons for your answer : 5

(i) 

(ii) 

(iii) 

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