(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS
MAIN EXAM

FOR THE DEGREE
OF
BACHELOR OF SCIENCE (CHEMISTRY)

COURSE CODE: SCH 333

COURSE TITLE: STREOCHEMISTRY, CONFORMATIONAL STUDIES AND REACTION

DATE: 19th April 2022 (Tuesday) **TIME:** 3.00 to 5.00 PM

INSTRUCTIONS TO CANDIDATES

1. Answer all questions

TIME: 2 Hours

This Paper Consists of 5 Printed Pages. Please Turn Over.

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QUESTION 1 (23 Marks)

a) Consider the compounds **A** through **D** listed named below and answer the questions that follow.

A: -2-Bromo-1-butanol   **B**: -4-Chloropentan-2-ol   **C**: -1,3-Dichlorocyclohexane
D: -1-Bromo-2-chlorocyclobutane

i)	Draw structures for stereoisomers of compounds **A** and **B** in perspective	2 Marks
ii)	Identify the structure with S configuration for compounds **A**.	1 Mark
iii)	Provide unambiguous IUPAC name for all the structures of **B**.	4 Marks
iv)	Draw all structures for all the stereoisomers represented by **C**.	2 Marks
v)	For structures in Q1, a) iii) and Q1, a) iv) above identify meso structures.	2 Marks
vi)	Draw all the isomers for **D** and identify any two enantiomers and any two diastereomers	4 Marks

b) What do you understand by the following terms used in stereochemistry   2 Marks
   i) Prochiral –
   ii) Optically active compound

c) An aqueous solution containing 10 g of optically pure D-fructose (Structure given below) was diluted to 500 mL with water and placed in a polarimeter tube 20 cm long. The measured rotation was - 5.20°.

$$
\begin{array}{c}
CH_2OH \\
| \\
=O \\
HO\!-\!\!|\!-\!H \\
H\!-\!\!|\!-\!OH \\
H\!-\!\!|\!-\!OH \\
| \\
CH_2OH
\end{array}
$$
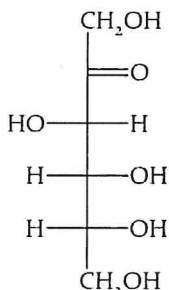
   i) Calculate the specific rotation of fructose.   2 Marks
   ii) On a separate experiment the specific rotation of a sample of fructose was found to be 0°. Explain this.   1 Mark
   iii) How would you explain a third measurement which gave a sample of fructose solution a specific rotation of +32.5°. Provide a more detailed explanation.   2 Marks
   iv) What is the ee for the sample in iii) above?   1 Mark
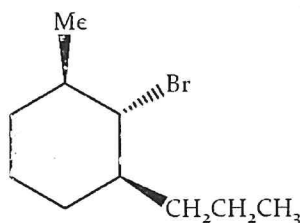
QUESTION 2 (18 Marks)

a) A Fijian lady studying in MMUST used Newman projection below to represent a compound she has synthesized in the lab. Study it and answer the questions that follow.
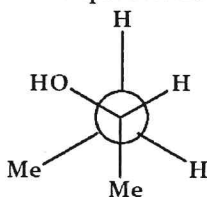
   i) Determine the unambiguous systematic name of this compound and draw its structure in perspective.   2 Marks

2

ii)

$$\xrightarrow{CH_3CH_2ONa}$$

iii)

$$\xrightarrow{CH_3O^-}$$
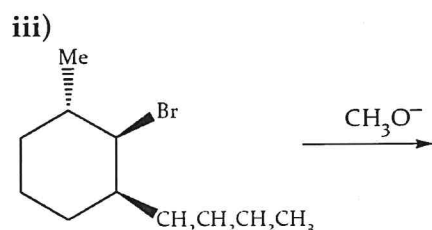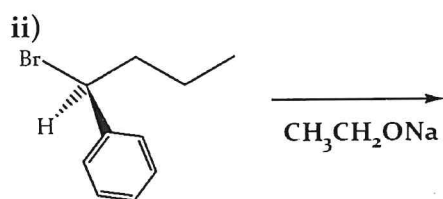
d) Give all possible products for the reactions given in Q3, c) i) and ii) above following E1 mechanism.

                                  3 Marks

e) Provide mechanism for reaction in Q3, b) i) above   **3 Marks**

f) Provide mechanism leading to the major product in Q3, c) iii) above..   **4 Marks**

g) Compare the rate of reaction for the structure given below and that in Q3, c), iii)   **2 Marks**

QUESTION 4(8 Marks)

Consider the reaction given below

Major   Minor
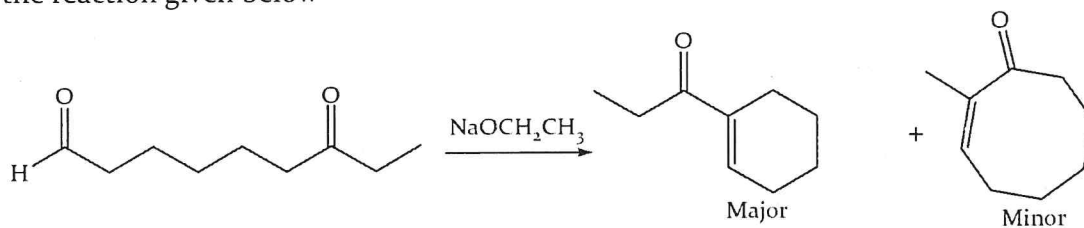
i) Provide reaction mechanism leading major compound.   **4 Marks**

ii) Why is the compound in i) preferred?   **1 Mark**

iii) Show the mechanism leading to the monor product   **3 Marks**

4

ii) Draw the other two staggered conformers of this compound about C2-C3 in Newman projection and with reasons determine, out of the three the one with the **HIGHEST** population. **4 Marks**

iii) Draw the all the eclipsed conformers of this compound about C2-C3 in Newman projection and with reasons determine the one with the **LOWEST** population. **5 Marks**

iv) Represent the energies of all the conformers given in Q2, a), ii) and iii) in an energy level diagram being sure to show clear differences in energy amongst them. **3 Marks**

b) Draw (accurately) the two chair conformers of the trisubstituted cyclohexane derivertive given below and determine with reasons which of the two has the highest population. **4 Marks**
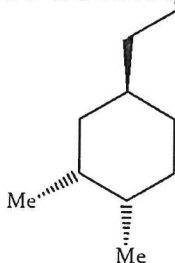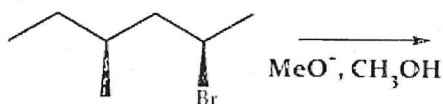

QUESTION 3(21 Marks)

a) Give products for the following Nucleophillic substitution reactions following S_N2 reaction mechanism. **3 Marks**
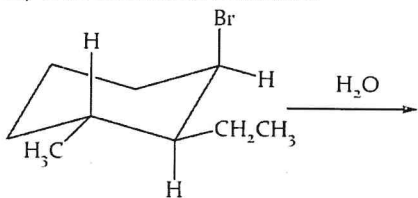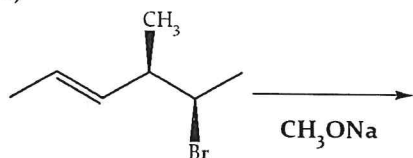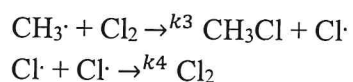
i)
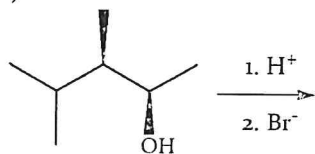
ii)

iii) Substitution reaction

b) Give all possible products for the reactions in 3, a) i) and ii) above following S_N1 reaction mechanism. **3 Marks**

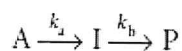c) Give **ONLY** the major product for the reactions given below following E2 reaction mechanism. **3 Marks**

i)

3

$$CH_3\cdot + Cl_2 \xrightarrow{k3} CH_3Cl + Cl\cdot$$
$$Cl\cdot + Cl\cdot \xrightarrow{k4} Cl_2$$

QUESTIONFOUR (15 MARKS)

a) What is an enzyme? What is the general mechanism describing enzyme catalysis? **[5 marks]**

b) Consider the following sequential reaction scheme

$$A \xrightarrow{k_a} I \xrightarrow{k_b} P$$

Assuming that only reactant A is present at t=0, what is the expected time dependence of [P] using steady state approximation **[5 marks]**

c) The rate constant for the reaction of hydrogen with iodine is 2.45 x 10-4 $M^{-1}s^{-1}$ at 302°C and 0.950$M^{-1}s^{-1}$ at 508°C.

   i. Calculate the activation energy and Arrhenius preexponential factor for this reaction **[3 marks]**

   ii. What is the value of the rate constant at 400°C? **[2 marks]**

·········E.N.D··········