

250



# KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER  
MAIN EXAMINATIONS**

**FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE**

**COURSE CODE: SCH 124**

**COURSE TITLE: ORGANIC CHEMISTRY**

**DURATION: 2 HOURS**

**DATE: 17/05/2022**

**TIME: 2:00PM-4:00PM**

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## INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **4** printed pages. Please Turn Over

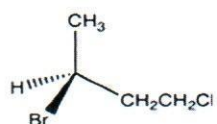


KIBU observes ZERO tolerance to examination cheating

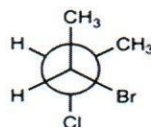
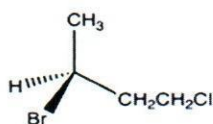
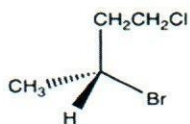
### Question 1

- a) Draw and name **two geometrical** isomers of  $C_4H_8$ . [4mks]
- b) Calculate the observed rotation for Compound A, whose specific rotation was  $(+)$   $176^\circ$  for a solution made from 0.250 g dissolved in 1 mL of chloroform solvent. The cell path length was 5 cm. [3mks]
- c) State four general methods that are extensively used for the resolution of racemic mixtures. [4mks]
- d) Clearly draw a chair conformation of cyclohexane **with Hs in the axial positions and Ds in the equatorial positions**. Draw its structure after ring flipping. [5mks]
- e) Determine the relationship for each pair of molecules: enantiomers, identical, constitutional isomers: 4mks

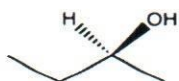
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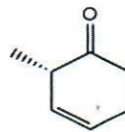
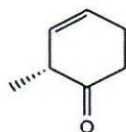
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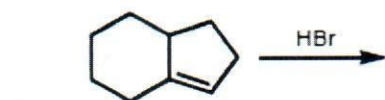
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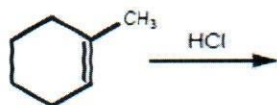
4)



- f) Give the major organic product of the reaction, Paying particular attention to regio- and stereochemical outcomes. [3mks]



i.



ii.



iii.

- g) Alkyl halides are organic compounds with the general formula  $R-X$ , where  $X$  is the halogen and they undergo both  $S_N1$  and  $S_N2$  reactions. State three differences between  $S_N1$  and  $S_N2$  reaction mechanisms among the alkyl halides [3mks]
- h) 2-chloro-2-methylpropane is reacted with potassium hydroxide solution.
- Write the equation for the reaction [1mk]
  - suggest the reaction mechanism [2mks]
  - classify the reaction mechanism as  $S_N1$  or  $S_N2$  [1mk]

## Question 2

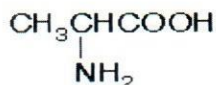
a) Explain the following terms;

[5marks]

- Stereochemistry
- Optical activity
- Racemic mixture
- Enantiomers
- Chiral centre


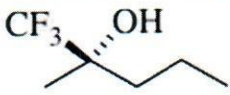
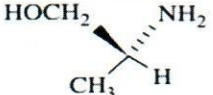

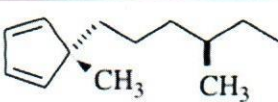
b) 2-aminopropanoic acid (alanine) has two enantiomers (optical isomers) because it has a chiral molecule containing an asymmetric carbon atom. One enantiomer is a non-superimposable mirror image of the other. The two enantiomers rotate the plane of polarisation of *plane polarised light* in opposite directions, but 2-aminopropanoic acid can also be found as a racemic mixture which has no effect on the plane of polarisation.

**2-aminopropanoic acid has the structure:**



- Draw the structures of the two enantiomers. Use your diagram to explain what is meant by the term *non-superimposable mirror image*. [3mk]
- Why doesn't a racemic mixture have any effect on the plane of polarisation of plane polarized light? [2mks]

b) Indicate the chiral centers by placing an asterisk (\*) in the following molecules and give the relative configuration (R,S) of each: [10mks]

i. 	ii. 	iii. 
iv. 	v. 	

## Question 3

- Explain three factors that affect the relative stabilities of conformations. [3mks]
- Which molecule, hexane or cyclohexane, would have a higher melting point? Explain your answer. [3mks]
- Draw Newman projection for all conformations about the C2-C3 bond of butane formed by rotation from  $0^\circ$  to  $360^\circ$ . Show both staggered and eclipsed conformations. [6mks]

d) Sketch a curve of potential energy versus dihedral angle for butane. Label each energy maximum and minimum with one of the conformations you drew in part (c). [8mks]

**Question 4**

a) Distinguish between the following [6mks]

- i. Nucleophile and electrophile
- ii. Homolysis reaction and Heterolysis reaction;
- iii. Substitution reactions; and Elimination reactions

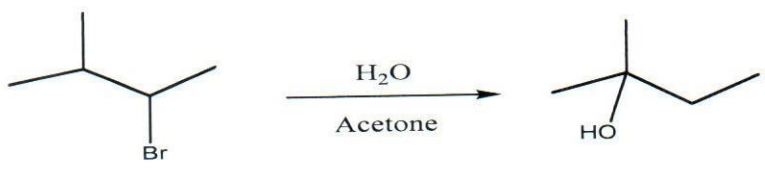
b) Show the plausible reaction mechanism for the addition of Br<sub>2</sub> to But-2-ene leading to the formation of

- i. Racemic-2,3- dibromo butane [3mks]
- ii. Meso-dibromo butane [3mks]

c) The carbocations below undergo rearrangement reaction. Give the structures of the rearranged carbocations. [ 4mks]



d) Suggest the mechanism for the reaction below [4mks]



**Question 5**

a) Explain the factors affecting elimination Reactions. [8mks]

b) C<sub>6</sub>H<sub>5</sub>CH(Br)CH(CH<sub>3</sub>)C<sub>6</sub>H<sub>5</sub> undergoes dehydrohalogenation under E<sub>2</sub> elimination reaction to give C<sub>6</sub>H<sub>5</sub>CH=C(CH<sub>3</sub>)C<sub>6</sub>H<sub>5</sub>. Demonstrate and explain the possible reaction mechanisms. [8mks]

c) By drawing the chair conformations, determine which is the more stable isomer between *cis*-1-ethyl-2-methylcyclohexane or *trans*-1-ethyl-2-methylcyclohexane [4mks]