



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 124

COURSE TITLE: ORGANIC CHEMISTRY

DURATION: 2 HOURS

DATE: 25/01/2022

TIME: 8.00AM – 10.00AM

INSTRUCTIONS TO CANDIDATES

Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.

This paper consists of 6 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

Question one (30 marks)

a) Define the following terms

[5 marks]

- i). Chiral compound
- ii). Plane of symmetry
- iii). Solvolysis
- iv). Racemic form
- v). Optical purity

b) 5g of a compound was dissolved in 20ml of solution. The observed rotation measured by a polarimeter was to be -12.6° . If the polarimeter tube is 30cm long, what is the specific rotation?

[3 marks]

c) Compounds of formula C_4H_7Cl exhibits both geometric and optical isomerism.

i). Explain why C_4H_7Cl shows geometric isomerism

[1 mark]

ii). Draw the *cis* and *trans* forms of the isomers represented by the formula C_4H_7Cl

[2 marks]

iii). Draw the structural formula of C_4H_7Cl that shows only optical isomerism. Show the chiral carbon atom with “*”.

[2 marks]

iv). What is the expected observed rotation of a 1.0×10^{-4} M methanol solution of the chiral

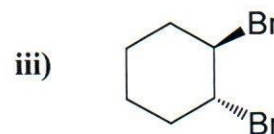
compound with a $[\alpha]_D^{20} = -49^\circ$ ($C = 1$, CH_3OH). Suppose the molecular weight is

$853.93 \text{ g mol}^{-1}$

[4 marks]

d) Draw the enantiomers for each of the following compounds

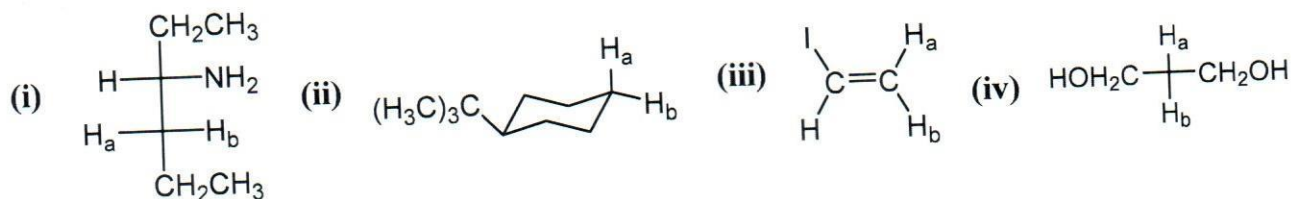
[3 marks]



e) State two physical properties of optical isomers

[2 marks]

- f) The reaction of warm aqueous KOH with 1-bromobutane occurs by an S_N2 mechanism. Draw the Mechanism for this reaction, including the structural formulae of 1-bromobutane, the transition state and the organic product. [4 marks]
- g) Specify with reasons, the topicity of the **Ha** and **Hb** atoms in each case of the following compounds. [4 marks]



Question two (20 marks)

- a) Draw chair conformations for each of the following compounds and state with reasons which conformer of each compound predominates. [10 marks]
- trans* and *cis*-1-ethyl-3-methylcyclohexane
 - trans* and *cis*-1-*tert*-butyl-4-methylcyclohexane
- b) Both chair and boat forms of cyclohexane are free of angle but the chair is more stable than the boat. Explain. [4 marks]
- c) Draw the Newman projections of propane. Indicate which conformation is more stable and give a reason for your choice. [3 marks]
- d) Plot a graph of potential energy change during rotation about the C – C bond of propane. [3 marks]

Question three (20 marks)

- a) Give the characteristics of S_N1 reactions [4 marks]
- b) In unimolecular substitution reaction, two enantiomeric products are obtained. Using a reaction between $\text{CH}_3(\text{CH}_2)_5\text{CH}(\text{Br})\text{CH}_3$ and H_2O , show how the enantiomeric products are produced. Which enantiomer is produced in larger amounts and why? [6 marks]
- c) Define the term solvolysis [2 marks]
- d) Predict which is generally a better nucleophile; CH_3S^- or CH_3O^- . explain the reason for your choice [3 marks]

- e) Show all steps in the acid-catalyzed hydration of 2-methyl-2-propene. Account for the fact that the product of the reaction is 2-methyl-2propanol and not 2-methyl-1-propanol.

[5 marks]

Question Four (20 marks)

- a) What is the difference between conformational and configurational stereoisomers? [4 marks]
- b) Draw Newman projections for the conformations of 2,3-dimethylbutane as follows [7 marks]
- Looking at C-2 from C-1
 - Looking at C-3 from C-2
 - For each set of conformations, you have drawn in (i) and (ii), state with reasons the most stable conformations.
- c) Draw the potential energy diagram for rotation of 2,3-dimethylbutane about. [6 marks]
- The C-3 from C-2
 - The C-2 from C-1
- d) Draw all the possible stereoisomers of 1,2-dimethylcyclopentane [3 marks]

Question five (20 marks)

- a) Draw the most favorable conformation of cyclohexane molecule. Account for your choice. [4 marks]
- b) Draw Newmann projections for the conformational isomers of $\text{BrCH}_2\text{CH}_2\text{Cl}$. Label each conformer as eclipsed, total eclipsed, staggered, anti, and/or gauche. Indicate the most and least stable conformers. [4 marks]
- c) Using the R-S system of nomenclature, give the IUPAC names of the following compounds. [12 marks]

