



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES
UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF
BACHELOR OF EDUCATION (SCIENCE) WITH IT
FOURTH YEAR SECOND SEMESTER EXAMINATIONS
UNIVERSITY EXAMINATIONS: 2023/2024 ACADEMIC YEAR
SCH 405: SYNTHETIC ORGANIC CHEMISTRY**

EXAM VENUE:

STREAM: (B.Ed. Science)

DATE:

EXAM SESSION:

TIME: 2.00 HOURS

Instructions:

- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION 1

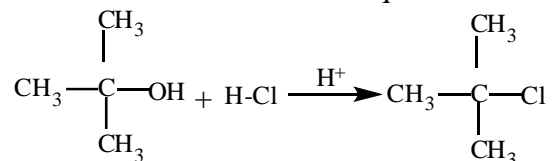
- a. Define the following terms as applied in Organic Synthesis [10 marks]
- Elimination bimolecular reaction
 - Regioselective reaction
 - Reaction mechanism
 - Divergent Synthesis
 - Transition state
- b. Give a brief description on planning and designing in organic Synthesis [5 marks]
- c. What is the significance of Organic Synthesis? [5 marks]
- d. Starting with 1-butyne and butane, outline the mechanism for the synthesis of butanone giving all the necessary reagents and reaction conditions. [10 marks]

SECTION B (40 MARKS): ANSWER ANY TWO QUESTIONS FROM THIS SECTION:

EACH QUESTION CARRIES 20 MARKS

QUESTION 2

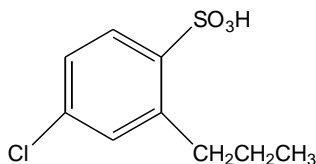
- a. Study the reaction below and answer the questions that follow:



- Give the mechanism for the reaction [5 marks]
 - Give the energy cycle diagram for the reaction [5 marks]
 - The above reaction is said to proceed without stereochemical inversion Explain [4 marks]
- b. Explain the following observations; [6 marks]
- Butyl iodide is fairly stable in water while *t*-butyl iodide is hydrolysed fairly rapidly.
 - Reduction of carbonyl compounds with $\text{LiAlH}_4/\text{NaBH}_4$ is essentially an electrophilic attack on hydrogen.

QUESTION 3

- a. A student required to synthesize 4-chloro-2-propylbenzenesulfonic acid in the laboratory.



Using retrosynthesis analysis show how the starting materials could be identified. [8 marks]

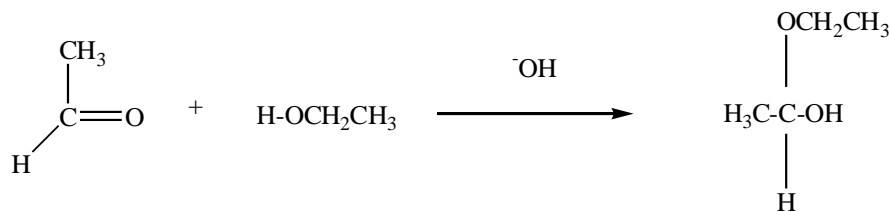
- b. What are the factors that increase the rate of $\text{S}_{\text{N}}2$ reactions at the expense of the E_2 reactions? [4 marks]
- c. Distinguish between the following terms: [6 marks]
- Synthon and reagent
 - E^1 and E^2 reactions
 - $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions

QUESTION 4

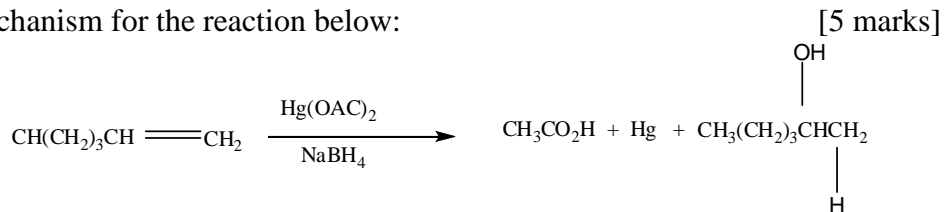
- a. Outline the chain reactions involved in the photoactivated synthesis of bromoethane. [5 marks]
- b. Briefly discuss the synthetic pathway of the following compounds. [10 marks]
- Pyrethrins
 - Flavonoids
- c. Complete the following reactions giving the necessary reaction conditions: [5 marks]
- $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3 \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-Br}$
 - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-Br} \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH}$
 - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH} \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-COH}$
 - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-COH} \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-COOH}$
 - $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-COOH} \rightarrow \text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-COO-CH}_2\text{-CH}_3$

QUESTION 5

- a. Write down the mechanism for the formation of the hemiacetal below and suggest the best type of catalyst to be employed. [5 marks]



- b. Give the mechanism for the reaction below: [5 marks]



- c. In a functional group interconversions reaction, 2-methylpropan-2-ol is reacted with hydrogen chloride to give 2-chloro-2-methylpropane. Write a suitable mechanism for this reaction. [5 marks]
- d. Starting with trans-2-butene, outline the mechanism for the synthesis of the meso compound (2R,3S)-2,3-butandiol. [5 marks]

E N D!!!!!!!