



# Technical University of Mombasa

Faculty of Applied and Health Sciences

**DEPARTMENT OF PURE AND APPLIED SCIENCES**  
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF  
SCIENCE IN COMMUNITY HEALTH

**BSCH 13S**

**ACH 4118 : ORGANIC CHEMISTRY I**

SUPPLEMENTARY/SPECIAL EXAMINATION

MARCH 2014 SERIES

2 HOURS

Instructions to candidates:

This paper consists of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

## QUESTION ONE

a) (i) Define the following terms

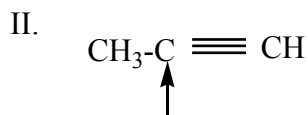
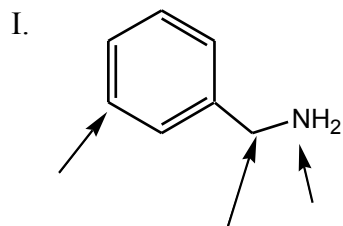
I. Resonance structures

II. Free radical

III. Bond dissociation energy.

(6marks)

(ii) Assign the hybridization for each of the indicated atoms



**(2marks)**

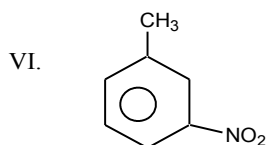
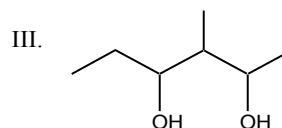
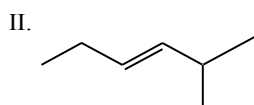
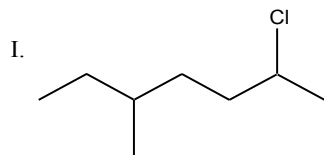
(iii) State Markovnikov's rule's rule.

**(2marks)**

b) (i) Give two industrial uses of alcohols.

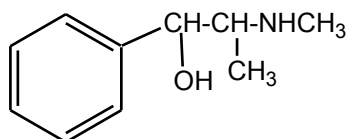
**(2marks)**

(ii) Name the following compounds using IUPAC nomenclature.



**(4marks)**

(iii) Ephedrine is a bronchodilator and a decongestant, whose structure is shown below. Identify all the functional groups in this drug.



**(3marks)**

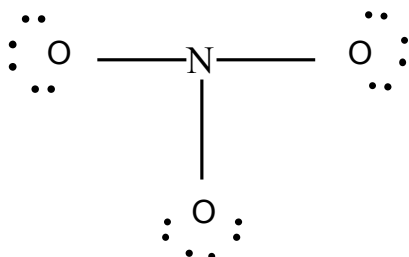
c) (i) The C-H bond length decrease in the order of hybridization :  $\text{SP}^3 > \text{SP}^2 > \text{SP}$ . Explain

**(2marks)**

(ii) Distinguish between empirical formula and molecular formula

**(3marks)**

(iii) Determine the formal charges in the following lewis structure



**(2marks)**

(iv) Combustion of a 3.02mg sample of a compound gave 8.86mg of  $\text{CO}_2$  and 5.43 mg

of H<sub>2</sub>O. Calculate the percent composition and the empirical formula of the compound. (C = 12.01, H = 1.008) **(4marks)**

## QUESTION TWO

- a) (i) Explain briefly how SP<sup>2</sup> hybrid atomic orbitals are formed in carbon.

**(5marks)**

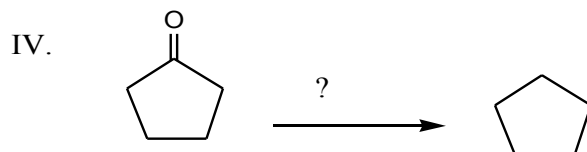
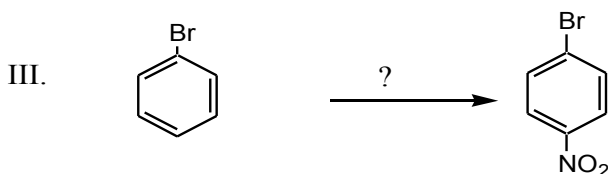
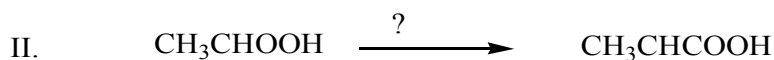
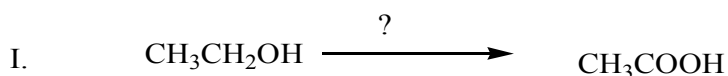
- (ii) Draw the sigma (σ) and pi (π) bonding interactions for ethane (C<sub>2</sub>H<sub>4</sub>) molecule.

**(4marks)**

- (iii) State two physical properties of alcohols.

**(2marks)**

- b) (i) Give the necessary reagents and conditions to carry out the following transformations

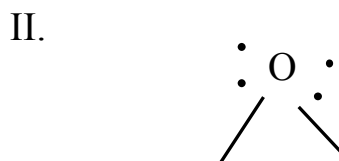
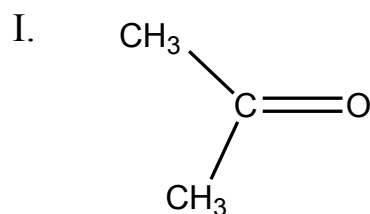


**(4marks)**

- (ii) Aryl and alkenyl halides are less reactive towards nucleophiles under ordinary conditions. Explain.

**(2marks)**

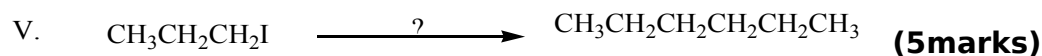
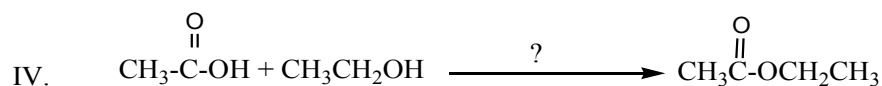
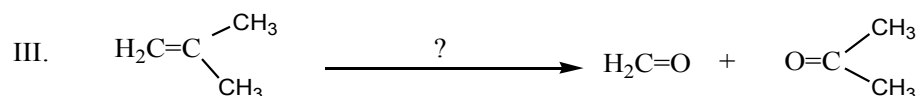
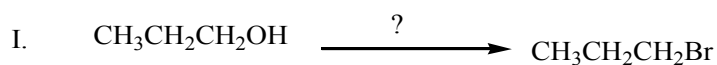
- (iii) Show the direction of dipole moment in the following molecules



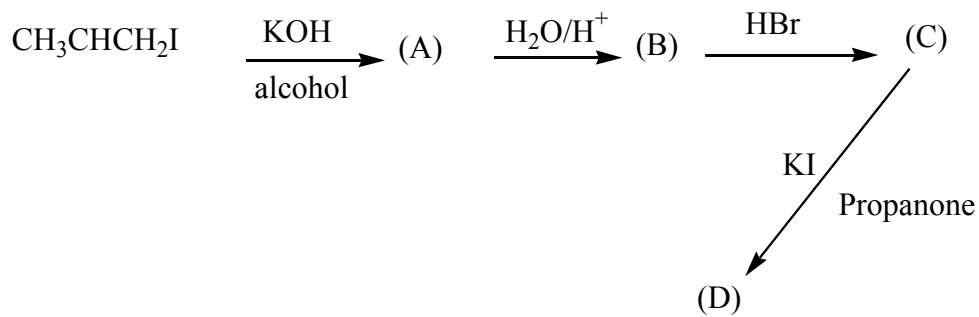
(2marks)

### QUESTION THREE

- a) (i) Provide the reagents and conditions necessary to perform the following conversions



- (ii) Write the structure of the unknown compounds indicated by letters in the following sequence of reaction.



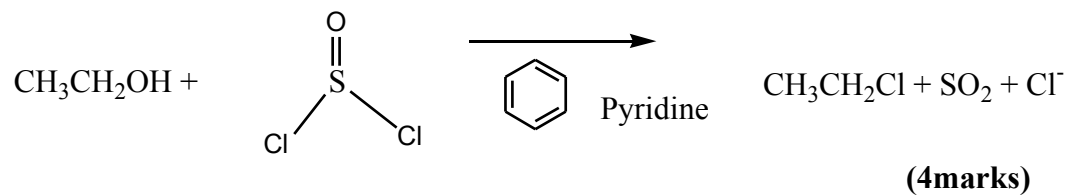
(4marks)

- (iii) Give two uses of alkanes

(2marks)

- b) (i) Thionylchloride ( $\text{SOCl}_2$ ) converts primary and secondary alcohols to alkyl chlorides in good yields usually with no rearrangement as shown below.

- I. Write the reaction mechanism for the reaction using curly arrows.



II. State the function of pyridine in this reaction **(1mark)**

(ii) Give the structural formula for each of the following organic molecules

- I. 4-methyl-2-pentanol
- II. 1,2-ethanediol
- III. Bicycle (2,2,1) heptanes
- IV. Benzoic acid.

**(4mark)**

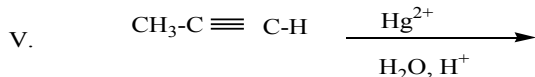
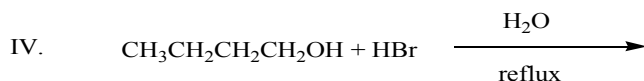
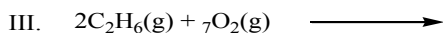
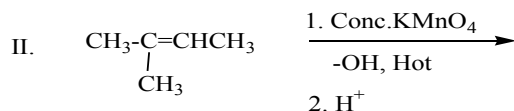
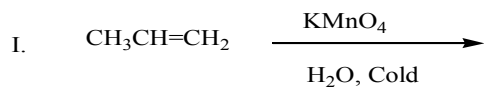
#### QUESTION FOUR

a) (i) Give the IUPAC name of each of the following compounds



**(2marks)**

(ii) Write the structure of the organic products of the following reactions



(iii) Give the structure of the following organic compounds

I. 2,3-dimethyl-2-hexene

II. 1,3-dimethyl cyclohexane

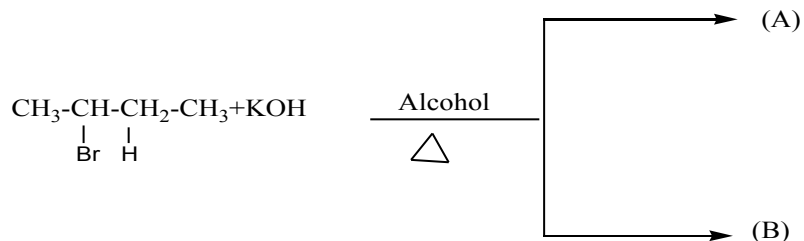
(2marks)

b) (i) State Saytzeff's rule

(2marks)

(ii) Give the structures of the two products labelled (A) and (B) in the reaction below.

Identify the major product



(iii) Combustion of 6.51mg of a compound gave 20.47mg of  $\text{CO}_2$  and 8.36mg of  $\text{H}_2\text{O}$ . The molecular weight was found to be 84.

Determine:

I. % composition

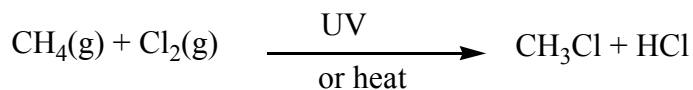
II. Empirical formula

III. Molecular formula of the compound (C=12.01, H = 1.008, O = 16.00)

(6marks)

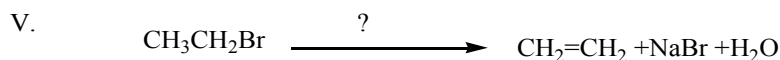
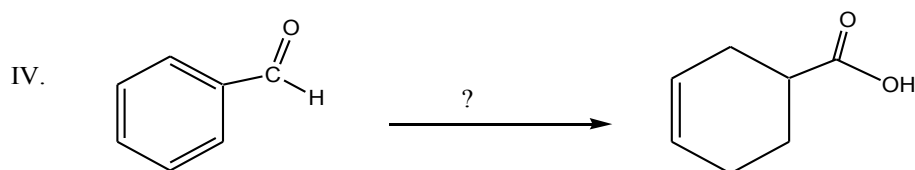
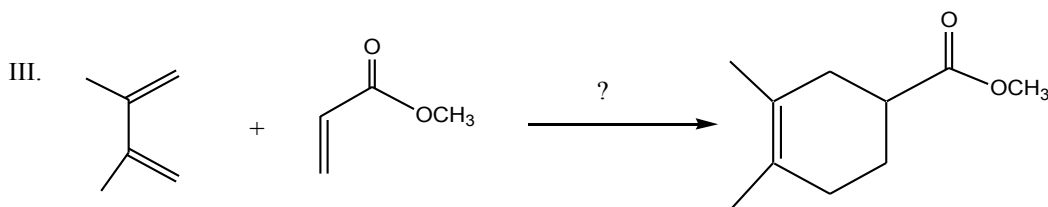
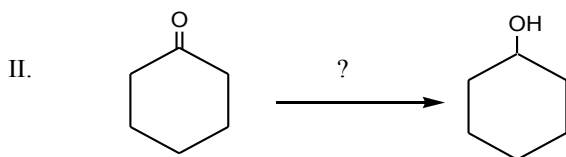
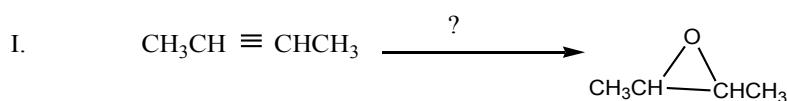
### QUESTION FIVE

- a) (i) State two physical properties of aldehydes and ketones. (2marks)
- (ii) Halogenation of alkanes occurs via free radical reaction. Show the mechanism for the reaction.



(3marks)

- (iii) Give the reagents and conditions that would best perform the following transformations



(5marks)

- b) (i) A primary alkyl bromide (A)  $\text{C}_4\text{H}_9\text{Br}$ , reacted with hot alcoholic KOH to give compound (B). Compound (B) reacted with hydrogen bromide to give an isomer of (A), (C). When (A) was reacted with sodium it gave compound (D),  $\text{C}_8\text{H}_{18}$ ,

which was different than the compound produced when n-butyl bromide was reacted with sodium. Draw the structure of (A) and write equations for all reactions taking place giving structures of compounds (B) to (D). **(6marks)**

(ii) Write chemical equation, showing all necessary reagents, for the preparation of 2-butanol by each of the following methods:

I. Hydrolysis of an alkyl halide

II. Reduction of a ketone.

**(4marks)**