



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF
BSC. BUILDING AND CIVIL, ELECTRICAL AND ELECTRONICS AND
MECHANICAL & AUTOMOTIVE ENGINEERING

BSCE, BSEE, BSME 13S Y1-SII

ACH 4131: CHEMISTRY II

SEMESTER EXAMINATION

DECEMBER 2013 SERIES

2 HOURS

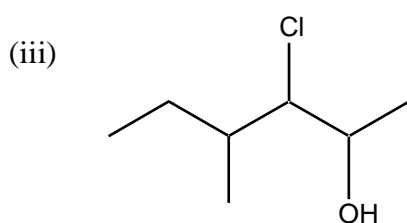
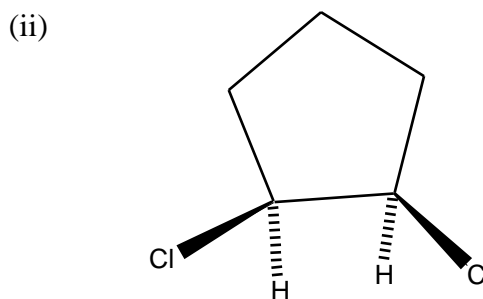
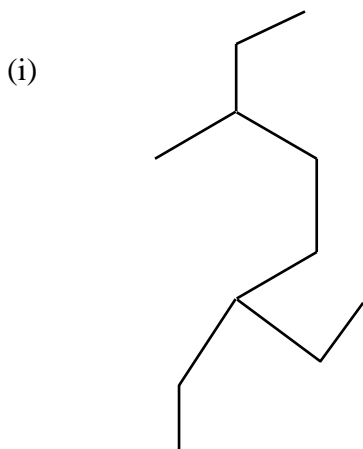
Instructions to candidates:

This paper consists of **FIVE** questions

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

QUESTION ONE

- a) Give the IUPAC name for each of the following compounds indicating stereochemistry where necessary:



(4marks)

b) Draw the structure for each of the following compounds indicating stereochemistry where appropriate:

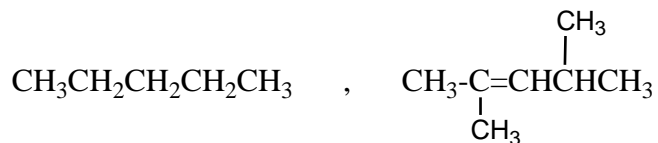
- (i) 1,4-Dichloro-2-butyne
- (ii) 3-methyl-2-butanone
- (iii) 4-chlorophenol
- (iv) (E)-1,2-dibromoethene

(4marks)

c) State the difference between a nucleophile and an electrophile.

(2marks)

d) Given the following compounds I and II.



I.

II.

- (i) State which compound has a higher octane rating
- (ii) Explain your answer in d(i) above.

(1mark)

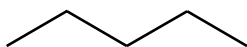
(2marks)

e) Draw the molecule below in 3-D.

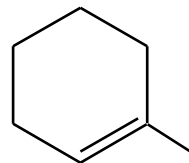


(2marks)

f) Give three visual chemical tests to differentiate between the pair of compounds below. Explain what happens in each case.



III



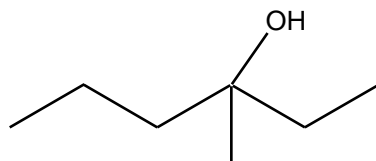
IV

g) State the specific catalyst used for each of the following transformation

- (i) Reaction of propene with H_2 to form propane
- (ii) Reaction of alcohol and carboxylic acid during esterification
- (iii) Reaction of butyne with H_2 to form cis-2-butene
- (iv) Chlorination of benzene to form chlorobenzene

(4marks)

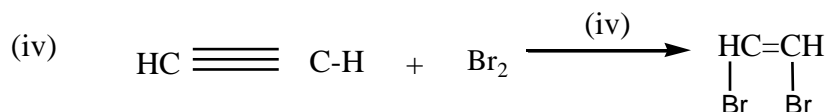
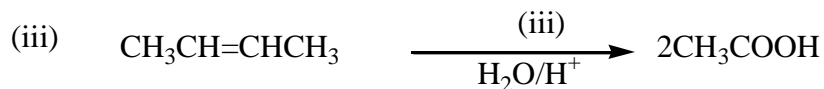
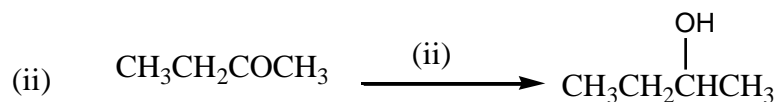
h) Draw all the possible dehydration products from the following compound V



V

(4marks)

i) Give the reagents/ conditions (i) – (iv) required to carry out the following reactions



j) Name the organic product formed when sodium metal reacts with propanoic acid.

(1mark)

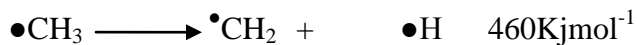
QUESTION TWO

a) Arrange the following atoms in increasing electronegativity:

- (i) Cl, F, O
 (ii) C, N, Br

(2marks)

b) Given the following bond dissociation energy value:-



(i) Explain the term bond dissociation energy.

(1mark)

(ii) Calculate the bond energy of the C-H bond. **(2marks)**

c) Show the polarity of the C-x bond using δ^- in each of the following molecules :

(i) $\text{CH}_3\text{CH}_2\text{OH}$

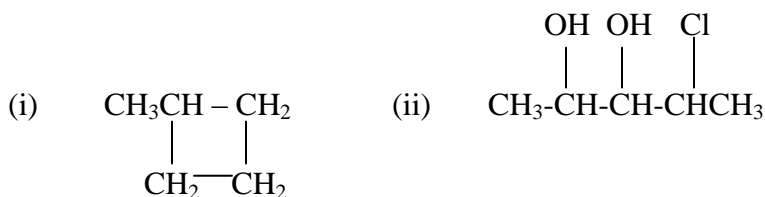
(ii) $\begin{array}{c} \text{CH}_3\text{CHCH}_3 \\ | \\ \text{NH}_2 \end{array}$

(iii) $\begin{array}{c} \text{CH}_3\text{CH}_2 \\ | \\ \text{Cl} \end{array}$

(3marks)

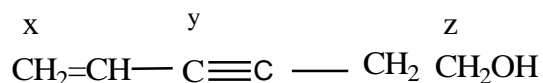
d) Give the possible structural formulas for all the compounds with molecular formula $\text{C}_3\text{H}_8\text{O}$. **(3marks)**

e) Give the bond-line formulas for the following molecules:



(2marks)

f) Indicate the type of hybridization for the carbons labelled x, y, z in the following molecule.



g) A sample of CH_4 weighing 9.67mg produced 26.53mg of CO_2 and 21.56mg of H_2O . Determine the percentage of C and H in the sample. **(4marks)**

QUESTION THREE

a) Define the term pyrolysis. **(2marks)**

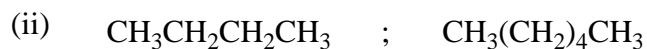
b) Alkanes can undergo combustion, and this is the most important of all their reactions.

(i) Write the balanced chemical equation for the combustion of pentane. **(2marks)**

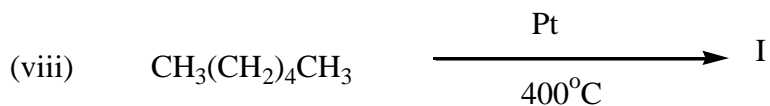
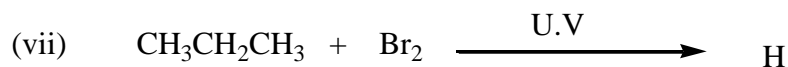
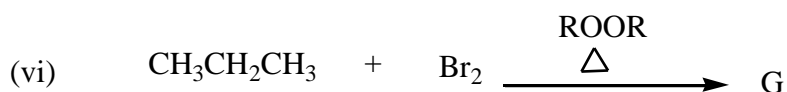
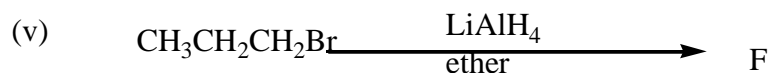
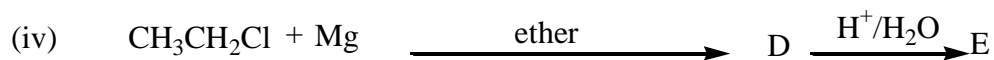
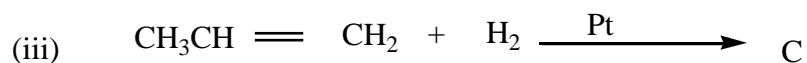
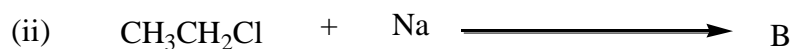
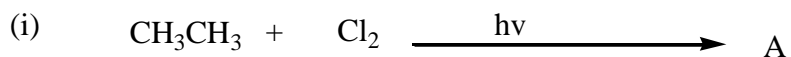
(ii) State the importance of this reaction in our daily life. **(2marks)**

c) Identify which compound among each pair has a higher boiling point and explain your

answer:



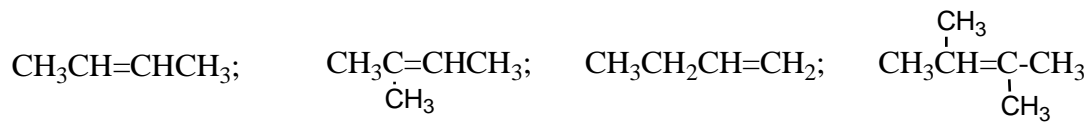
d) Give the major organic product (A-I) for each of the following reactions:



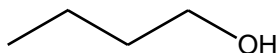
(10marks)

QUESTION FOUR

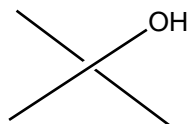
a) Arrange the following alkenes in order of decreasing stability:



- b) Write the chemical equation for the reaction between sodium metal and ethanol and give the name of the organic product formed. **(2marks)**
- c) Identify which one among the following compounds VI and VII has a higher boiling point. Explain your answer.



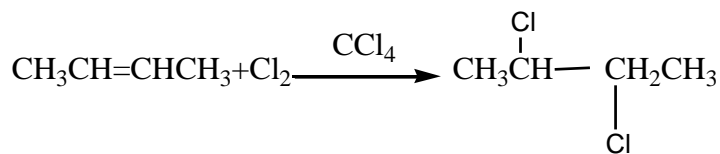
VI



VII

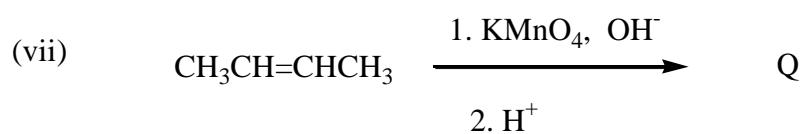
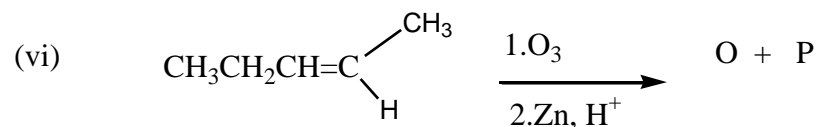
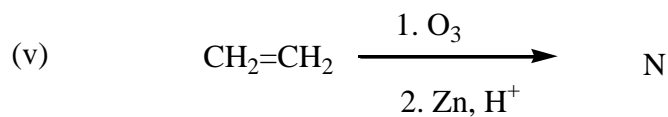
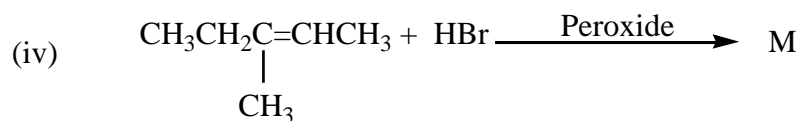
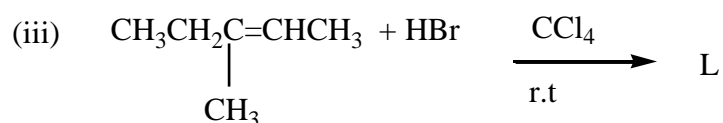
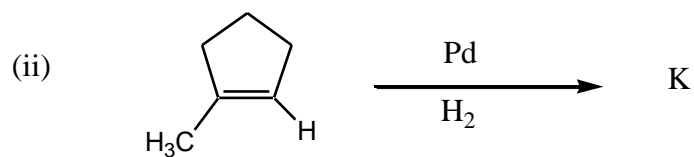
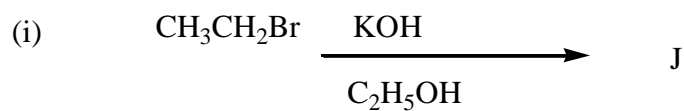
(3marks)

- d) Using curly arrows, show the reaction mechanism for the following transformation:



(3marks)

- e) Give the major organic products (J-S) for each of the following reactions :



(10marks)

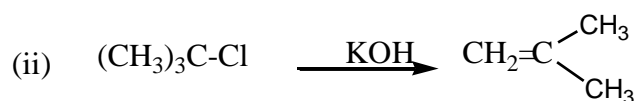
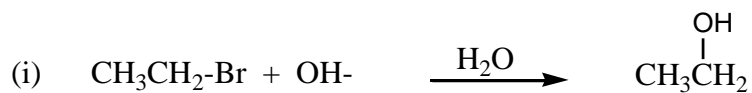
QUESTION FIVE

- a) Write the following term in full : IUPAC **(1mark)**
b) Arrange the following molecules in order of increasing boiling point. Give reason for this trend.



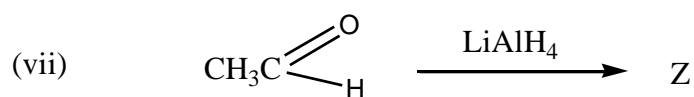
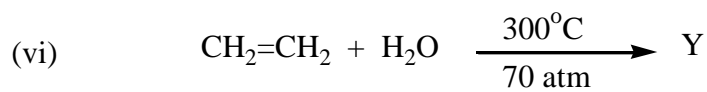
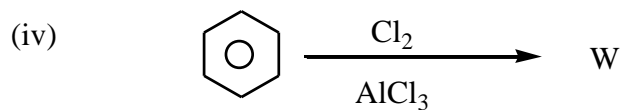
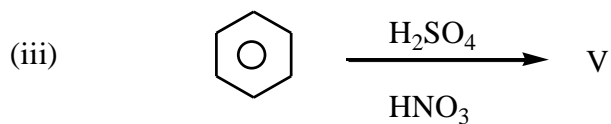
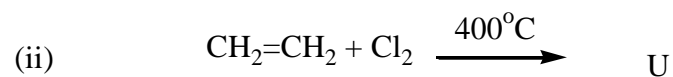
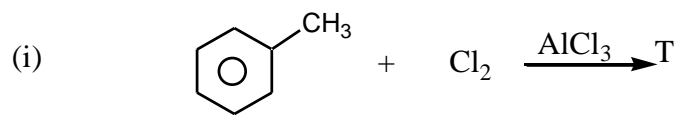
(4marks)

- c) Identify whether the following reactions are $\text{S}_{\text{N}}1, \text{S}_{\text{N}}2, \text{E}1$ or $\text{E}2$



(2marks)

- d) Write the reaction mechanism for each of the transformation in 5C(i) and (ii) above using curly arrows. **(6marks)**
e) Give the major products (T-Z) for each of the following transformations:



(7marks)