



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF
TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4107 : ORGANIC CHEMISTRY II

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

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

Question ONE

a) Draw the line bond structures of each of the following organic compounds.

- (i) N,N-Diethylcyclopentanamine
- (ii) 3-Methyl-4-hydroxyhexanal
- (iii) 4-Bromopentanoic acid
- (iv) Propyl butanoate
- (v) Butanenitrile
- (vi) 1-4-butanolithiol
- (vii) m-Bromophenol

(7marks)

b) Give a systematic (IUPAC) name for each of the following compounds.

c) Provide the reagents and or conditions required for the following synthetic conversions:

(3marks)

d) Provide the structure of the reagents (A-E) required to furnish the organic products formed from each of the following reactions. **(6marks)**

e) Explain the following observations:-

(i) Methylamine has lower boiling point than methanol. **(2marks)**

(ii) All classes of amines are more soluble in water than hydrocarbons of comparable molecular weight. **(2marks)**

(iii) Aliphatic amines are stronger bases than ammonia.

(2marks)

Question TWO

- a) Provide reasons for the following observations:
- (i) Carboxylic acids have higher boiling points than aliphatic alcohols of comparable molecular weight. **(2marks)**
 - (ii) 2-Bromopropanoic acid is a stronger acid than propanoic acid. **(2marks)**
- b) Complete each acid-base reaction by providing the structure and name of the carboxylic acid salt formed.

- c) Provide the structure of the organic compounds formed from the following reactions of carbonylic acids **(4marks)**
- d) Write a plausible reaction mechanism leading to formation of the product in (c) (ii) above. **(4marks)**
- e) Carboxylic acids that have a carbonyl group β to the carboxyl group undergo decarboxylation quite readily on mild heating. Provide the decarboxylation product and mechanism leading to its formation. **(4marks)**

Question THREE

- a) Explain why aldehydes and ketones are polar compounds. **(2marks)**
- b) Write structural formulas for all ketones with the molecular formula $C_6H_{12}O$, and give each its IUPAC name. **(6marks)**
- c) (i) Ketones readily undergo nucleophilic acyl additions. Explain why the carbonyl carbon atom is highly electrophilic. **(2marks)**
- (ii) Provide the structures of hemiacetal and acetal which are formed from the following reactions of ketones with alcohols. **(4marks)**

- d) Provide plausible reaction mechanism leading to formation the acetal in (c) (ii) (I) above. **(3marks)**
- e) Provide the structures of the two enol forms for the following ketone and indicate which enol has the larger concentration at equilibrium **(3marks)**

Question FOUR

- a) State the conditions that have to be satisfied by a compound to qualify to be aromatic as outlined by Hückel's criteria for aromaticity **(4marks)**
- b) Describe the structure of benzene based on the molecular orbital theory and account for the observed great stability of benzene molecule. **(6marks)**
- c) Name the following aromatic compounds by making use of IUPAC nomenclature system.

- d) Explain why phenols readily react with bases. **(4marks)**

Question FIVE

- a) The observed order of reactivity of carboxylic acid derivatives toward nucleophilic acyl substitution is amide < Ester < Anhydride < Acid halide. Explain the two effects that lead to the observed trend in the reactivity of the carboxylic acid derivatives. **(2marks)**
- b) (i) Complete and balance the equation for the following hydrolysis reaction.
(2marks)
- (ii) Provide reaction mechanism by making use of curly arrows for the saponification reaction in (b) (i) above.
- c) Provide the reagents and final product in the following synthetic scheme. **(4marks)**
- d) (i) Amides can be synthesized by reacting esters with ammonia. Provide the structure of amides formed from the following reactions **(4marks)**

- (ii) Provide the reaction mechanism leading to formation of the amide in (d) (i) I above. **(4marks)**