MACHAKOS UNIVERSITY

University Examinations 2021/2022

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SECOND YEAR SUPPLEMENTARY/ SPECIAL EXAMINATION FOR

BACHELOR OF EDUCATION (SPECIAL NEEDS EDUCATION)

BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY

BACHELOR OF SCIENCE (MATHEMATICS)

BACHELOR OF EDUCATION (SCIENCE)

SCH 202: ORGANIC CHEMISTRY II

DATE: 17/03/2022 **TIME: 2:00-4:00 PM**

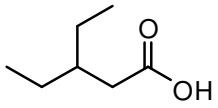
INSTRUCTIONS:

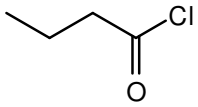
- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

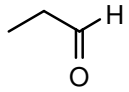
SECTION A (COMPULSORY)

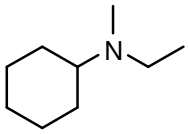
QUESTION ONE (30 MARKS)

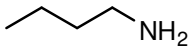
a) Give the IUPAC name to the following compounds (10 marks)

i) 

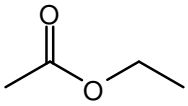
ii) 

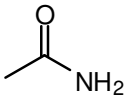
iii) 

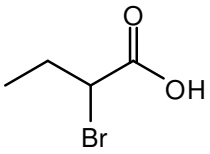
iv) 

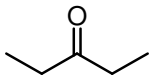
v) 

vi) $CH_3CH(CH_3)CH_2CHO$

vii) 

iv) 

ix) 

x) 

b) Draw the structures to the following compounds (6 marks)

i) *N*-ethyl-*N*-methylcyclopentanamine

ii) 2-phenylethanamine

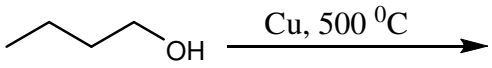
iii) N-Methylacetamide

iv) 2-Methylpropanal

v) 4-methylhexan-3-one

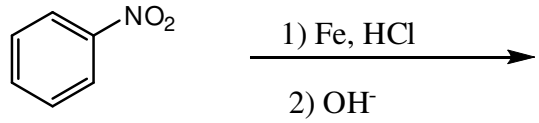
vi) Methyl propanoate

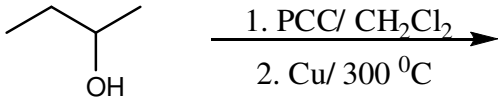
c) Complete the following reactions. (10 marks)

i) 

ii) $CH_3CH_2CH_2OH \xrightarrow{K_2Cr_2O_7/\ H_2SO_4}$

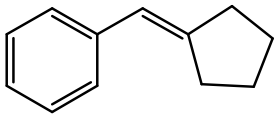
iii) $(CH_3CH_2)NH_2 + HBr \longrightarrow$

iv) 

v) 

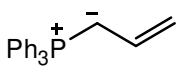
d) The compound below is a target to be synthesized using Witting reaction. Draw the structures of the carbonyl compound and Phosphorus Ylides needed for its synthesis.

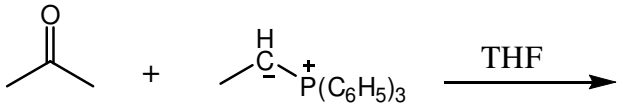
(4 marks)



QUESTION TWO (20 MARKS)

a) Identify the alkene product to be produced in each of the following Witting reaction.

Butanal + 



(4 marks)

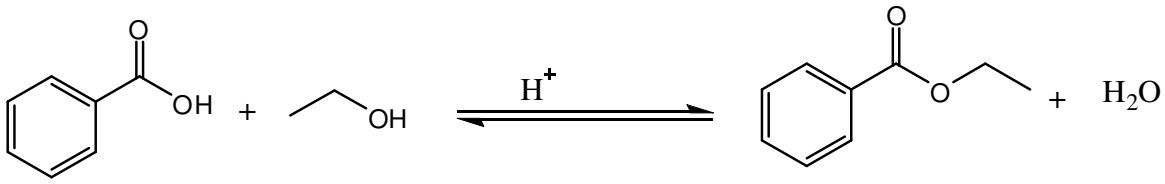
b) Iodoform, a yellow precipitate, was used as an analytical evidence for compounds containing a methyl ketone. Using 2, 2–dimethylbutan-3-one and Iodine (I_2), describe the reaction mechanism scheme for the formation of iodoform. (6 marks)

c) List four properties of carboxylic acids (4 marks)

- High melting and boiling points due to H-bonding
-

d) Write the overall mechanism for the acid catalyzed esterification reaction below.

(6 marks)



QUESTION THREE (20 MARKS)

a)

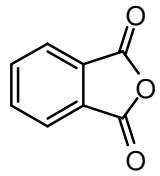
i. What is a cyanohydrin (2 marks)

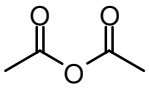
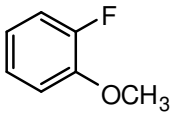
ii. Using an appropriate reaction scheme and showing the mechanism of the reaction, explain how sodium cyanide reacts with 2-butanone in the presence of water followed by addition of sulphuric acid to produce cyanohydrin (2-hydroxy-2-methylbutanenitrile. (5 marks)

iii. Explain **ANY** two mechanisms that stabilize the carboxylate (acetate) ion

(3 marks)

b) Draw the structures of the products formed in the following reactions. (6 marks)

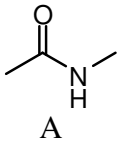
i)  + H_2O ⟶

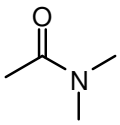
ii)  +  Friedel-Crafts acylation ⟶

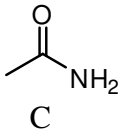
iii)  $\xrightarrow[130\ C]{CCl_4}$

c) Using IR spectroscopy, describe how the following compounds can be differentiated.

(4 marks)


A


B


C

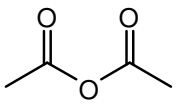
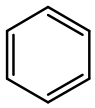
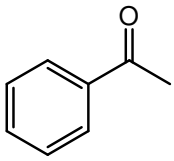
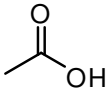
QUESTION FOUR (20 MARKS)

a) Identify the type of reaction given below and provide the name of the compound(s) formed.

(9 marks)

i) $CH_3CH_2OH + CH_3CH_2CO_2H \underset{-\ H_2O}{\overset{H^+}{\rightleftharpoons}} CH_3CH_2CO_2CH_2CH_3$

ii) $CH_3CH_2CH_2CO_2H \xrightarrow{Br_2/\ PCl_3} CH_3CH_2CH(Br)CO_2H + HBr$

iii)  +  $\xrightarrow{AlCl_3}$  + 

b) Using appropriate examples, differentiate between a lactone and a lactam. (2 marks)

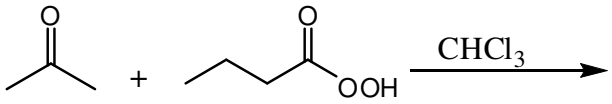
c) Draw the hydroxyl acid structure which leads to the formation of 5-pentanolide.

(2 marks)

d) Give a detailed description of the synthesis of Pentan-1-ol from the following reagents. Ethylbromide, magnesium powder, diethylether, water, propanal and sulphuric acid. (NB: Use **equations**, **curly arrows).** (7 marks)

QUESTION FIVE (20 MARKS)

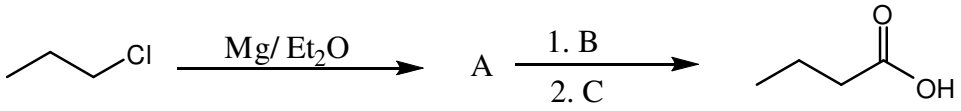
a) The reaction below is a Baeyer-Villiger oxidation of acetone.



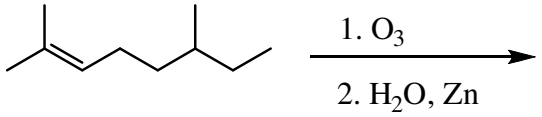
i. Complete the reaction by writing the products formed (2 marks)

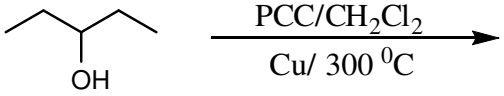
ii. Describe the mechanism for the formation of the products in **a(i)** above.(6 marks)

b) Identify the product A and reagents B and C in the reaction below. (3 marks

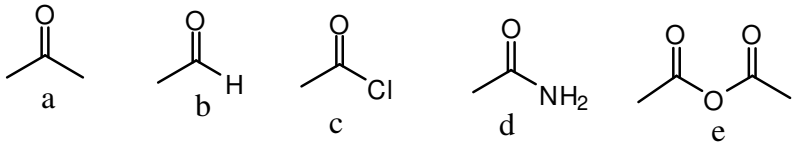


c) Complete the reactions below by giving the final product(s). (3 marks)





d) Describe the relative reactivity of the carbonyl compounds shown below. (5 marks)



e) State the meaning of keto-enol tautomerism (1 mark)