



# **KIBABII UNIVERSITY**

**UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER  
SUPPLEMENTARY EXAMINATIONS**

**FOR THE DEGREE OF BSC (CHEMISTRY)**

**COURSE CODE: SCH 222**

**COURSE TITLE: ORGANIC CHEMISTRY II**

**DURATION: 2 HOURS**

**DATE: 29/07/2022**

**TIME: 8:00AM-10:00AM**

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## **INSTRUCTIONS TO CANDIDATES:**

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

### Question One

a) Draw the structures of the following compounds (6 marks)

i) Benzoic anhydride

ii) Ethanoic acid

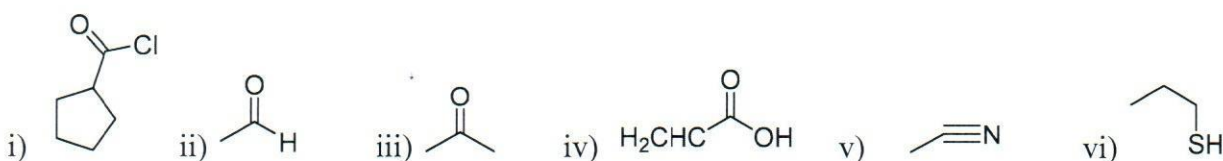
iii) 2-oxacyclopentanone

iv) Phenylpropanoate

v) Benzene carboxamide

vi) Butanamine

b) Give the IUPAC names of the following compounds (6 marks)



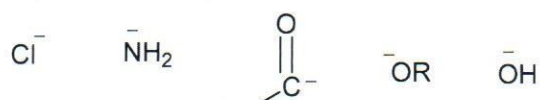
c) Explain why:

i) The boiling point of thiols is lower than that of alcohols (2 marks)

ii) Carboxylic acids do not react with carboxylate ions (2 marks)

iii) Ester and acyl chloride have lower boiling points than alcohols with a comparable molecular weight (2 marks)

d) Arrange in order of increasing basicity (2 marks)



e) Give the general formula of the following (5 marks)

i) Thioester

ii) Aldehyde

iii) Nitrile

iv) Alkyl halide

v) Thiocarbonyl

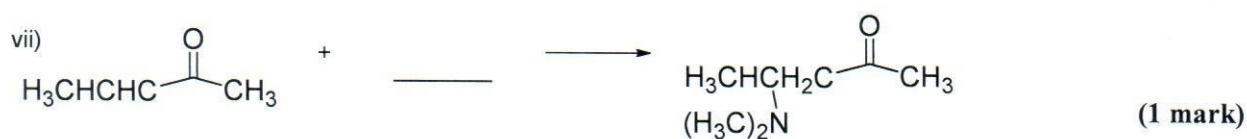
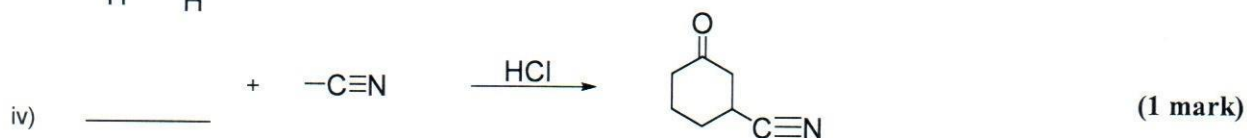
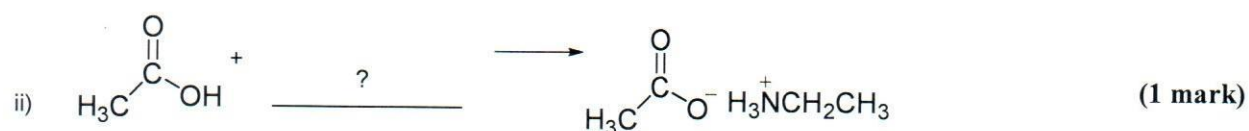
f) Define the following terms: (5 marks)

i) Bathochromic shift    ii) Hypsochromic shift    iii) Hyperchromism    iv) Hypochromism

v) Auxochromes

## Question Two

a) Give the products or reactants to the following reactions



b) By use of examples illustrate primary, secondary and tertiary:

i) alcohols

(3 marks)

ii) amines

(3 marks)

c) Show and label correctly the forces of attraction holding together molecules of an amide and a carboxylic acid

(3 marks)

d) Define a carbonyl group

(1 mark)

### Question Three

a) Esters hydrolyze slowly because water is a poor nucleophile and esters have very basic leaving groups. The rate of hydrolysis can however be increased by either acid or a  $\text{HO}^-$ .

i) Illustrate the mechanism for acid-catalyzed ester hydrolysis

(6 marks)

ii) To push the reaction forward considering the acid catalyzed reaction what must be done?

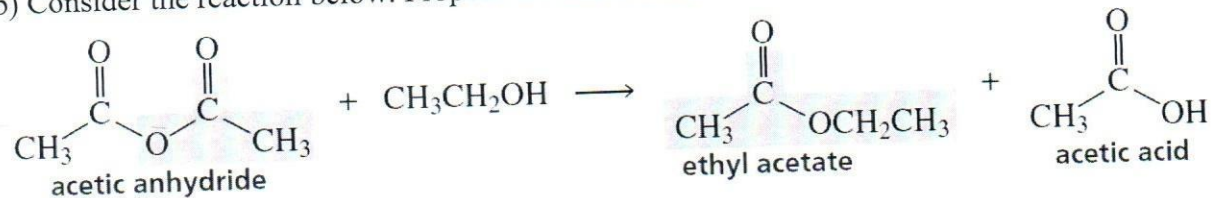
(2 marks)

iii) Illustrate the mechanism for Hydroxide-Ion-Promoted Ester Hydrolysis

(5 marks)

b) Consider the reaction below. Propose its mechanism

(4 marks)



c) i) Draw the most reactive and least reactive forms of carboxylic acids

(2 marks)

ii) Carboxylic acids do not react with halide ions. Why?

(1 mark)

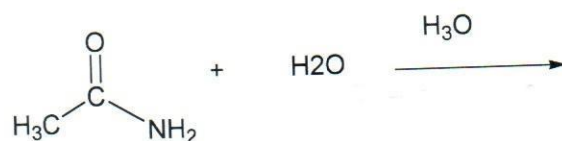
### Question Four

a) i) Amides do not react with carboxylate ions. Why?

(1 mark)

ii) Amides only react with water and alcohols if the reaction mixture is heated in the presence of an acid. Show the mechanism and the products formed from the reaction below

(7 marks)



iii) Give the reasons for using the acid catalyst

(2 marks)

b) Define the following:

- i) A stretch (1 mark)  
ii) A bend (1 mark)  
iii) IR spectrometer (1 mark)

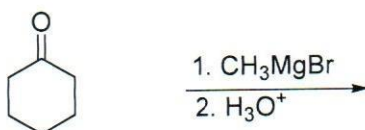
c) Give the advantages of using a Fourier transform IR (FT-IR) spectrometer. (4 marks)

d) Which would be expected to be more intense and the least intense the stretching vibration of N-H bond, C-H bond, or O-H bond. Explain (3 marks)

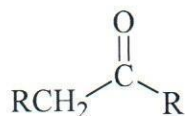
### Question Five

- a) i) There are two most general means of synthesis of organosilanes. Namely (2 marks)  
ii) In both cases above give examples (4 marks)  
iii) Show how alcohols can be protected by Si-Cl compounds during multi-step synthesis (3 marks)

b) Methylmagnesium bromide reacts with cyclohexanone to yield a product with the molecular formula  $C_7H_{14}O$ .



- i) What is the structure of the product (1 mark)  
ii) What identifying IR peak will it show? (2 marks)  
ii) Arrange in order of increasing reactivity (2 marks)  
Ester, carboxylic acid, acid anhydride, amide, acyl chloride  
c) i) Illustrate an acid catalyzed keto-enol interconversion using the species below. (3 marks)



- iii) Illustrate a base catalyzed keto-enol interconversion using the species in (ii) above (3 marks)