



MACHAKOS UNIVERSITY

University Examinations 2022/2023 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ANALYTICAL CHEMISTRY)

BACHELOR OF EDUCATION (SPECIAL NEEDS)

BACHELOR OF SCIENCE (MATHEMATICS)

BACHELOR OF EDUCATION (SCIENCE)

SCH 202: ORGANIC CHEMISTRY II

DATE: 13/4/2023

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

QUESTION ONE (30 MARKS)

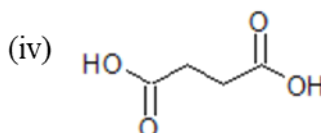
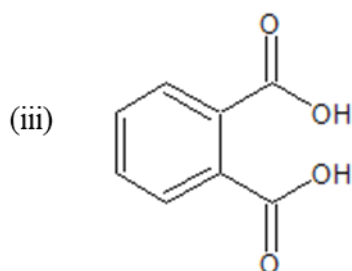
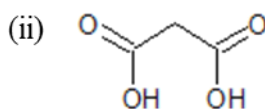
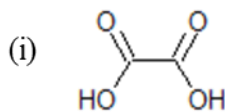
- Explain the carbonyl group and name two compounds containing carbonyl group. (2 marks)
- Explain the differences between the double bonds in alkenes and in carbonyl groups. (2 marks)
- With the help of a structure, illustrate the correct partial positive or negative of the formaldehyde. (2 marks)
- Explain the solubility of hydrocarbons in water. (2 marks)
- Differentiate between an Aldehyde and a Ketone. (2 marks)

f) Explain the chemical test for the following compounds; (4 marks)

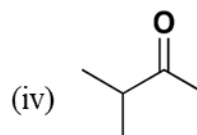
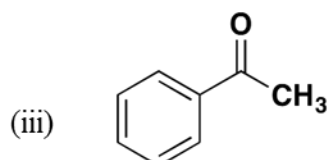
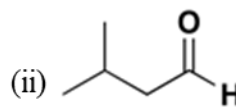
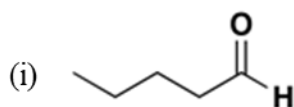
(i) Aldehyde

(ii) Carboxylic acid

g) Provide the common names for the following dicarboxylic acids. (4 marks)



h) Provide the IUPAC and the common name of the following compounds. (8 marks)



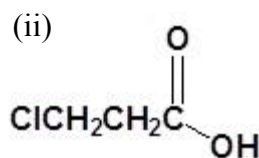
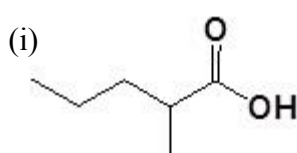
i) Complete the table below with the correct formula, source, IUPAC name, or common name. (4 marks)

Formula	Source	IUPAC name	Common name
CH ₃ CO ₂ H	Vinegar	Ethanoic Acid	
	Milk	Propanoic Acid	Propanoic Acid
HCO ₂ H	Ants		Formic Acid
CH ₃ (CH ₂) ₂ CO ₂ H		Butanoic Acid	Butyric acid

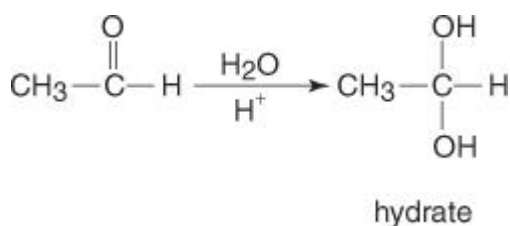
SECTION B

QUESTION TWO (20 MARKS)

- a) Define carboxylic acids and provide three common household items containing them. (4 marks)
- b) Provide the IUPAC and the common name for the following carboxylic acid. (4 marks)



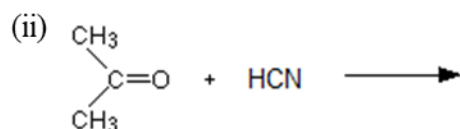
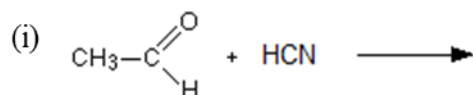
- c) The reactions of methanol and ethanal produce hemiacetal, or acetals if hydrochloric acid is present. Use structures to show these reactions. (4 marks)
- d) Explain the reason why Benzaldehyde is less reactive to nucleophilic addition reactions than aliphatic aldehydes. (2 marks)
- e) The addition of water to aldehyde results in the formation of a hydrate as shown by the equation below. Using arrows, provide the mechanism for this reaction. (6 marks)



QUESTION THREE (20 MARKS)

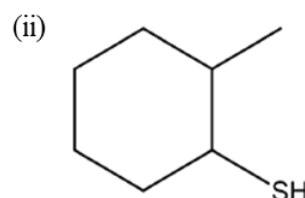
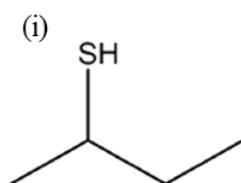
- a) The electrophilic carbon atom of ketones can be attacked by amines to form an imine. Using arrows provide the detailed mechanism for this conversion. (4 marks)
- b) Define the term Nitrile (2 marks)
- c) The following nitrile compound is known as butanenitrile, provide the alternative name for the same compound. (2 marks)
- CH_3-CH_2-CH_2-C\equiv N
- d) Draw structures for the following nitrile compounds. (4 marks)
- (i) 2-methoxybenzonitrile
- (ii) 2-methylcyclohexanecarbonitrile

- e) Define Nitrile rubber and give two of its uses in the laboratory, giving reasons for the uses. (4 marks)
- f) Explain the effect of electronegative nitrogen in the nitrile compounds in terms of polarity and boiling point. (2 marks)
- g) Aldehydes and ketones undergo an addition reaction with hydrogen cyanide to form nitrile compounds. Complete the following reactions and give the IUPAC name of the nitrile formed. (4 marks)

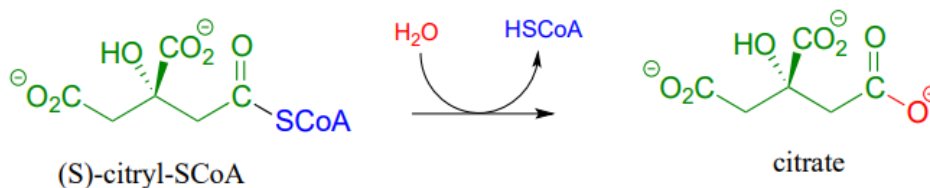


QUESTION FOUR (20 MARKS)

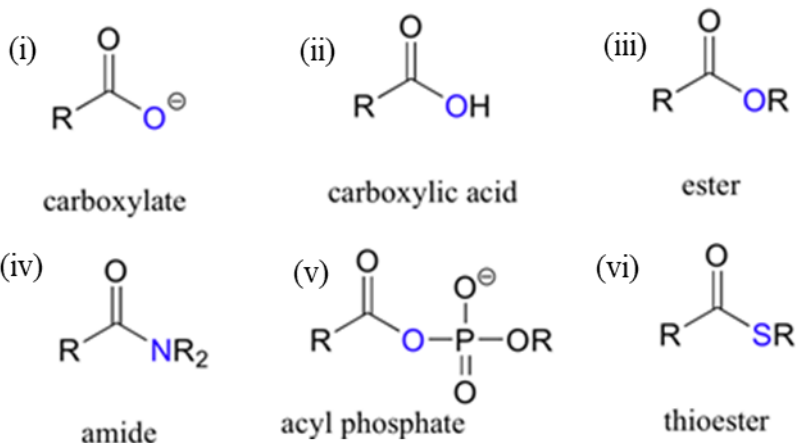
- a) Provide the alternative name for thiols (1 mark)
- b) Draw the structure of the following thiols. (4 marks)
- (i) Cyclopentane thiol
- (ii) 2-mercaptobenzoic acid
- c) Name the following thiol compounds. (4 marks)



- d) In the citric acid cycle (commonly known as Krebs cycle), (S)-citryl CoA is hydrolyzed to citrate as shown below. Using arrows, show the detailed mechanism for this hydrolysis process. (4 marks)



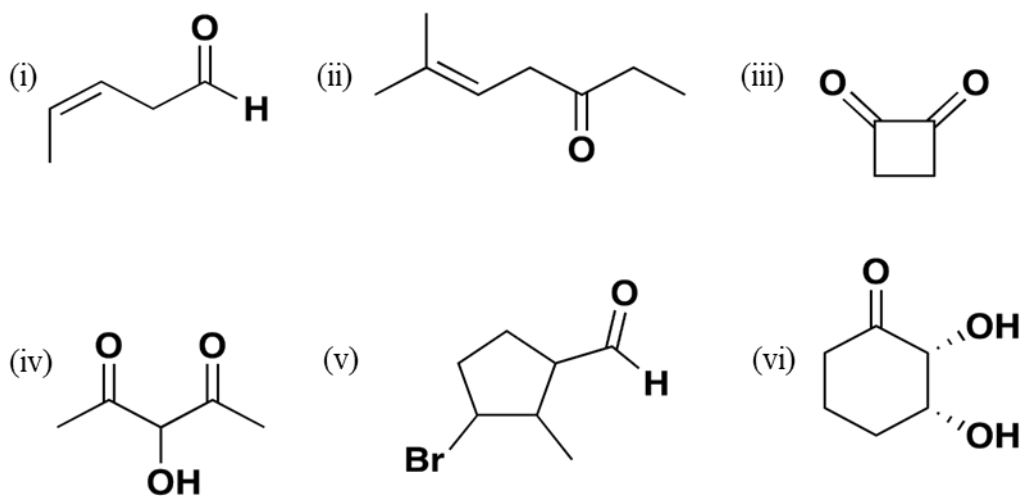
- e) Arrange the following groups in the increasing order of their reactivity. (3 marks)



- f) Many thiocarbonyl compounds tend to be deeply coloured and highly reactive, explain the reason. (2 marks)
- g) State two uses of thiocarbonyl compounds. (2 marks)

QUESTION FIVE (20 MARKS)

- a) Provide the IUPAC name for each compound. (12 marks)



- b) Provide the structure corresponding to each of the following names. (8 marks)
- 3-oxobutanal
 - (*E*) 3-methyl-2-hepten-4-one
 - cis*-3-bromocyclohexanecarbaldehyde
 - 2-hydroxycyclopentanone