



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

AUGUST SESSION EXAMINATION FOR
BACHELOR OF EDUCATION (SCIENCE)

SCH 202: ORGANIC CHEMISTRY II

DATE: SCHOOL BASED

TIME:

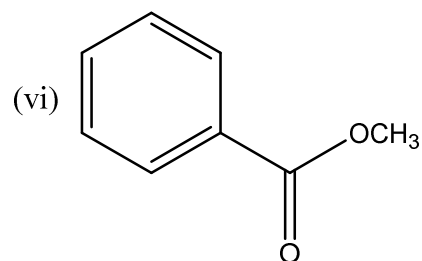
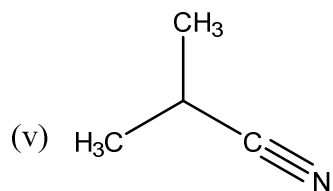
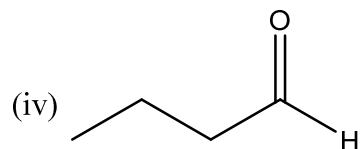
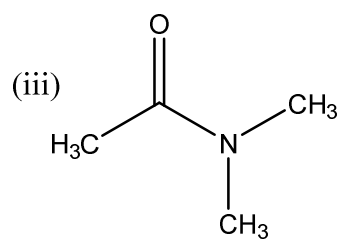
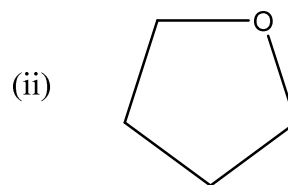
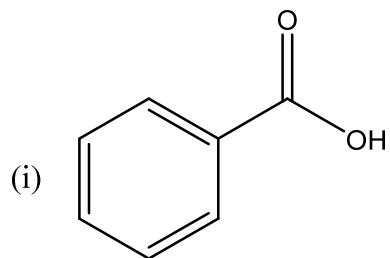
INSTRUCTIONS:

- 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) (30 MARKS)

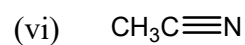
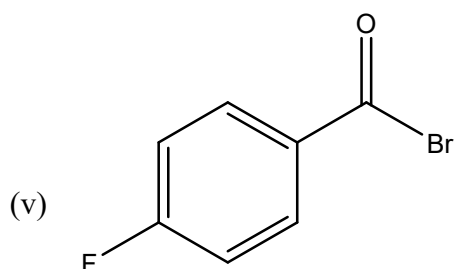
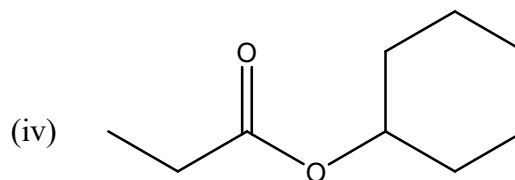
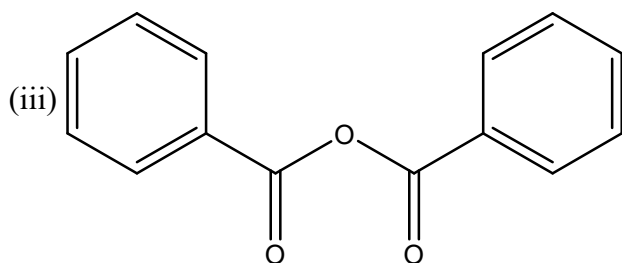
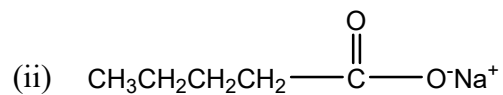
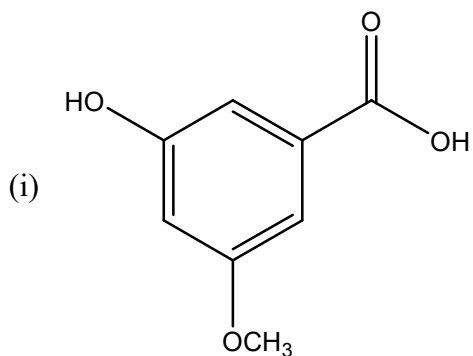
QUESTION ONE (30 MARKS)

- a) Briefly explain the following terms
- (i) Carboxylic acid derivatives (1 mark)
 - (ii) Functional groups (1 mark)
- b) Identify and name the functional groups present in the following molecules



(6 marks)

c) Provide the IUPAC names for each of the following compounds



(6 marks)

e) Draw the following molecules, based on their IUPAC name:

- (i) 2-hydroxy-5,5-dimethylheptanedioic acid
- (ii) Methyl ethanoate
- (iii) Acetamide
- (iv) Nitroaniline
- (v) Phenylethanal

(10 marks)

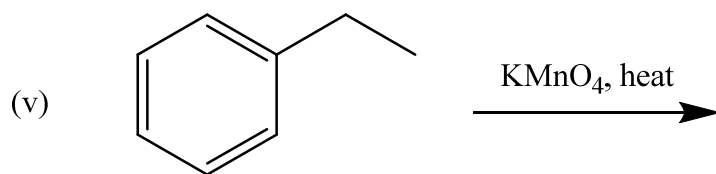
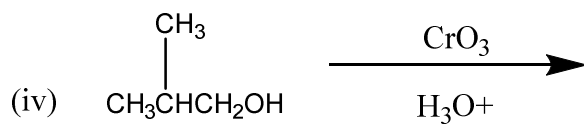
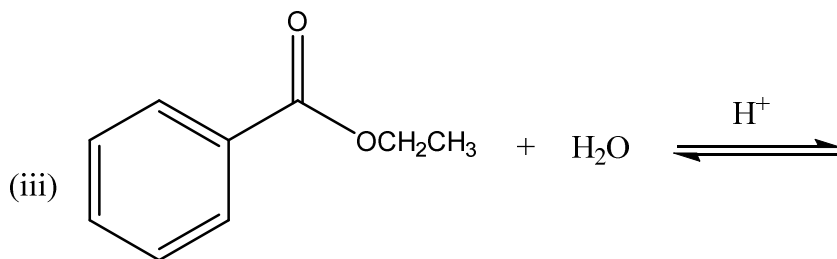
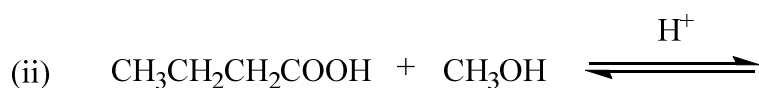
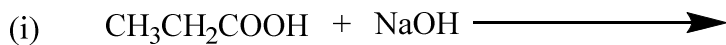
f) Given a primary, secondary, and a tertiary amine, describe a chemical test that one can use in the laboratory to distinguish the three. (2 marks)

- g) Aldehydes and ketones possess two sites where reactions can take place and therefore can undergo two types of reactions. With illustration, describe the two reactions. (4 marks)

SECTION B (ATTEMPT ANY TWO QUESTIONS)

QUESTION TWO (20 MARKS)

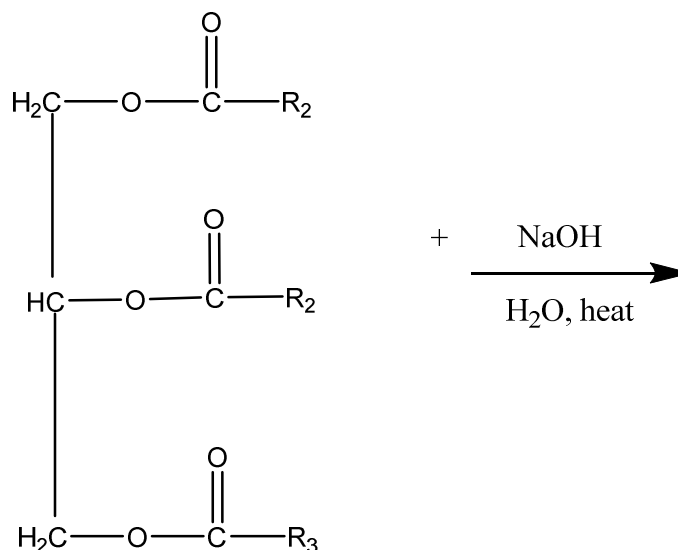
- a) Complete the following reactions and provide the name for the resulting product(s).



(10 marks)

b) Soap is made through base hydrolysis of fatty acid, a process called saponification.

(i) Complete the reaction below by showing all the products formed.



(4 marks)

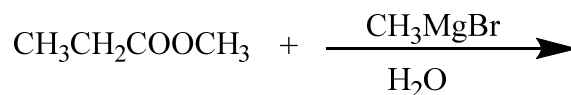
(ii) Describe the mechanism of soap action in removal of grease.

(6 marks)

QUESTION THREE (20 MARKS)

a) Esters are synthesized through esterification, which can either be a 'direct esterification' or 'indirect esterification'. Using examples describe the two processes. (4 marks)

b) The reaction between an ester and a Grignard reaction is one of the routes applied to synthesize alcohols. In the reaction below, use curly arrows to indicate the mechanism resulting in the formation of an alcohol.



(5 marks)

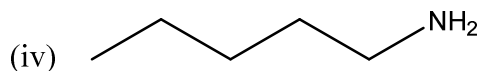
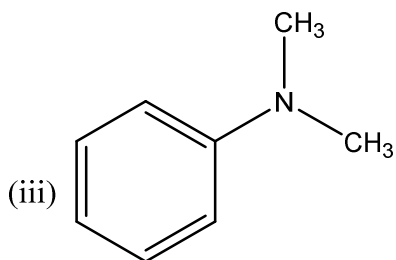
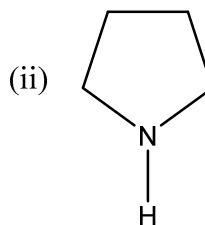
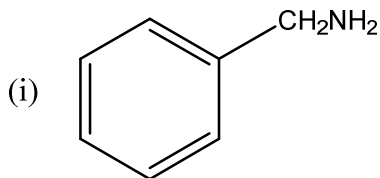
c) List four physical properties of esters

(4 marks)

- d) Condensation polymerization has come in handy in synthesis of polymers, which have found application in various ways. One of the most important polymer is polyethylene terephthalate commonly known as PET. Identify the starting materials in the synthesis of PET. (4 marks)
- e) Carboxylic acids have higher boiling points compared to ketones, aldehydes and alcohols of similar molar mass. Discuss why this is so. (3 marks)

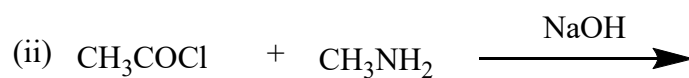
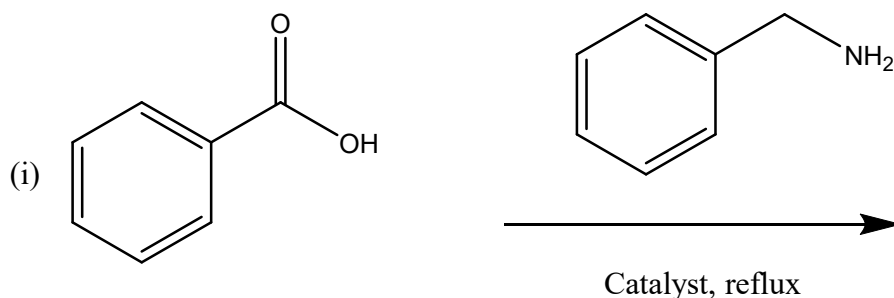
QUESTION FOUR (20 MARKS)

- a) For the compounds shown below, identify them as either primary (1°), secondary (2°) or tertiary amines (3°).



(4 marks)

- b) Explain why short chain amines are soluble in water while long chain amines are only sparingly soluble in water. (2 marks)
- c) Complete the reactions below to show the products formed and their names. Identify the one which is a direct amidification and the indirect procedure.



[6 marks]

d) Clearly illustrate the structural difference between the following

(i) Thiols and alcohols

(ii) Thioesters and Esters

(iii) Thiocarbonyls and carbonyls

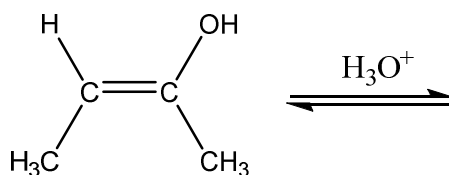
(6 marks)

e) Describe a simple chemical procedure that can be used in the laboratory to identify carboxylic acids.

(2 marks)

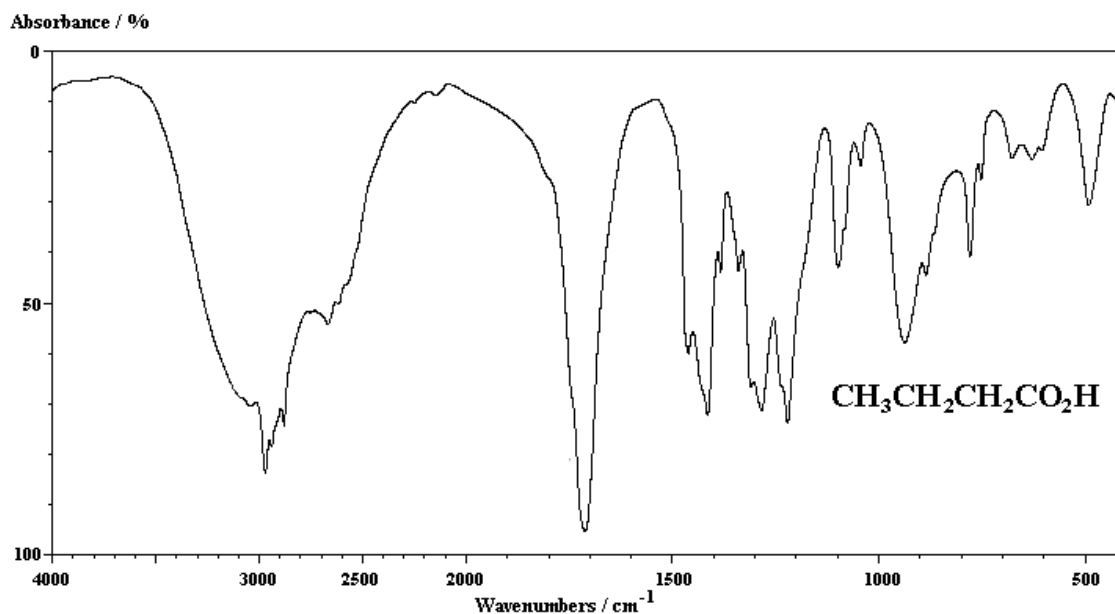
QUESTION FIVE (20 MARKS)

a) Enols are easily converted to more stable keto forms through a process called tautomerization. In the reaction shown below, use curly arrows to show the mechanism for acid catalysed enol-keto tautomerism.



(5 marks)

- b) Describe a chemical identification procedure that is used to distinguish between a ketone and an aldehyde. Be careful to indicate the chemical reaction involved. (5 marks)
- c) Briefly explain the following terms as used in spectroscopy
- (i) Spectroscopy
- (ii) Fingerprint region (2 marks)
- d) The figure shown below is an infrared (IR) spectrum for butanoic acid. Indicate the stretching frequencies for OH and CO (carbonyl) group.



- (4 marks)
- e) Quinones belong to the family of antioxidants which are useful in the body. Describe how antioxidants work to render them useful in the body. (2 marks)
- f) Carboxylic acids are described as highly polar. Using any carboxylic acid, illustrate this phenomenon. (2 marks)