



# KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS  
2022/2023 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER  
MAIN EXAMINATIONS**

**FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE**

**COURSE CODE: SCH 312\*/313**

**COURSE TITLE: ORGANIC SYNTHESIS**

**DURATION: 2 HOURS**

**DATE: 19/12/2022**

**TIME: 2:00-4:00PM**

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**INSTRUCTIONS TO CANDIDATES**

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 4 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

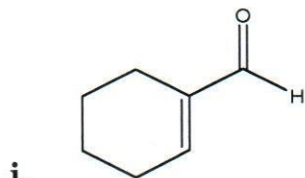
**Question 1 (30 marks)**

a) Distinguish between Synthesis and retrosynthesis

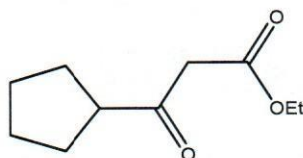
[2 marks]

b) Indicate all the acidic hydrogens

[4 Marks]

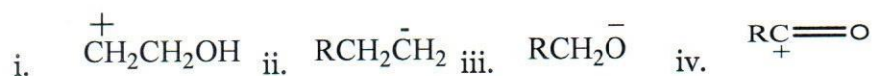


ii



c) Provide possible synthetic equivalents for the following synthons

[4 marks]



d) Show a reasonable disconnection for

[4 marks]

i. 3-pentanol

ii. 2-ethyl-3-methylbutanenitrile.

e) Give two protecting groups for alcohols

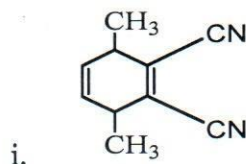
[2 marks]

f) Explain briefly why protecting groups are essential in organic synthesis.

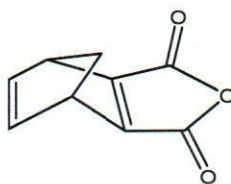
[2 marks]

g) Give reagents that would be used to give the following compounds using Diels-Alder reaction.

[4 marks]



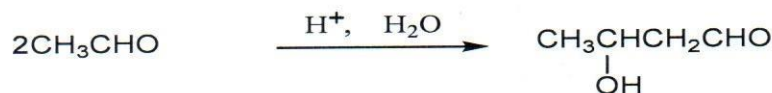
ii.



h) I) What do you understand by the term 'mixed aldol condensation'

[2 marks]

II) Using curly arrows, provide a plausible reaction mechanism for the reaction below.



[4 marks]

i) State two applications of organic synthesis to pharmaceutical chemists.

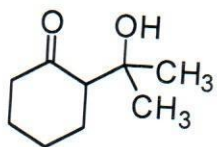
[2 marks]

**Question 2 (20 marks)**

a) Outline the steps involved when you want to disconnect a target molecule (TM) so as to plan for its synthesis.

[4 marks]

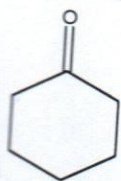
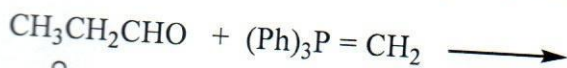
b) You are supposed to synthesize compound shown below (TM) starting with a diester using Dieckmann condensation reaction as first step of synthesis and Grignard reagent.



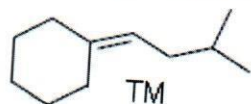
- i). Carry out retrosynthesis of compound. [3 marks]  
 ii). Write its synthesis giving specific reagents and conditions. [6 marks]  
 iii). Propose a reaction mechanism involved in the above synthesis. [7 marks]

**Question 3 (20 marks)**

- a) What is meant by term 'ylide' [1mark]  
 b) Starting with chloroethane as a precursor, explain how the phosphorous ylide is formed to initiate a Wittig reaction. Illustrate your answer with appropriate chemical equations. [4 marks]  
 c) Complete the following reactions by giving the structures of the products. [4 marks]



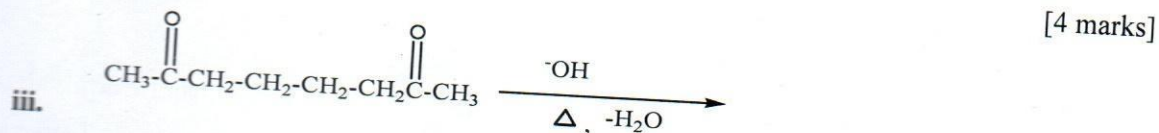
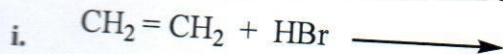
- d) By carrying retrosynthesis of the TM given below, propose one possible method of synthesizing the following compound (TM) using the starting material containing no more than seven carbons and triphenyl phosphine. [4marks]



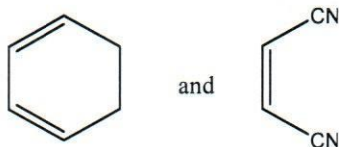
- e) Provide mechanism for proposed method in d) above [3marks]  
 f) State two Advantages of Wittig reaction over other methods [4mks]

**Question 4 (20 marks)**

- a. Complete and provide mechanism for each of the following reactions:



b. Using the following compounds,



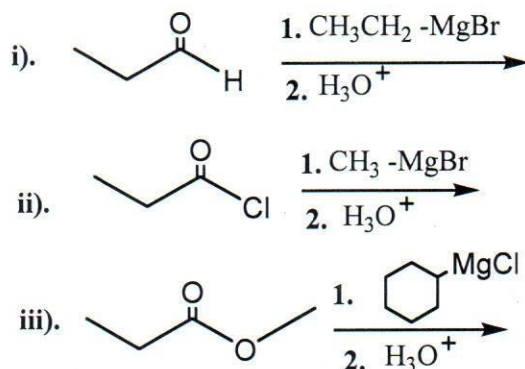
- Indicate the dienophile and the diene [2 Marks]
- Show the mechanism and explain the stereochemistry of the product when they undergo Diel\_Alders reaction [6marks]

**Question 5 (20 marks)**

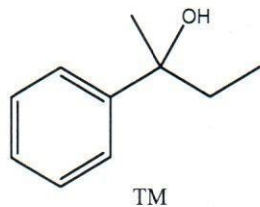
a) Give the reagents and conditions for the following transformations [4 marks]



b) Provide the products formed in the reactions shown below. [6 marks]



c) The following compound (TM) was synthesized using Grignard reagents and other organic reagents



- Carry out its retrosynthesis showing clearly the synthons and synthetic equivalents [4marks]
- Write its synthesis and provide the mechanism. [6marks]