



# KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER  
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE) AND BCH

**COURSE CODE:** SCH 330

**COURSE TITLE:** ORGANIC SYNTHESIS

**DATE:** 15/02/21 **TIME:** 2-4 Pm

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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 1 (30 marks)**

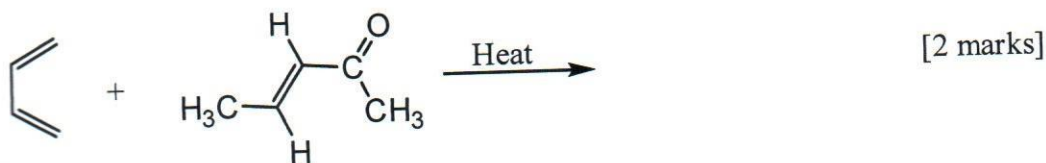
Diels-Alder reactions are useful in organic synthesis in preparation of some stereo- and region-specific products from dienes and dienophiles.

a) Draw the frontier molecular orbitals (highest occupied molecular orbitals (HOMO) and the lowest unoccupied molecular orbitals (LUMO) of the dienes and dienophiles showing features that make the reactions stereo-specific. [4 marks]

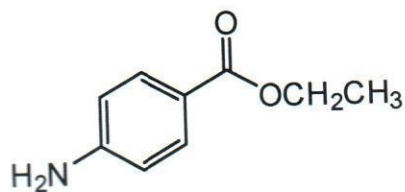
b) Compounds given below are products of the Diel-Alder reactions. Provide the structures of the diene and dienophile necessary to prepare each molecule and label them.



c) Write down the products of the following reactions. Where appropriate, include the stereochemistry of the product. [4 marks]

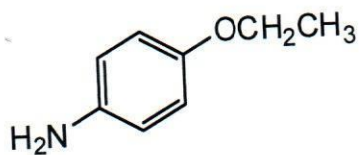


d) Benzocaine is a compound that is used as a local anesthetic in hospitals.



- i). Provide a retrosynthetic analysis of the drug up to toluene. [4 marks]
- ii). Starting from toluene, show how benzocaine can be synthesized. [4 marks]

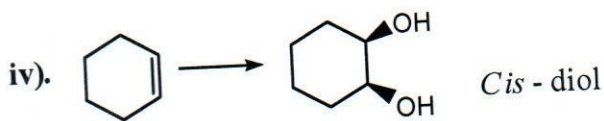
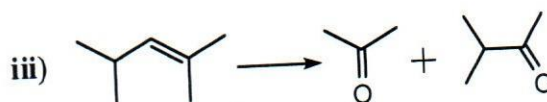
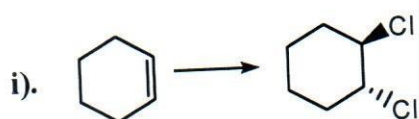
e) Paracetamol is a common pain reliever that can be purchased over the counter.



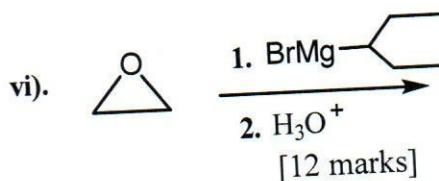
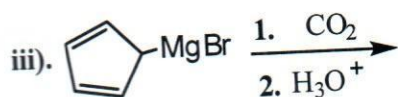
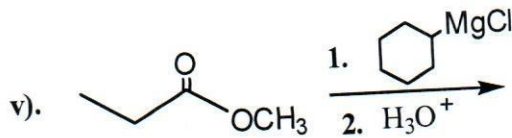
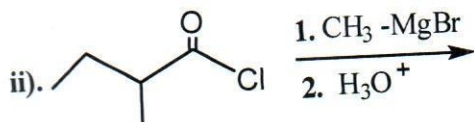
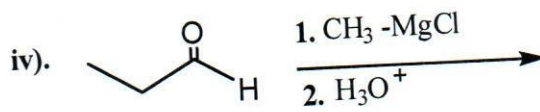
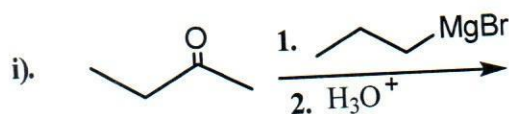
- i). Provide retrosynthetic analysis for its synthesis up to phenol. [3 marks]
- ii). Starting from phenol, propose a reaction sequence for the synthesis of Paracetamol, indicating all possible intermediate products. [3 marks]

**Question 2 (20 marks)**

a) Give the reagents and conditions for the following transformations [8 marks]

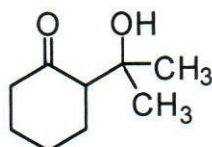


b) Grignard reagents are formed by the reaction of magnesium metal with alkyl or alkenyl halides. They're extremely good nucleophiles, very strong bases and will react with acidic hydrogens. Provide the products formed in the reactions shown below.

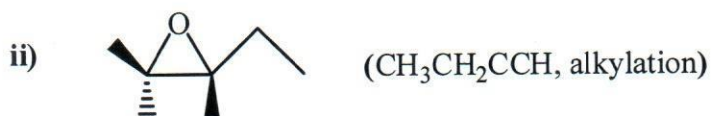
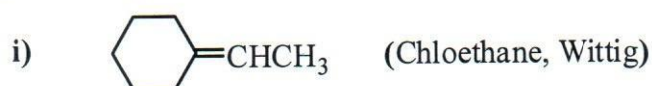


### Question 3 (20 marks)

- a) You are supposed to synthesize compound 2 (TM) starting with a diester using Dieckmann condensation reaction as first step of synthesis.

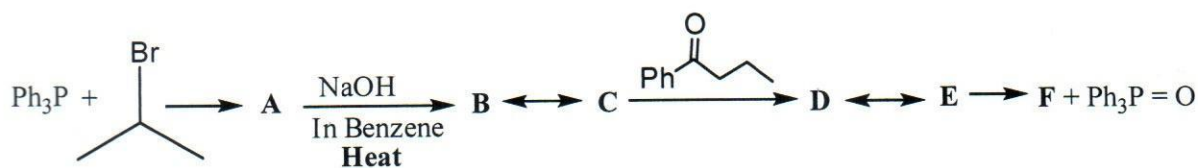


- Carry out retrosynthesis of compound 2. [3 marks]
  - Write its synthesis giving specific reagents and conditions. [6 marks]
  - Propose a reaction mechanism involved in the Dieckmann cyclization step in the above synthesis. [3 marks]
- b) Write equations showing the preparations of the following compounds starting with precursor given in the brackets and at least one of the indicated reaction. [8 marks]



### Question 4 (20 marks)

- a) Suggest the structures A, B, C, D, E and F in the following reaction sequences. [6 marks]



- b) i). 2-heptanone is responsible for the peppery odor in some cheese. You have been asked to synthesize it. Show how you would arrive at the starting materials. [6 marks]



- ii). Show how you synthesize 2-heptanone using the starting materials you identified in b (i) above. [8 marks]