



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF
EDUCATION

SCH 402: CONCEPTS OF ORGANIC SYNTHESIS

DATE: 2/8/2017

TIME: 8.30-10.30 AM

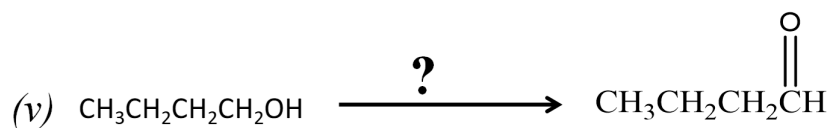
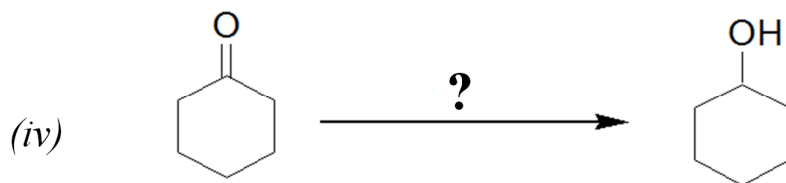
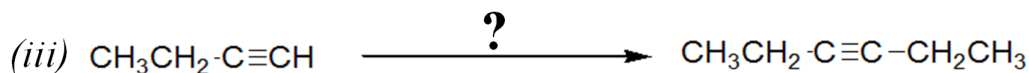
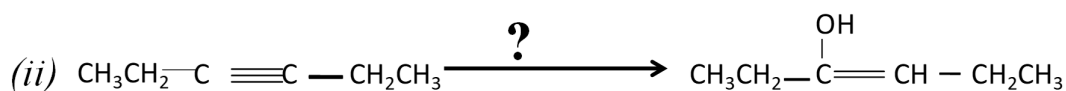
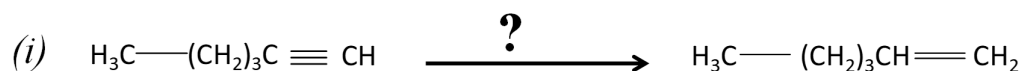
INSTRUCTIONS:

- 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)

- a) Explain the following terms as used in organic synthesis (4 marks)
- Synthons
 - Synthetic equivalents
- b) Convergent synthesis is preferred over linear synthesis. Give two reasons to defend this statement (4 marks)
- c) Provide the reagents in the following transformations (10 marks)

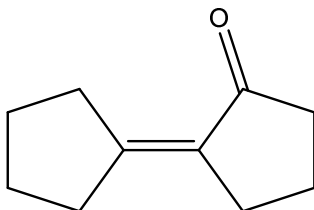


- d) Briefly define the following concepts using examples
- Markovnikov Rule (2 marks)
 - Tautomers (2 marks)
 - Functional group interconversion (2 marks)
- e) Provide the possible synthetic equivalents for the following synthons (6 Marks)
- $\text{RCH}_2\text{CH}_2^-$
 - $\text{RCH}_2\text{CH}_2^+$
 - $^+\text{CH}_2\text{CH}_2\text{OH}$

SECTION B

QUESTION TWO (20 MARKS)

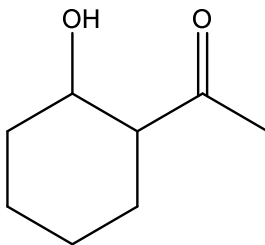
- a) Write three key considerations when disconnecting any target molecule to get the synthetic equivalents (3 marks)
- b) i Using 1,1'-bi(cyclopentylidene)-2-one shown below, identify the synthons and their respective synthetic equivalents (Note: Functional group interconversion maybe necessary to ease the disconnection) (7 marks)



- ii Using the identified synthetic equivalents, show the forward reaction (synthesis) of the Target Molecule showing the mechanism and reagents (10 marks)

QUESTION THREE (20 MARKS)

- a) Following an appropriate disconnection demonstrate how the molecule below can be synthesized (5 marks)



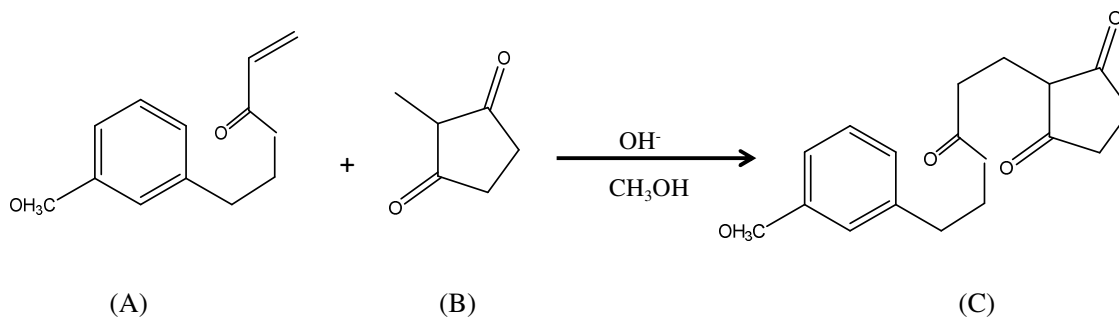
1-(2-hydroxycyclohexyl)ethan-1-one

- b) Upon heating the solution, the above compound is likely to be converted into α,β -unsaturated carbonyl. Show the mechanism for the base catalyzed dehydration of the above compound (5 marks)
- c) Show the mechanism for the acid catalyzed dehydration of the above compound (5 marks)

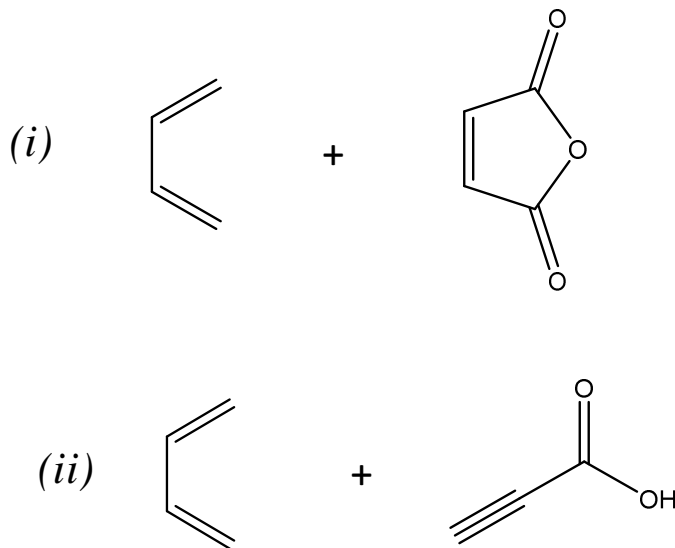
- d) In the aldol reaction between (i) propanal and acetaldehyde, and (ii) acetaldehyde and benzaldehyde, only one is synthetically useful. With reasons, identify the one which is useful and give the mechanism for the resulting product (5 marks)

QUESTION FOUR (20 MARKS)

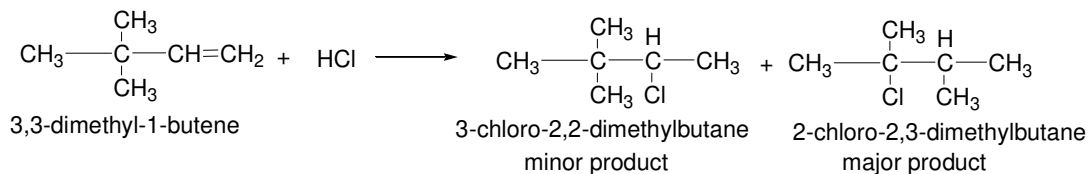
- a) Estrone is one of the female sex hormones synthesized from compound C using the precursors A (α,β -unsaturated carbonyl) and B (carbonyl compound) as shown below. Show the mechanism resulting into formation of compound C (5 marks)



- b) In the compounds below, indicate the dienophile, the diene and the product formed showing the mechanism leading to its formation (10 marks)

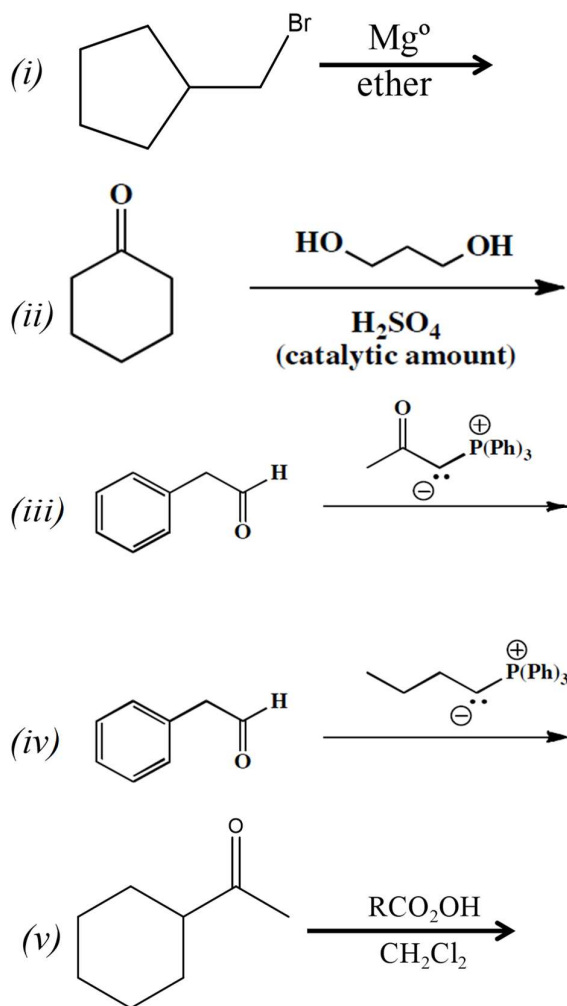


- c) It is expected that addition of HCl to 3,3-dimethyl-1-butene should give 3-chloro-2,2-dimethylbutane as the major product. However this is never the case and 2-chloro-2,3-dimethylbutane is isolated as the major product. Explain this observation and show the mechanism resulting in the formation of the major product (5 marks)

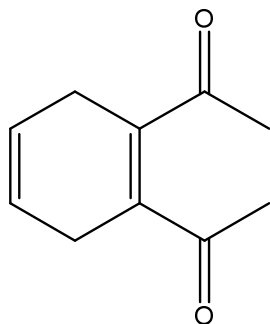


QUESTION FIVE (20 MARKS)

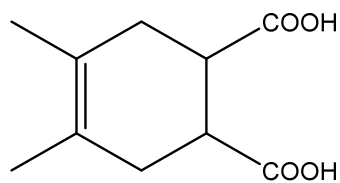
- a) Write the structure of the predominant product that will occur for each transformation in the reactions below. Show the mechanism where appropriate (14 marks)



- b) What are the starting materials for each of the following Diels Alder reaction products? (6 marks)



(i)



(ii)