

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE IN  
BACHELOR OF SCIENCE (CHEMISTRY)

CHEM 439: INTRODUCTION TO ORGANIC SYNTHESIS

STREAM: BSc (CHEMISTRY)

TIME: 2 HOURS

DAY/DATE: THURSDAY 9/04/2020

11.30 A.M -1.30 P.M.

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**INSTRUCTIONS:**

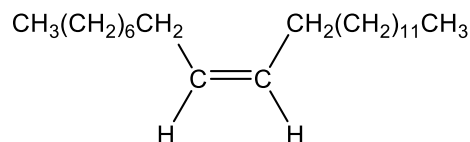
Answer question **One** (Compulsory) and any other **Two** questions

**QUESTION ONE [30 MARKS]**

(a) Define the following terms (3Marks)

(i) Retron (ii) Synthons (iii) Synthetic equivalents

(b) Muscalure (i.e. (Z)-9-Tricosene) is a sex pheromone produced by female house flies (*Musca domestica*) to attract males:

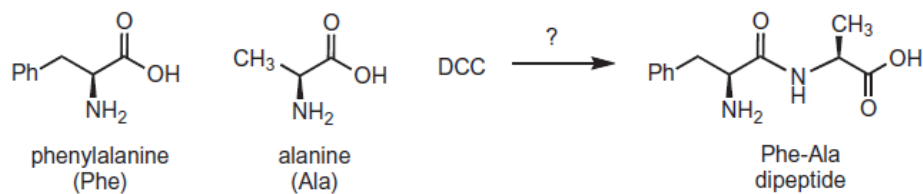


Muscalure

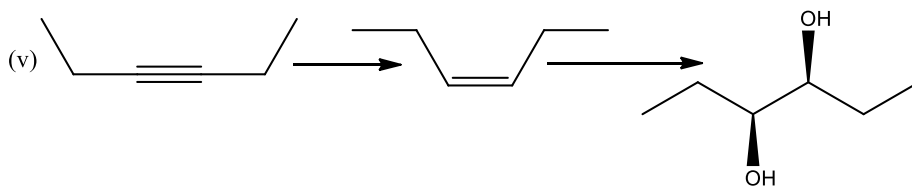
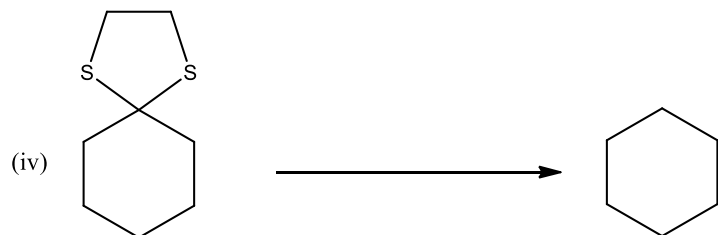
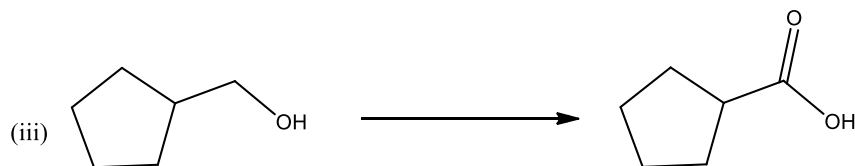
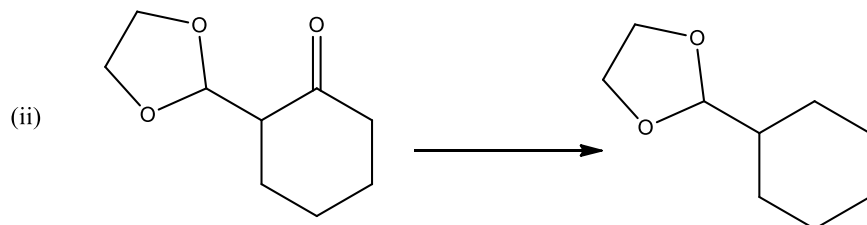
(i) Conduct a retrosynthetic analysis of muscalure. (4 Marks)

(ii) Design a stepwise synthesis of muscalure based on your retrosynthetic analysis (4 Marks)

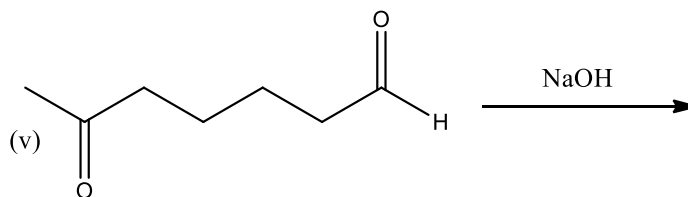
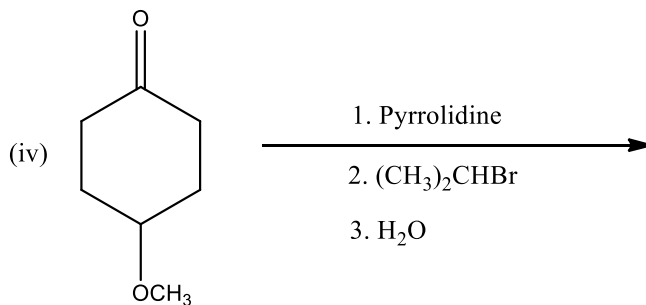
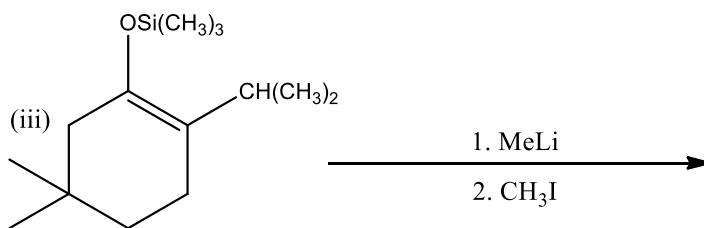
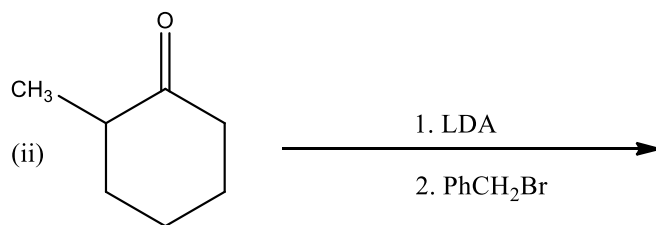
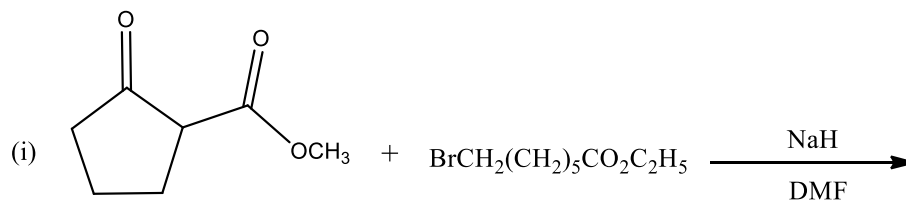
(c) Describe the synthesis of the following dipeptide from the given amino acids. (5 Marks)



(d) Write the reagent(s) that are required to accomplish each of the following transformations (6marks)



(e) Draw the structure of the major organic product(s) of the following reactions. (5Marks)



(f) Explain three qualities of a good protecting group.

(3 Marks)

## **QUESTION TWO [20 MARKS]**

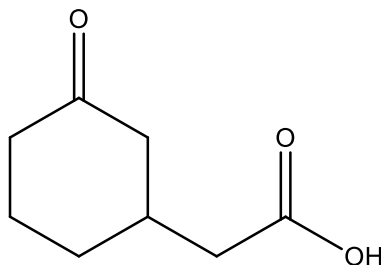
(a) Discuss solvents effects in the alkylation of enolates . **(6 Marks)**

(b) Describe, with an aid of a suitable example, how the following functional groups can be protected and protected during multistep organic synthesis (one method per functional group)

**(9 Marks)**

(i) Amines    (ii) ketones    (iii) carboxyl groups

(c) Conduct a retrosynthetic analysis and design a plausible synthesis of the following compound using cyclohexanone as one of the starting material **(5 marks)**

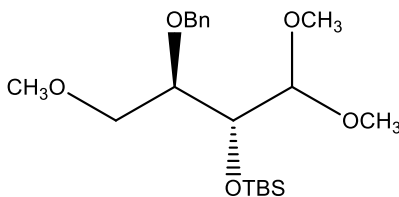


## **QUESTION THREE [20 MARKS]**

(a) Discuss, with the aid of a suitable example, three methods that can be used for laboratory synthesis of amino acids **(6 marks)**

(b) Explain why *tert*-butoxycarbonyl (BOC) is widely used for protecting alcohols. **(3 Marks)**

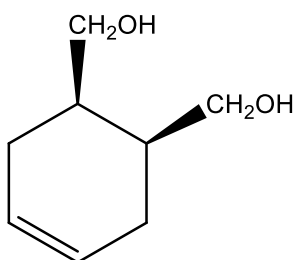
(c) Predict the major product, if any, expected when the following compound is treated with each of the following reagents **(5 marks)**



(i) H<sub>2</sub>, Pd    (ii) PhMgBr then Aq. NH<sub>4</sub>Cl    (iii) H<sub>3</sub>O<sup>+</sup> (pH 1)

(iv)  $\text{Bu}_4\text{NF}$  (v) LDA (strong base)

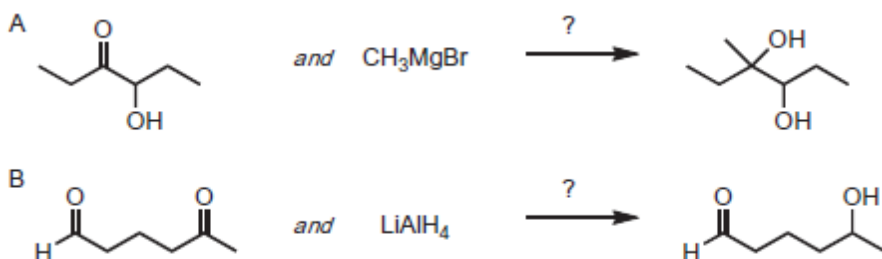
(d) Conduct a retrosynthetic analysis and design a plausible synthesis of the following molecule. Your synthesis must form at least one new C-C bond. (6 Marks)



**QUESTION FOUR [20 MARKS]**

(a) Explain (give examples) how  $\text{LiAlH}_4$  can be made less reactive and selective (4 Marks)

(b) Design a step-wise synthesis (provide any required reagents) of the following compounds. (6 Marks)



(c) Conduct a retrosynthetic analysis and design a plausible total synthesis of geraniol

(10 Marks)

