



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF SCIENCE, MATHEMATICS AND TECHNOLOGY
EDUCATION

MSE - CHE

PST6142 ORGANIC CHEMISTRY

Main Examination Paper

November 2024

This examination paper consists of 5 printed pages

Time Allowed:	3 hours
Total Marks:	100
Special Requirements:	NONE
Examiner's Name:	I. MATIBELA
External Examiner:	DR. S. J. MPOFU

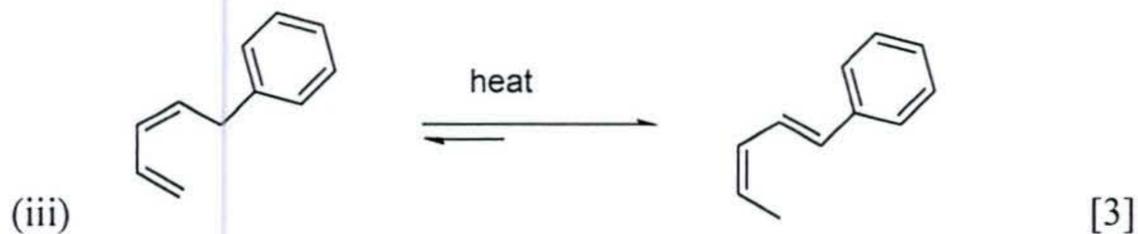
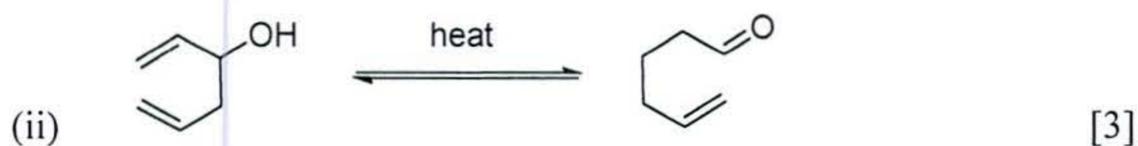
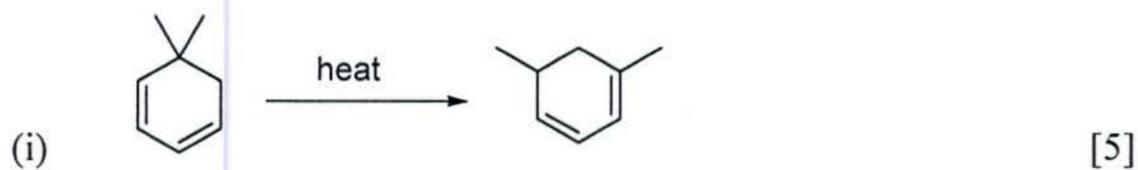
INSTRUCTIONS

1. Answer **any four** questions.
2. Each question carries 25 marks
3. Begin each question on a new page.
4. Use **curved arrows** when writing mechanisms

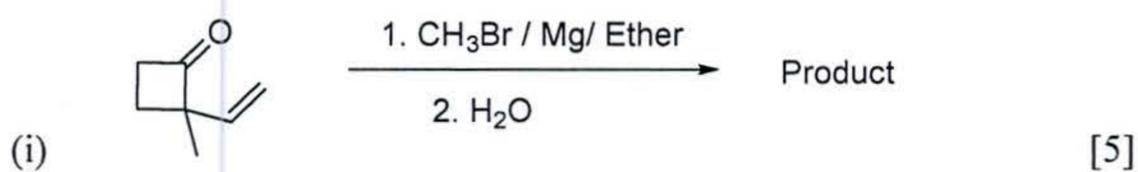
Answer any four questions.

Question 1 [25 marks]

(a) Write the reaction mechanism for the following reactions, where hydrogen or any other group are involved in migration (shift). Name the type of shift, e.g. [1,2 H-shift].

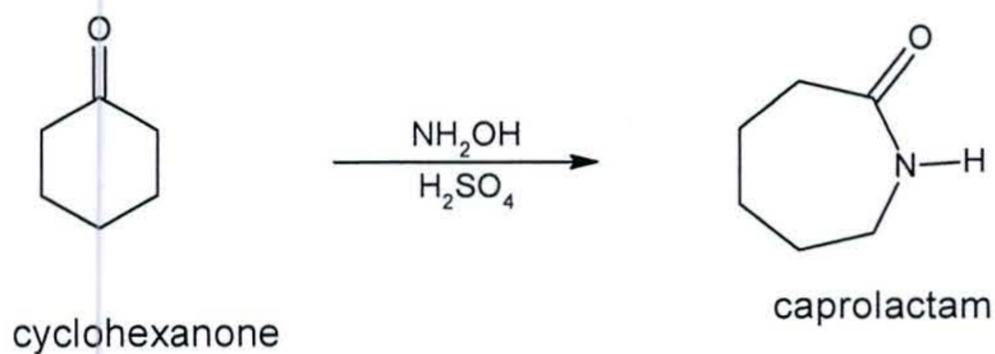


(b) Write the reaction mechanism for the following reactions:



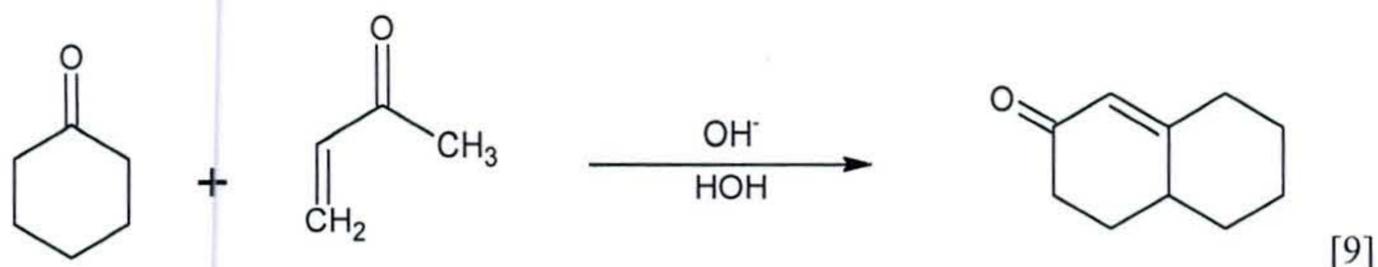
Question 2 [25 marks]

(a) A Beckmann rearrangement occurs when cyclohexanone reacts with hydroxylamine in the presence of an acid to produce caprolactam.



Write reaction mechanism for the caprolactam reaction. [8]

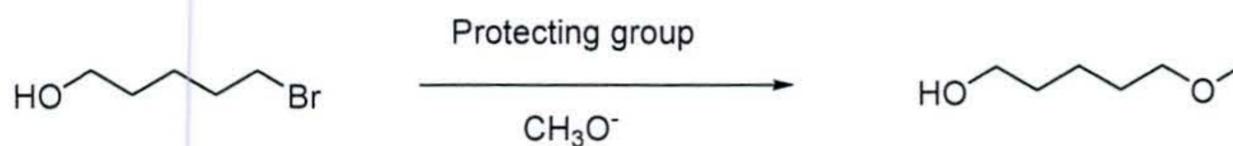
- (b) Write a reaction mechanism for the following Robinson annulation (ring structure). One of the steps will be an Aldol condensation.



- (c) Baeyer-Villiger oxidation occurs when a carbonyl compound in the presence of peroxide produces a carboxylic acid or its derivatives. Write a reaction mechanism for the reaction between cyclohexanone and peroxyacetic acid. [8]

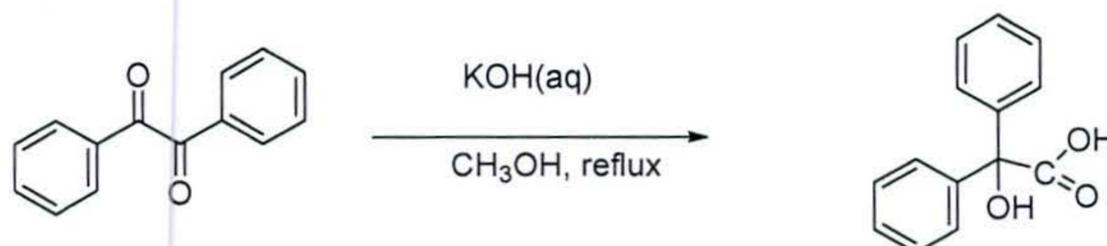
Question 3 [25 marks]

- (a) When p-chloro methylbenzene reacts with hydroxyl ion at high temperature and pressure, it forms m and p products while m-chloro methylbenzene forms o, p and m products.
- Account for the reactions. [6]
 - The unstable intermediate produced in the reaction can react with cyclopentadiene to yield a Diels-Alder product. Write the mechanism. [3]
- (b) Consider the reaction below:



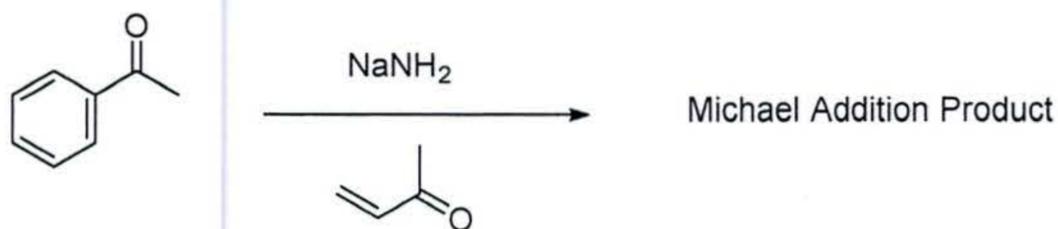
The alcohol group in the substrate is protected and at the end deprotected to form the product.

- Draw the structure of the product if the alcohol was not protected. [2]
 - Write the mechanism for the reaction including the protection of the alcohol group. [6]
 - Give any *three* factors to consider when choosing a protecting group. [3]
- (c) Write the mechanism to show how this reaction occurs. [5]

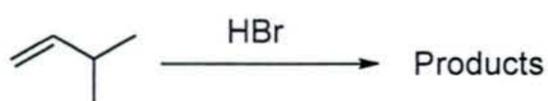


Question 4**[25 marks]**

(a) The following reaction is the Michael reaction.



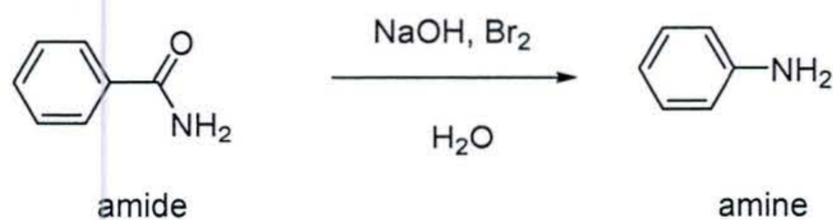
- (i) Write mechanism for it. [6]
- (ii) The Michael Addition product reacts with amine ion to yield a Robinson annulation product. Write the mechanism for the reaction. [5]
- (b) Write reaction mechanism for the reaction between the compounds below. With a good reason, indicate the major product. [8]



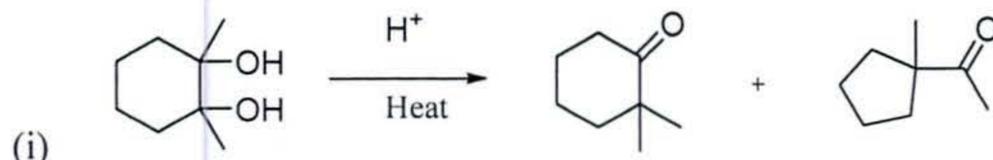
- (c) Give reasons for the instability of three membered ringed organic compounds. [6]

Question 5**[25 marks]**

(a) A Hoffmann rearrangement reaction below shows conversion of an amide to an amine. Write the mechanism for the reaction. [9]



(b) Write the mechanism the following reactions:

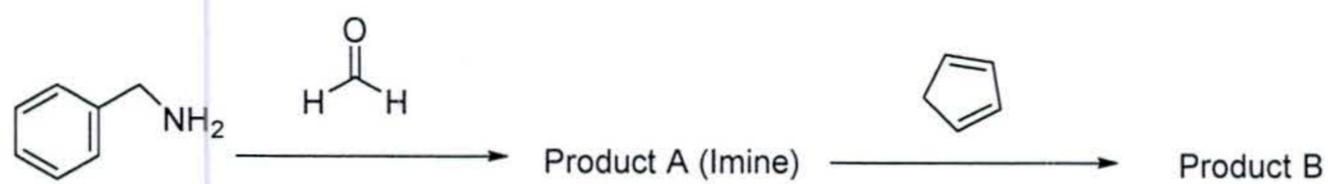


Why is a five membered ringed product formed? [9]



(c) Predict the products. Use curved arrows.

[4]



END OF EXAMINATION PAPER