

**MANICALAND STATE UNIVERSITY OF
APPLIED SCIENCES**

FACULTY OF ENGINEERING

Chemical and Processing Engineering Department

ORGANIC SYNTHESIS

CODE: HCHE 213

SESSIONAL EXAMINATIONS

APRIL-MAY 2021

DURATION: 3 HOURS

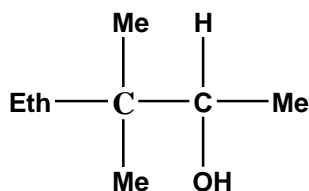
EXAMINER Dr BC NYAMUNDA

INSTRUCTIONS

- 1. Answer any four questions*
 - 2. Each question carries 25 marks*
 - 3. Total marks 100*
-

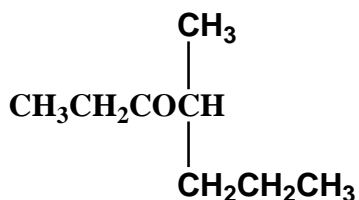
Question 1

- a. Outline the mechanism for the acid catalysed dehydration of the alcohol D clearly showing **methyl** 1,2-rearrangement reaction to form **two** products. [8]



D

- b. Norrish reactions are examples of photochemical reactions. Make use of the following organic structure to show how a **Norrish 1** photochemical reaction produces **five** different products. [5]



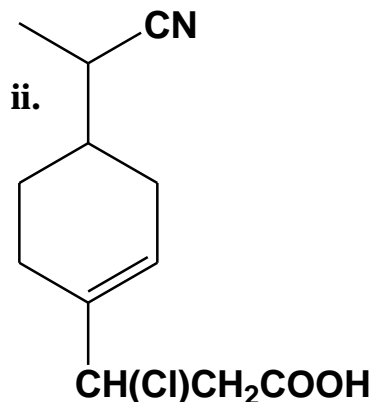
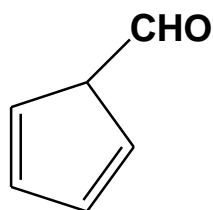
- c. Make use of hydrolysis of 3-bromo 3-methyl hexane to illustrate what is meant by SN1 mechanism (include kinetics and reaction mechanism). [6]
- d. Under what reaction conditions are substitution or elimination reactions promoted in circumstances where organic molecules are capable of undergoing both reaction types? [2]
- e. With aid of organic structures show **four** different groups/classes of organic compounds capable of exhibiting geometric isomerism. [4]

Question 2

- a. i. Draw and name conformers (Newman projections) exhibited by propane [4]
- ii. Plot a graph of energy versus bond rotation of propane from 0° to 180° [5]

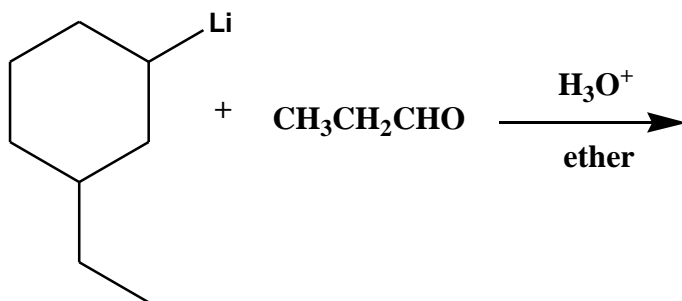
- b. Define the terms *absolute configuration*, *chiral carbon* and *dexta-rotatory* [3]
- c. Assign R and S configurations for 2 chloro butane amine . [2]
- d. Draw organic Z and E structures for but-2-ene. [2]
- e. Encircle all chiral carbon atoms in the following organic structures stating the **type** of hybridization on carbon atoms for each of the organic compounds? [9]

i.



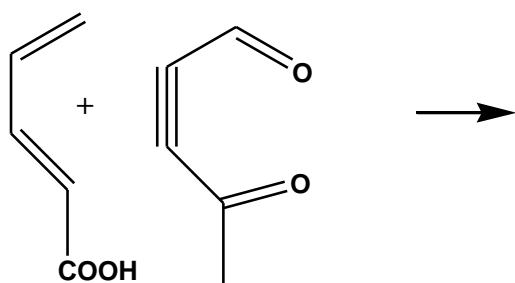
Question 3

- a. Identify the organic product and describe the mechanism of the following organometallic reaction: [5]

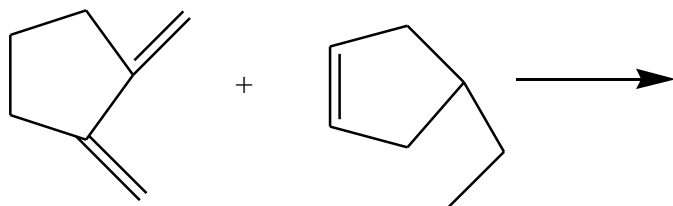


- b. Give the chemical structures of products of the following Diels-Alder reactions showing the **electron** movement in each reaction. [2x3]

i.

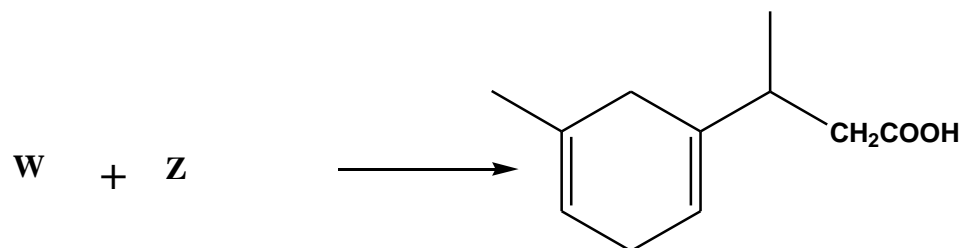


ii.

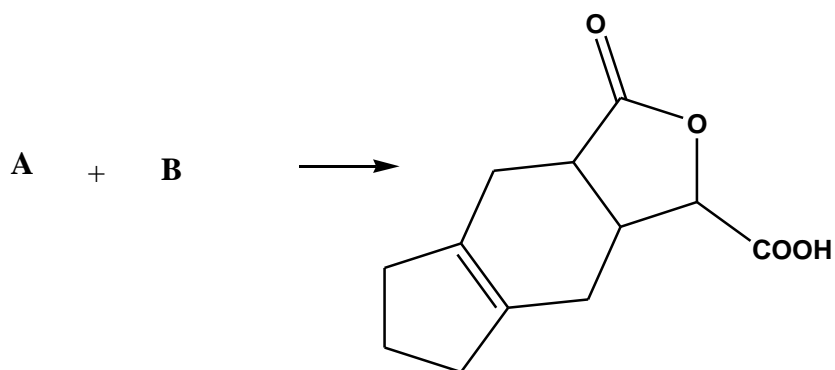


c. Identify the starting materials and complete the following Diels-Alder reactions showing arrows for movement of electrons/bonds: [3x2]

i.

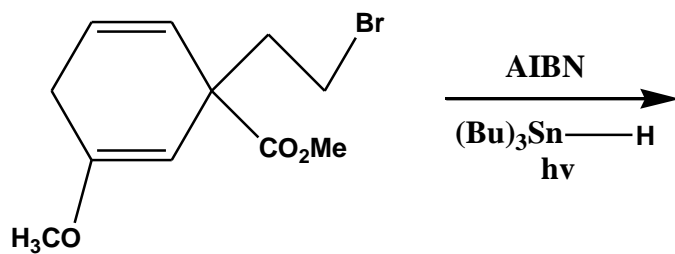


ii.

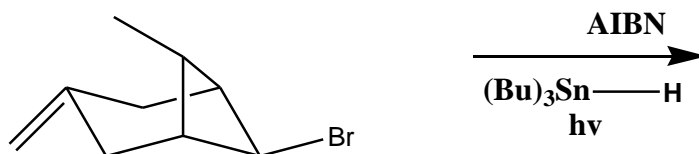


d. Identify structures of organic products of the following free radical reactions [8]

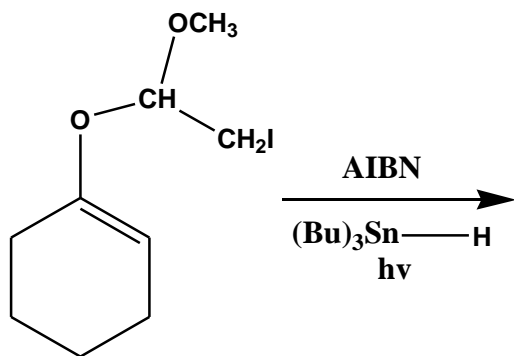
i.



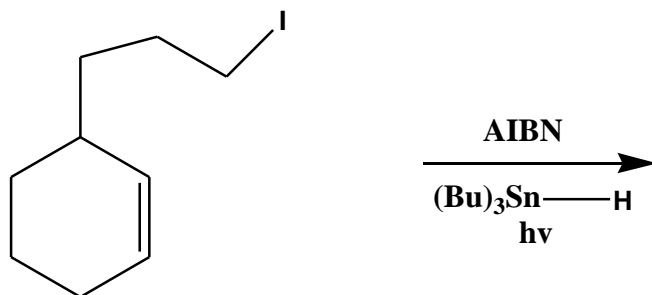
ii.



iii.



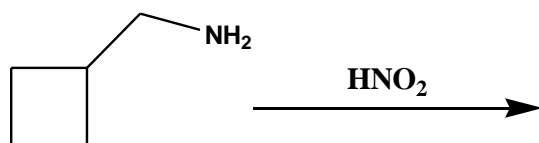
iv.



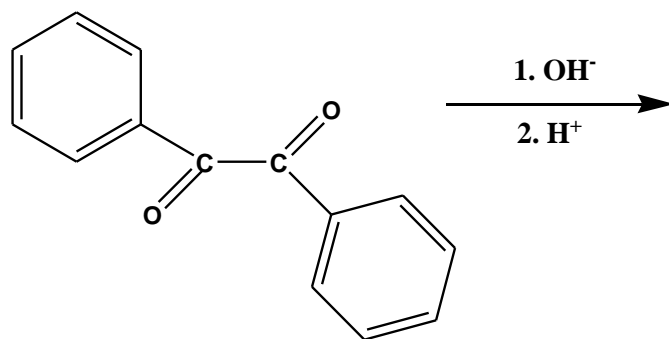
Question 4

Predict the structural products of the following reactions and outline the reaction mechanism of each. [25]

a.

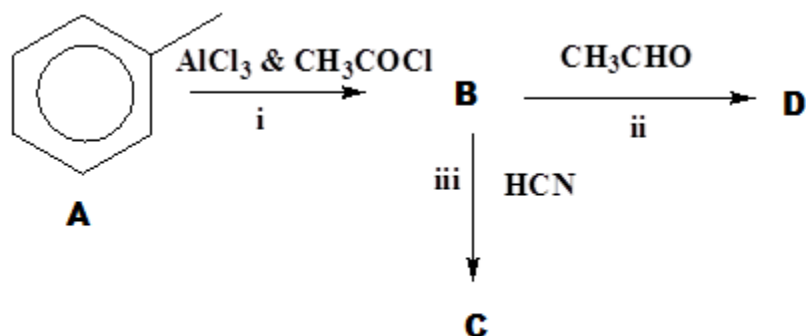


b.



Question 5

Methylbenzene is a starting material for the industrial processes shown in reaction scheme below:



- Draw molecular structures of compounds B, C and D. [3]
- Name the type of reactions (i-iii) [3]
- Outline the reaction mechanism for the formation of compound C from B. [6]
- Outline the reaction mechanism for the reaction of B with propanone. [8]
- Outline the reaction mechanism for the formation of B from A. [3]
- Compound B is formed together with a second isomer. Draw the structure of the isomer. [2]

END OF PAPER