MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

FACULTY OF ENGINEEERING

CHEMICAL AND PROCESSING ENGINEERING DEPARTMENT

ORGANIC CHEMISTRY FOR ENGINEERS/ORGANIC SYNTHESIS

CODE: CHEP 122/HCHE 213

SESSIONAL EXAMINATIONS

JUNE 2023

DURATION: 3 HOURS

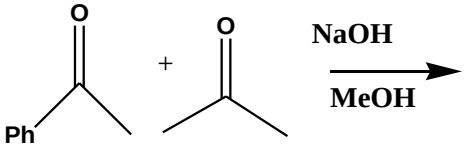
EXAMINER DR BC NYAMUNDA

INSTRUCTIONS

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

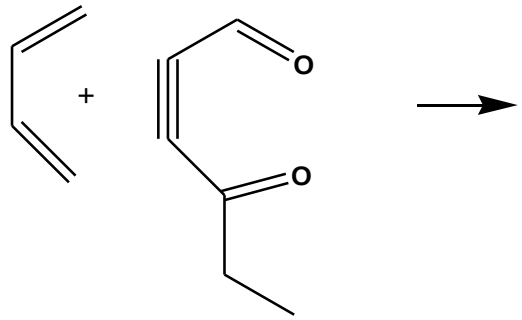
Question 1

a. i. Complete the following reactions showing the Adol and the Adol condensation products: [3]



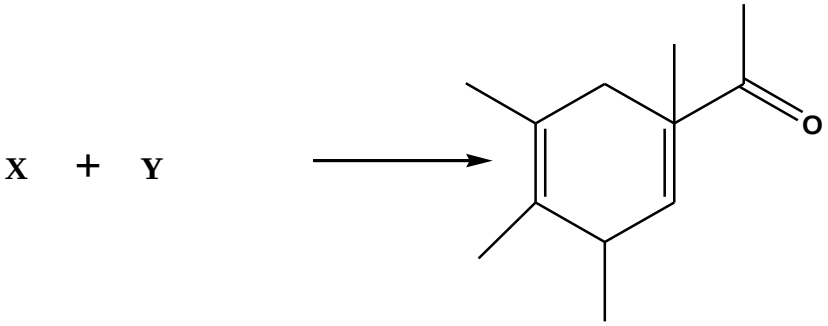
ii. Outline the reaction mechanism for reaction a (i) [3]

b. Give the chemical structures of products of the following Diels-Alder reactions showing the **electron** movement in the reaction: [3]



c. Complete the following reactions showing arrows for movement of electrons/bonds: [3x2]

i.



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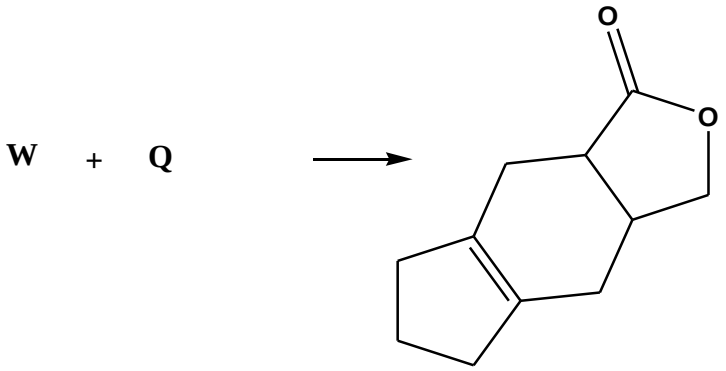
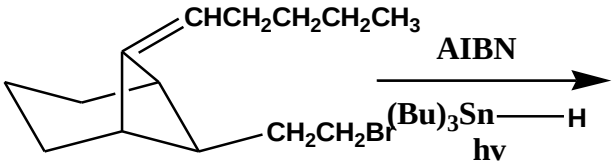


d. Identify structures of organic products of the following free radical reactions [10]

i.



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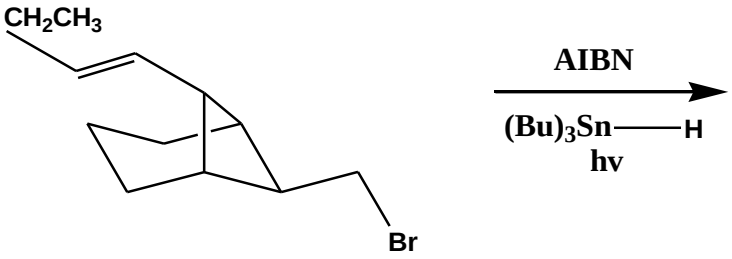

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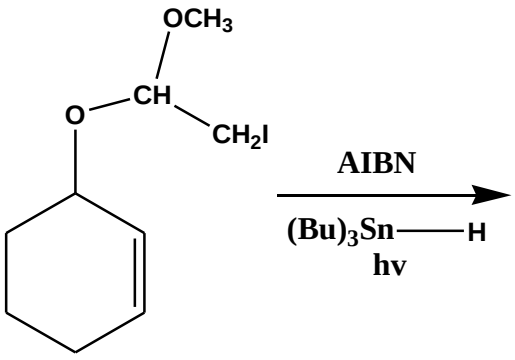
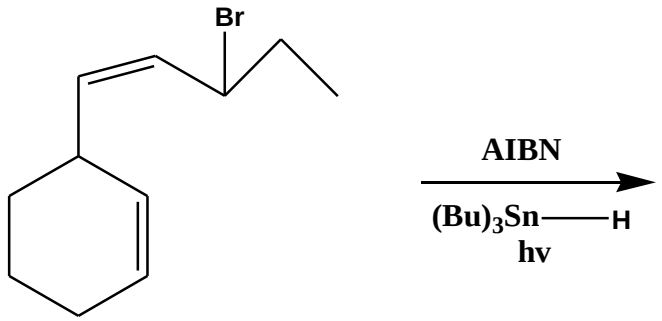


iv.



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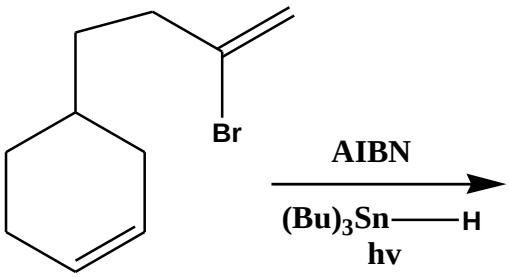


Question 2

Varoon Beverages Company is involved in the synthesis of a wide range organic of alcoholic beverages.

a. What factors should be considered when carrying out such syntheses? [5]

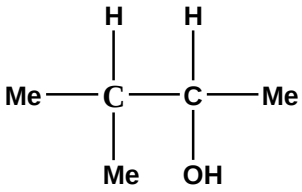
b. Identify the importance of the organic synthesis at Astra and related chemical manufacturing entities. [5]

c. Define the following terms that are used in organic synthesis:
   i. Target molecule
   ii. Retrosynthetic analysis
   iii. Starting material
   iv. Disconnections
   v. Synthetic equivalent [5]

d. Give an outline for the synthesis of aspirin starting from benzene. [10]

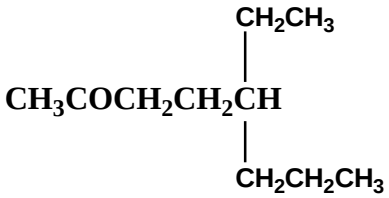
Question 3

a. Outline the mechanism for the acid catalysed dehydration of the alcohol D clearly showing hydride 1,2-rearrangement reaction forming **two** products. [9]



D

b. Norrish reactions are examples of photochemical reactions. Make use of the following organic structure to show how a **Norrish 2** photochemical reaction produces **two** different products. [5]



c. Explain the ***effect*** of the following substituents groups on benzene ring electrophilic substitution and the ***location*** of substitution. [11]

i. –OH
ii. $–NHCOCH_3$
iii. $–NO_2$
iv. $–NH_2$
v. –Br
vi. –COOH

Question 4

a. Explain how Fischer projections are drawn. What rules are applied in Fischer projections? [4]

b. Draw and **name** all conformation organic structures formed of butane upon rotation from *zero* to 180 degrees. [6]

c. Define the terms:

i. Constitutional isomers
ii. Laeva-rotatory
iii. Absolute configuration [3]

d. Assign R and S configurations for 1,2-dibromo-butane. [2]

e. Draw organic Z and E structures for 1-bromo, 2-chloro-but-1-ene. [2]

f. Compare and contrast the physical properties of geometric isomers. [8]

Question 5

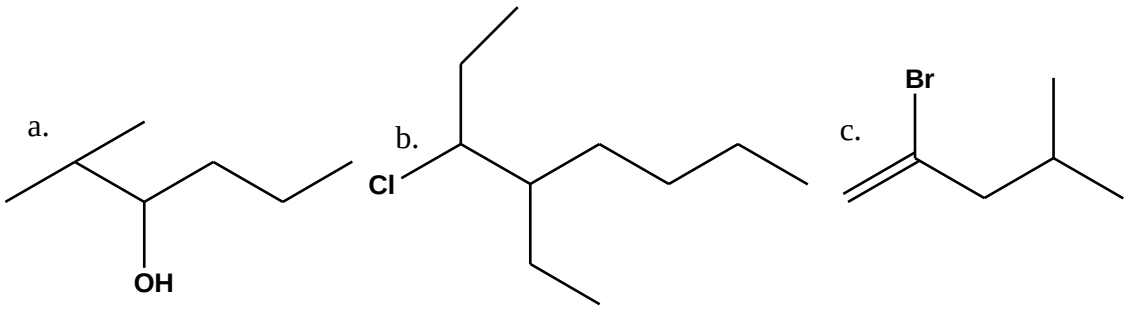
a. Alkyl halides undergo hydrolysis either via SN_1 or SN_2 mechanism.

i. What is meant by SN_1 or SN_2 mechanism? [3]

ii. Make use of 2-chloro-2 methyl butane and 1-chloro pentane to outline SN_1 and SN_2 mechanisms undergone by these alkyl halides when heated with aqueous sodium hydroxide illustrating differences in mechanisms undergone by these organic compounds. [15]

iii. What are the effects of solvents on SN_1 and SN_2 reactions? [4]

b. Name the following organic compounds [3]



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