



FACULTY OF SCIENCE

**DEPARTMENT OF APPLIED CHEMISTRY
NATIONAL DIPLOMA IN CHEMICAL ENGINEERING**

MODULE CET1BO1
 ORGANIC CHEMISTRY

CAMPUS DFC

NOVEMBER EXAMINATION

DATE: 01/11/2014

SESSION: 12:30 – 15:30

ASSESSORS:

**MR E.S. AGORU
DR PN NOMNGONGO**

INTERNAL MODERATOR:

DR PP GOVENDER

DURATION: 3 HOURS

MARKS: 120

NUMBER OF PAGES: 8 PAGES

REQUIREMENTS: 2 ANSWER SCRIPTS

INSTRUCTIONS: ANSWER ALL QUESTIONS.
NO PENCIL IS ALLOWED WHEN ANSWERING QUESTIONS.
ANSWER SECTION A AND SECTION B ON SEPARATE
ANSWER BOOKS.

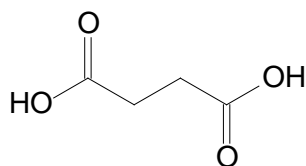
SECTION A (ANSWER IN A SEPARATE ANSWER BOOK)**QUESTION 1**

1.1 Draw structures for the following compounds.

- 1.1.1 Benzyl bromide (2)
1.1.2 (*E*)-7-Isopropyl-2-nonen-5-yne (2)
1.1.3 Butyl mercaptan (2)
1.1.4 2-Chloro-3-phenylpropanal (2)
1.1.5 *p*-Nitrobenzophenone (2)

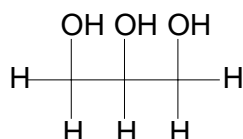
1.2 Give **common** names for the following compounds.

1.2.1



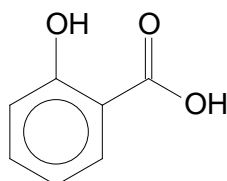
(1)

1.2.2



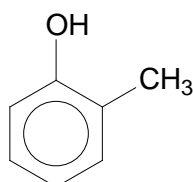
(1)

1.2.3



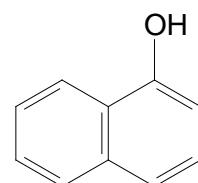
(1)

1.2.4



(1)

1.2.5

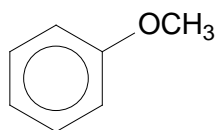


(1)

Question 1 contd.

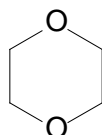
1.3 Give **IUPAC** names for the following compounds.

1.3.1



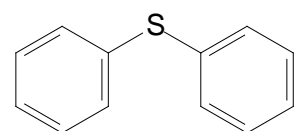
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1.3.2



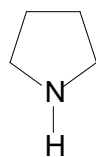
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1.3.3



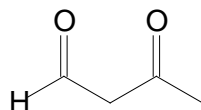
(2)

1.3.4



(2)

1.3.5



(2)

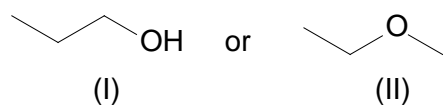
[25]

QUESTION 2

2.1 Draw the Newman projections of 2-butane. Which conformation is the most stable? (3)

2.2 Which compound in each of the following pairs will have the highest boiling point?

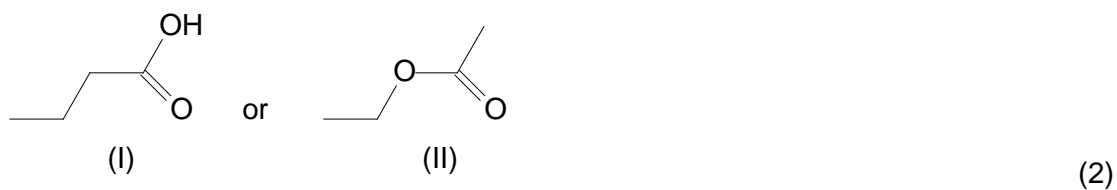
2.2.1



(2)

Question 2 contd

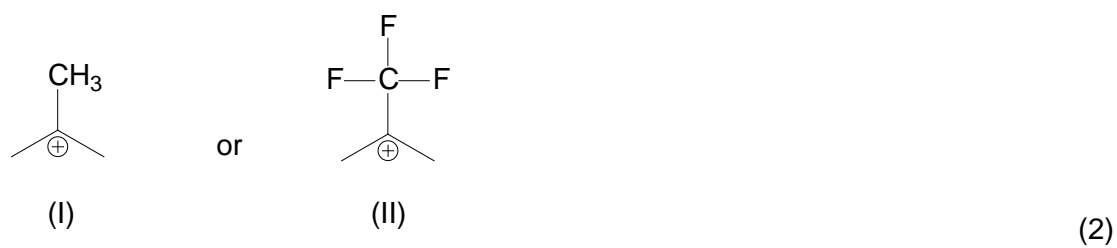
2.2.2

2.3 Which carbocation is the **most stable**?

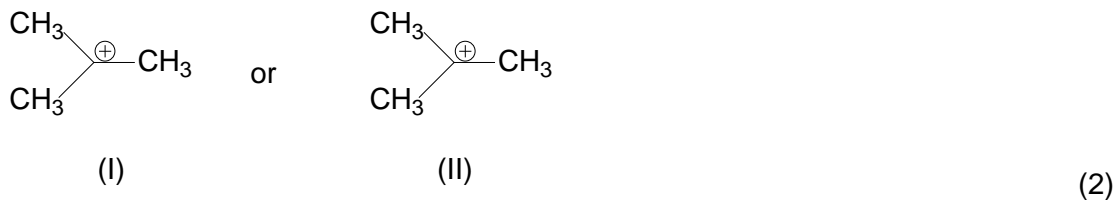
2.3.1



2.3.2

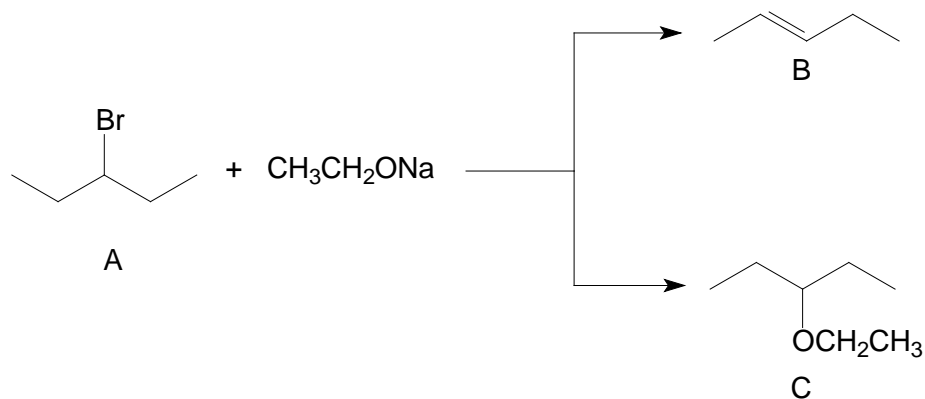


2.3.3

**[13]**

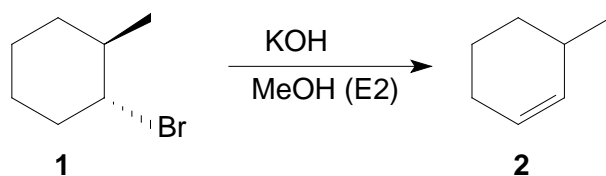
SECTION B (ANSWER IN A SEPARATE ANSWER BOOK)**QUESTION 1**

1.1 Answer the questions that follow based on the chemical equations below.



- 1.1.1 What type (1° , 2° or 3°) of alkyl halide is substrate A? (1)
- 1.1.2 Is $\text{CH}_3\text{CH}_2\text{ONa}$ a strong or weak nucleophile/base? (1)
- 1.1.3 Give the solvent used in this reaction. (1)
- 1.1.4 What mechanistic pathway produces products B and C, respectively? (2)
- 1.1.5 Which of products B and C is the major product? Explain your choice. (3)

1.2 Compound **1** undergoes an E2 reaction to produce compound **2** as shown below:



- 1.2.1 Provide a detailed mechanism for the formation of compound **2**. (4)
- 1.2.2 Write the rate law expression for the conversion of **1** into **2**. (2)
- 1.3 Explain why trans-1-bromo-2-methylcyclohexane yields the Hofmann product, 3-methylcyclohexene, on treatment with any strong base. (4)
- 1.4 Draw a free- energy diagram for hypothetical $\text{S}_{\text{N}}1$ reactions. Use the reaction of tert-Butyl chloride with water to label all the steps. (7)

[25]

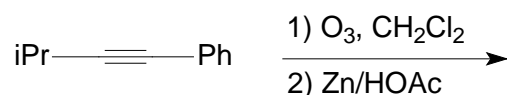
QUESTION 2

- 2.1 From each of the pairs given below predict which compound is the most stable. Explain your choice.
- 2.1.1 2-Methyl-2-pentene or 2,3-Dimethyl-2-butene (2)
- 2.1.2 *trans*-2-Hexene or 2-Methyl-2-pentene (2)
- 2.2. Each of the following alkyl halides is subjected to dehydrohalogenation with potassium ethoxide in ethanol. List the alkenes that form and use Zaitsev's rule to predict the major product of each reaction.
- 2.2.1 2-Bromo-3-methylbutane (4)
- 2.2.2 2-Bromo-2,3-dimethylbutane (4)
- 2.3 Outline all the steps in the synthesis of propyne from each of the following substrate structures.
- 2.3.1 $\text{CH}_3\text{CH}_2\text{CHBr}_2$ (2)
- 2.3.2 CH_3COCH_3 (4)
- 2.3.3 $\text{CH}_3\text{CH}=\text{CH}_2$ (3)
- 2.4 Acid-catalyzed dehydration of 2-methyl-1-butanol yields 2-methyl-2-butene as a major product. Provide a full mechanism showing all steps involved in the formation of the product. (6)

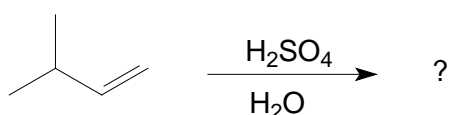
[27]**QUESTION 3**

- 3.1 Predict the major organic product(s) for each of the following reactions. (10)

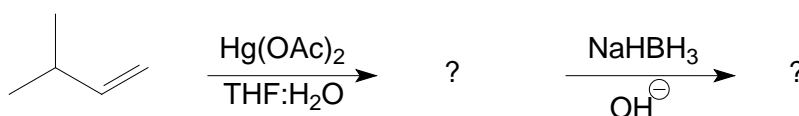
3.1.1



3.1.2



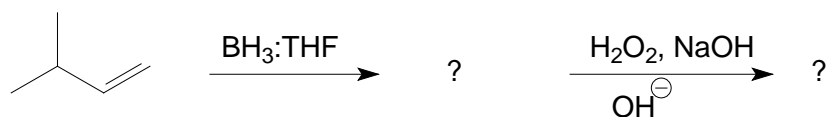
3.1.3



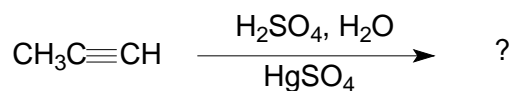
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Question 3 contd.

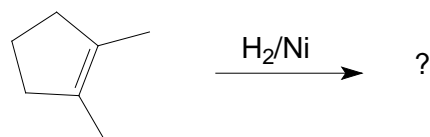
3.1.4



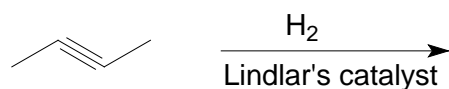
3.1.5



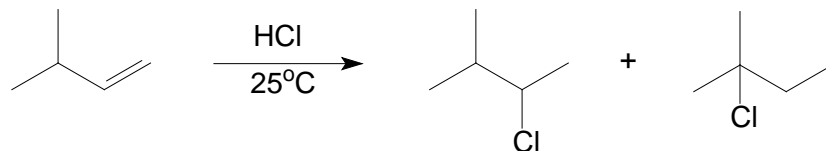
3.1.6



3.1.7



3.2 Give the mechanisms for the formation of both products in the following reaction.



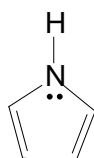
(7)

[17]

QUESTION 4

4.1 Use the criteria for aromaticity to determine whether the following molecules are aromatic or not.

4.1.1



(1)

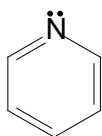
4.1.2



(1)

Question 4 contd.

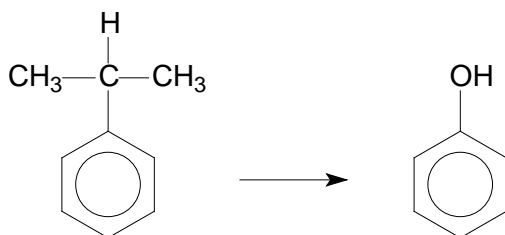
4.1.3



(1)

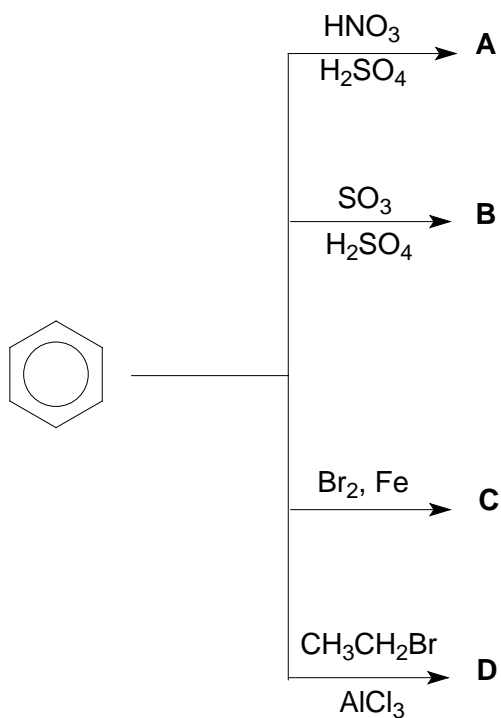
4.2 Outline **ALL** steps for the synthesis of the following organic compound.

(4)



4.3 Draw the structures of the expected organic products (A-D) formed under the following reaction conditions and provide the names of the reactions.

(8)



[15]