NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCES
DEPARTMENT OF APPLIED CHEMISTRY

ORGANIC CHEMISTRY- SCH1116

FOR SBB, SBT, EFW and TXT

Supplementary Examination Paper August 2024

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: None

Internal Examiner: S. Mlilo

External Examiner:

INSTRUCTIONS & INFORMATION

1. Answer **all** questions in Section A and **any three** from Section B. Section A carries 40 marks and each question in Section B carries 20 marks.
2. Start a new question on a new page. (Not each part of a question).
3. Show mechanisms or synthesis by means of push and pull arrows.

MARK ALLOCATION

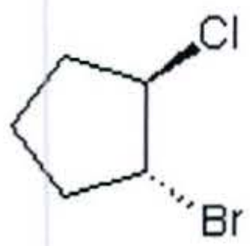
QUESTION	MARKS
1.	40
2.	20
3.	20
4.	20
5.	20
TOTAL POSSIBLE MARKS	**100**

Section A

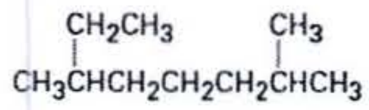
QUESTION 1

a. Define the following terms:
   i. Homolysis [2 marks]
   ii. Carbocation [2 marks]
   iii. Nucleophile [2 marks]
   iv. Alkyne [2 marks]
   v. Achiral [2 marks]

b. Give IUPAC names for the following compounds:

i. 

[2 marks]

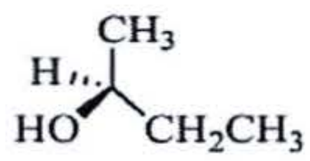
ii. 

[2 marks]

c. Draw the structural formula for the following compounds
   i. 3-Methylbutanal [2 marks]
   ii. (E)-3,5-Dimethyl-2-hexene [2 marks]

d. Calculate the specific rotation of an optically active compound in a solution containing 0.75g/10ml, when measured in a 10 cm tube of a polarimeter at 25°C shows a rotation +1.2°. [4 marks]

e. Give the IUPAC name and assign the R or S configuration for the following compound:

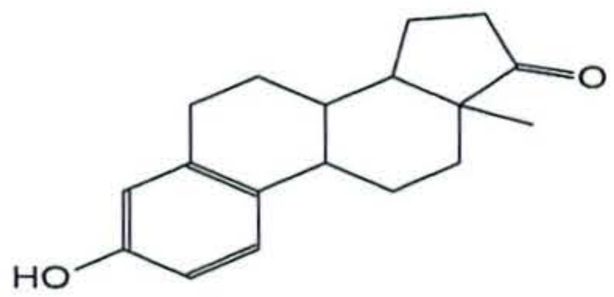


[4 marks]

f. Draw the highest, and lowest in energy and two different gauche rotamers in Newman projection for 1,2-dibromoethane. [6 marks]

g. Give a mechanism for the formation of dichloromethane by free-radical chlorination of chloromethane. [6 marks]

h. Identify chiral centres on the following compound and mark them with an asterisk (*)



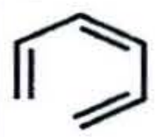
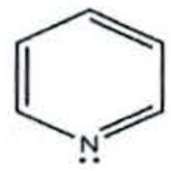
[3 marks]

Section B

QUESTION 2

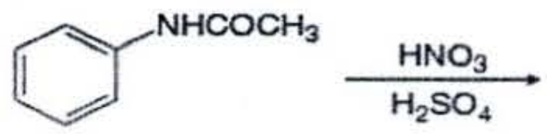
a. State Huckel's rule. [2 marks]

b. State whether the following compounds are aromatic or anti-aromatic giving reasons for your answer

i.  ii.  iii. 

[9 marks]

c. Benzene is a compound of unusual stability. Monosubstituted benzene can undergo electrophilic substitution depending on the nature of the substituent the reaction can be faster or slower than that of benzene.



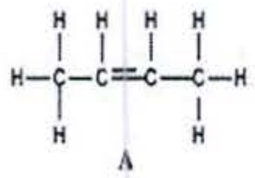
i. Draw the product of the following reaction above. [3 marks]

ii. State whether the reaction above is faster or slower than a reaction with benzene. [3 marks]

d. Although the benzene ring is stable and unreactive under room conditions, it is possible to carry out substitution reactions for benzene. Write down equations for the nitration of benzene showing the conditions and any reagent(s) used. [3 marks]

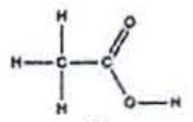
QUESTION 3

a. The structures of six organic compounds are shown below:

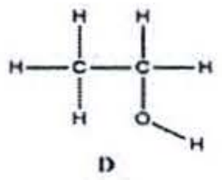


A

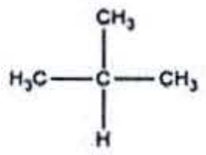
B



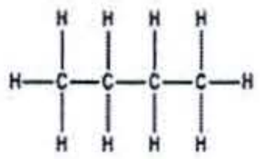
C



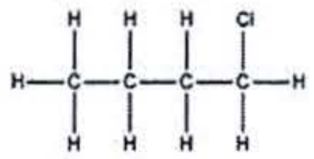
D



E



F

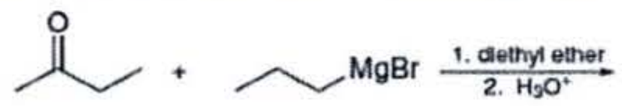


G

i. Name compound C. [2 marks]
ii. Which two compounds are isomers of each other? Explain [3marks]
iii. Explain how D can be synthesised from a Grignard reagent. Giving an equation for the reaction. [4 marks]
iv. Outline the mechanism for the formation of compound G from compound F stating the type of reaction and the reactants required [8 marks]
v. F has a lower boiling point than G. Explain [3 marks]

QUESTION 4

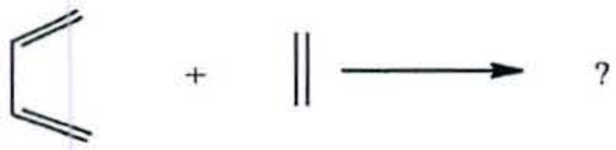
a. State Markovnikov's rule [2 marks]
b. A reaction mechanism is a process or a pathway by which a reaction occurs. Explain the following using suitable examples:
   i. Stepwise [2 marks]
   ii. Concerted [2 marks]
c. Outline the mechanism for the reaction of 2-methylbut-2-ene and HBr. Stating the major product for the reaction. [8 marks]
d. Predict the products for the following reactions:

i. 

[2 marks]

ii. 

[2 marks]

iii. 

[2 marks]

QUESTION 5

a. Describe the following hybridization of carbon:
   i. sp [3 marks]
   ii. sp^2 [3 marks]
   iii. sp^3 [3 marks]

b. Compare and contrast the following reactions:
   i. SN1 and SN2 [6 marks]
   ii. E1 and E2 [5 marks]

End of Question Paper.