NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

ORGANIC CHEMISTRY – SCH 1116 (FOR SBB, ESH, EFW AND TXT STUDENTS: PARALLEL AND CONVENTIONAL)

First Semester Examination Paper

December 2017

This examination paper consists of 5 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: NONE

Examiner's Name: DR D NYONI

INSTRUCTIONS TO CANDIDATES

1. ANSWER **ALL** QUESTIONS FROM SECTION A AND **ANY THREE** FROM SECTION B. SECTION A CARRIES 40 MARKS AND EACH QUESTION IN SECTION B CARRIES 20 MARKS.
2. START NEW QUESTION ON A NEW PAGE. (NOT EACH PART OF A QUESTION.)
3. SHOW MECHANISM, CHEMICAL STEPS OR SYNTHESIS BY MEANS OF CURLY ARROWS.

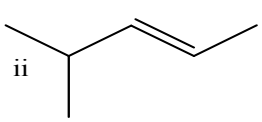
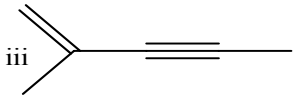
MARK ALLOCATION

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

SECTION A

QUESTION ONE

1. (a) Give IUPAC names for the following compounds. [3 marks]

i. $CH_3CH=CHCH_2CH=CH_2$ ii  iii 

(b) The following names are incorrect. Draw the structure and provide proper IUPAC names. [4 marks]

(i) 4-heptyne
(ii) 4,4,3-trimethylpentane

(c) Draw and name geometric isomers for the molecules of the following compounds:

i. 1,2-dimethylcyclobutane ii. 2-pentene [4 marks]

d) State whether each of the molecules below is an Electrophile OR Nucleophile. [5 marks]

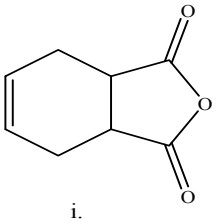
i) $H_2C=O$ ii) CH_3Li iii) $LiAlH_4$ iv) CH_3CH_2Cl v) RMgBr

e) i) Explain what is meant by the term electronegativity. [1 mark]

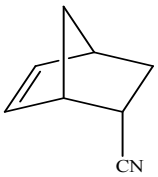
ii) Use δ^+/δ^- symbolism to label all electron-rich and electron-poor sites in the following molecules: [3 marks]

i) CH_3OH ii) $H_2C=CH_2$ iii) $CH_3CO_2CH_3$

f) Give the reactants required to synthesise the following compounds using the Diels-Alder reaction? [4 marks]



i.



ii.

g) Describe the mechanism of free-radical substitution using the reaction between methane and chlorine as an example. [5 marks]

h) Give equations (not mechanisms) to represent the reactions between a symmetrical alkene (ethene), $CH_2=CH_2$, and i) HBr ii) H_2O. [5 marks]

i) Hybridisation is used to describe the geometrical arrangement of bonds in a given atom. Identify the state of hybridisation of each of the carbon atoms in the following molecules, indicating the geometry/shape. [6 marks]

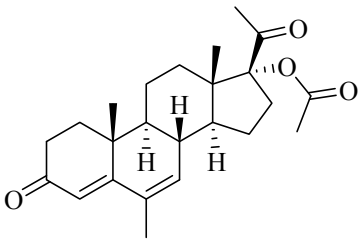
i) CH_3CHO ii) $HC\equiv N$ iii) $H_2C=CH_2$

SECTION B

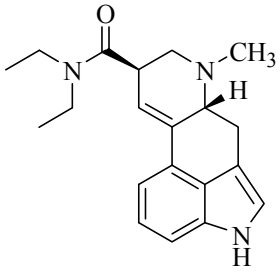
QUESTION TWO

a) Define the term "functional group" with regards to Organic chemistry, and identify the functional groups present in Megastrol and Lysergic acid diethylamide shown below.

[5 marks]



Megestrol acetate: an oral contraceptive



Lysergic acid diethylamide (LSD): a hallucinogen

b) Explain why carbonyl groups undergo reactions with both electrophiles and nucleophiles, whereas alkenes react only with electrophiles. [5 marks]

c) Indicate, with the use of curly arrows, how the following two reactions of the carbonyl group are depicted: [10 marks]

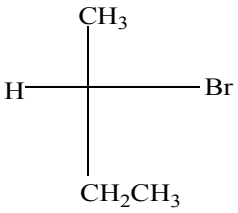
i) H^+ followed by CN^-

ii) H^- followed by H^+

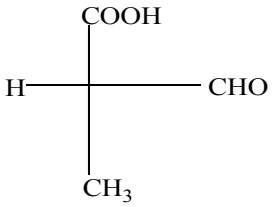
QUESTION 3

a) Draw the Newman projections of 1-chloropropane along the C1–C2 bond. Indicate with reasons the most stable and least stable conformations. [6 marks]

b) Assign *R* and *S* configurations to each of the following: Indicate priority on the Structure. [4 marks]



i



ii

c) Organometallic compounds react readily with carbonyl groups. Write mechanisms to represent the reactions between cyclohexanone and: [10 marks]

i) Methyllithium ii) propylmagnesium bromide

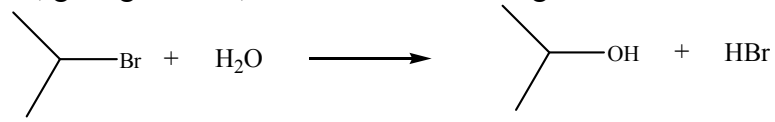
QUESTION 4

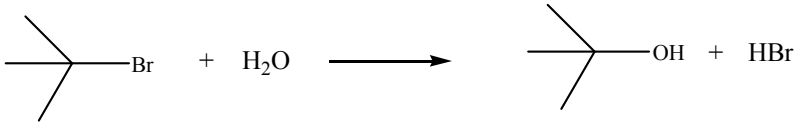
a) What do the following terms mean in relation to reaction mechanisms? Explain using suitable examples.

i) Stepwise [4 marks]

ii) Concerted [4 marks]

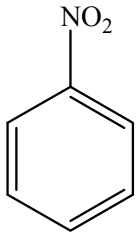
b) Predict, giving reasons, which of the following reactions occurs faster. [4 marks]

i. 

ii. 

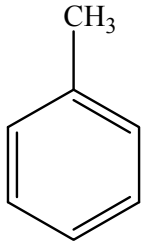
c) Why does benzene undergo electrophilic substitution reactions and not addition reactions? [2 marks]

d) Give the products of the following reactions, justifying the positions of the substituents.

i. 

+ Br_2 $\xrightarrow{FeBr_3}$

[3 marks]

ii. 

+ Cl_2 $\xrightarrow{FeCl_3}$

[3 marks]

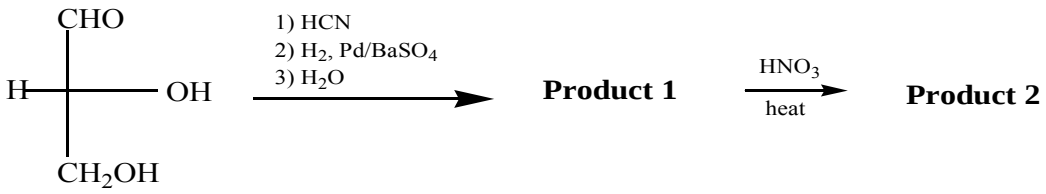
QUESTION 5

a) Give the structures of two possible products formed when HBr reacts with an unsymmetrical alkene ($Me_2C{=}CH_2$). [4 marks]

b) In practice, in the reaction in 5a) only one product is formed. Which product is formed, and why? [6 marks]

c) Benedict's solution is used to test for reducing sugars. Describe how the test works. [5 marks]

d) Glyceraldehyde is the simplest known monosaccharide. Show the products of the following reactions using the Killiani-Fischer synthesis: [5 marks]



D-(+)-glyceraldehyde

THE END!!!