



MACHAKOS UNIVERSITY

University Examinations 2022/2023 Academic year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

FIRST YEAR SECOND SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE (FOODS, NUTRITION AND DIETETICS)
BACHELOR OF EDUCATION SCIENCE (SPECIAL NEEDS)
BACHELOR OF SCIENCE (MATHEMATICS)
BACHELOR OF EDUCATION (SCIENCE)
SCH 102/HFN 146: ORGANIC CHEMISTRY I

DATE: 12/4/2023

TIME: 2:00 – 4:00 PM

INSTRUCTIONS

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS

SECTION A: COMPULSARY

QUESTION ONE (30 MARKS)

- a) Define the following terms as used in organic chemistry
- i. Functional group; (2 marks)
 - ii. Hydrocarbons; (1 mark)
 - iii. Isomers (1 mark)
- b) Explain the uniqueness of carbon responsible for formation of the majority of compounds found in nature (2 marks)
- c) Explain the difference between hydrolysis and condensation reactions (2 marks)
- d) State four rules that guide placing a central atom when developing the lewis formula of a compound (4 marks)
- e) Name types of bond in C=C (double bond) (2 marks)
- f) Work-out step by step the Lewis structure for methanol a compound with molecular formula CH₄OH. (4 marks)

g) Draw the structures for the primary product in each of the following reactions;



h) Provide the number of bonds and lone pairs in the following atoms Carbon, Nitrogen and Oxygen (4 marks)

Element	Number of bonds	Number of lone Pair electrons
C		
N		1
O	2	

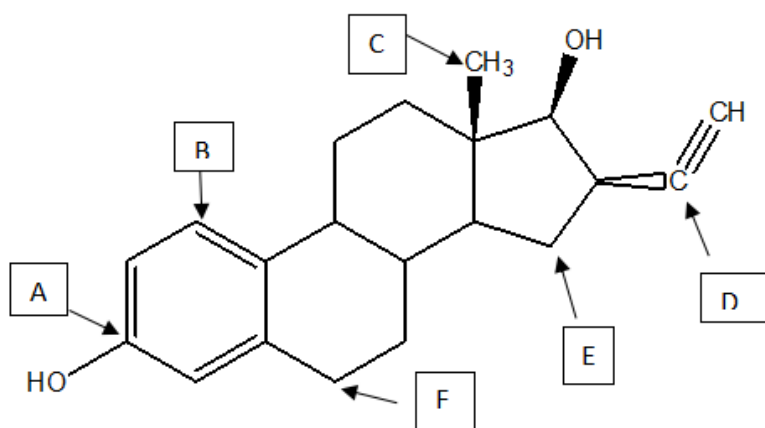
i) Determine the nucleophiles and electrophiles from the list provided below; (4 marks)



SECTION B: ATTEMPT ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

Study the structure below and answer the following questions;

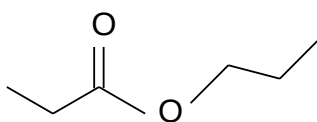


- i. Identify the type of hybridization in the six labelled carbons (**A-F**) in the structure above (6 marks)
- ii. Illustrate step by step the hybridization in the carbon labelled **C** and provide an explanation. (7 marks)
- iii. Illustrate step by step the hybridization in the carbon labelled **D** and provide an explanation. (7 marks)

QUESTION THREE (20 MARKS)

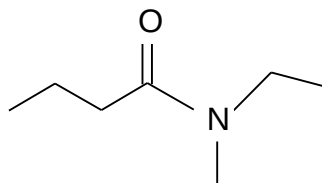
- a) Analysis of a sample of an organic compound gave 52.14% C, 13.13% H and 34.73% O by mass. (C=12, H=1, O=16. RFM = 46).
 - i. Work out the empirical formula and molecular formula of the organic compound. (8 marks)
 - ii. Draw two possible isomeric structures for the compound above. (2 marks)
- b) Identify the functional group and give the IUPAC name of the following molecules;

i.



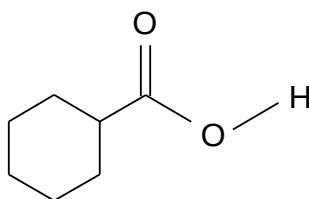
(2 marks)

ii.



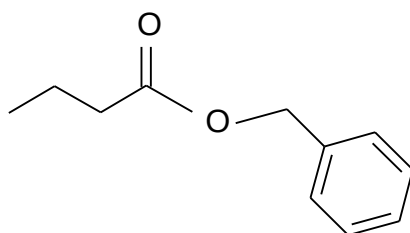
(2 marks)

iii.



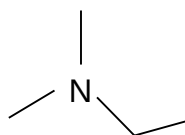
(2 marks)

iv.



(2 marks)

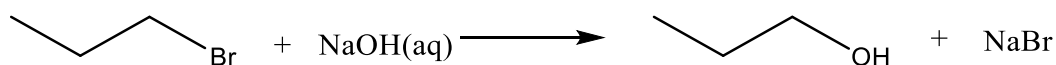
v.



(2 marks)

QUESTION FOUR (20 MARKS)

- a) Explain the following terms used in organic chemistry
- i) Dehydrohalogenation (2 marks)
 - ii) Esterification (2 marks)
- b) i) Describe the fermentation of cane sugar in preparation of alcohol. (5 marks)
- ii) Explain the solubility of ethanol in water (2 marks)
- c) i) Explain the term nucleophile (2 marks)
- ii) Provide a detailed mechanistic explanation using curly arrows for the observed product in the following reaction. (3 marks)



- iii) Explain the type of substitution reaction in b (ii) above. (2 marks)
- d) Draw two geometrical isomers from the compound $C_2H_2Cl_2$ commonly used to make cling films. (2 marks)

QUESTION FIVE (20 MARKS)

- a) List five laboratory tests for alcoholic group in an organic compound (5 marks)
- b) State the observation made for a positive result in each of the test given in 5 a above (5 marks)
- c) Describe two laboratory tests to determine unsaturation in organic molecules (10 marks)