DAG 059

University of choice

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)
SCHOOL OF AGRICULTURE, VETERINARY SCIENCES AND TECHNOLOGY (SAVET)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2023/2024 ACADEMIC YEAR

MAIN EXAMS OF DIPLOMA IN GENERAL AGRICULTURE

COURSE CODE: DAG 059

COURSE TITLE: BASIC ORGANIC CHEMISTRY

DATE: 25.04.2024 **TIME: 8-10AM**

INSTRUCTIONS TO CANDIDATES

This paper is divided into two sections, **A and B**. Answer ALL Questions in SECTION A and any Two in SECTION B

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over

SECTION A: ANSWER ALL QUESTIONS (30 MARKS)

Q1a. Define organic Chemistry **(1mks)**

Organic Chemistry is a branch of Chemistry which deals with the study of organic compounds.

b).What are the two properties that makes carbon so unique?

i. *Catenation*

As a group 4A element (at the Centre of the periodic table), carbon can share four valence electrons and form four strong covalent bonds with other elements to form straight chains, branched chains and cyclic chains.

ii. *Tetravalency of Carbon atom*

Carbon can neither lose nor gain electrons to gain octet, it forms covalent bonds by sharing its four electrons with other atoms and by this virtue of which it forms four covalent bonds is called tetravalency of carbon. **(4mks)**

c). State two applications of carbon compounds and give an example

i. *Every living organism is made of organic chemicals such as hormones, carbohydrates, proteins vitamins. For example, proteins make up your hair, skin, and muscles; the DNA that controls your genetic heritage comprises organic chemicals.*

ii. *Synthesis of compounds not found in nature. This prevents the shortage of naturally occurring products. Chemists have learned to synthesize products not found in nature such as synthetic fabrics, plastics, medicines.Examples CH_4 (Methane as a natural gas) / medicine / plastics.*

(6mks)

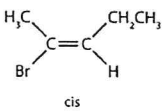
d). Draw and name structural formula for the following hydrocarbons

i	Ethanal	CH_3CHO
ii	Ethanoic acid	CH_3COOH
iii	Acetylene	$H–C\equiv C–H$
iv	2-proponone	$(CH_3)_2CO$
v	Propanamide	$CH_3CH_2C=O(NH_2)$

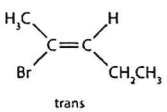
(5mks)

e). Draw the structures of the cis-trans isomers for each compound. Label them cis and trans. If no cis-trans isomers exist, write none.

i. . 2-bromo-2-pentene

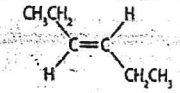


cis

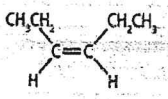


trans

ii. 3-heptene



cis

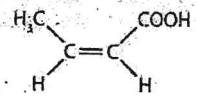


trans

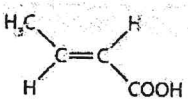
iii. 4-methyl-2-pentene NONE

iv. 1,1-dibromo-1-butene NONE

v. 2-butenoic acid (CH3CH=CHCOOH)



cis



trans

(10mks)

f) Complete the following equation

i $CH_3CH_2OH \xrightarrow{[O]} CH_3CHO \xrightarrow{[O]} CH_3COOH$

ii $(CH_3)_2C=CH_2 + Br_2 \rightarrow (CH_3)_2CBrCH_2Br$

iii $CH_3COOH + LiAlH_4 \longrightarrow CH_3CH_2OH$

iv $CH_3COOC_2H_5 \xrightarrow[\Delta\ KOH]{} CH_3COOH + C_2H_5OH$

(4mks)

SECTION B

Answer any three (2) Questions

Q2a.i) Briefly describe the physical properties of alkenes.

Alkenes have physical properties (low boiling points, insoluble in water)

How are these properties compared to those of the alkanes? *Similar to those of their corresponding alkanes*

ii) Arrange the following alkenes in order of increasing boiling point:

a. 

Ethene < propene < 1-butene < 1-hexene

iii) Briefly describe the bonding in benzene

The six electrons are shared equally by all six carbon atoms

(4mks)

b) Define (i) hybridization.

Is a concept of mixing two atomic orbitals to give a new degenerate hybrid orbital which have same energy levels.

ii) Anti-bonding

Is a molecular orbital containing an electron outside the region between the two nuclei.

iii)σ- bond

Are types of covalent bonds that differ in the overlapping of atomic orbitals.

iv)Π bonds *are Chemical Bonds that are Covalent in Nature and Involve the Lateral Overlapping of Two Lobes of the Same Orbital Between Two Different Atoms bond*

(4mks)

c). Draw lewis structure of the following molecules

A. CH_2CO2H B.$C2H_4$ C.$HNO3$ D.CF_4 (4mks)

d) For molecules A and B in © above give hybridization of all carbon and oxygen atom (3mks)

Q3a i) What is the principal difference in properties between alkenes and alkanes?

Alkenes undergo addition reactions; alkanes do not.

How are they alike? *Both burn* (1mks)

ii, If C12H24 reacts with HBr in an addition reaction, what is the molecular formula of the product?

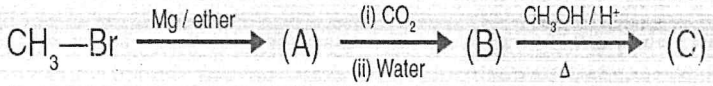
$C_{12}H_{24}Br_2$, (1mks)

ii. Why is there a significant difference in the boiling points of butanal and butanol?

Butanol has a higher boiling point than butanal because butanol has a polar O-H bond,. due to which it forms intermolecular hydrogen bonding, which is absent in butanal. Thus leading to a higher boiling point of Butanol (2mks)

ii) Identify the compounds A, B and C in the following reactions

X

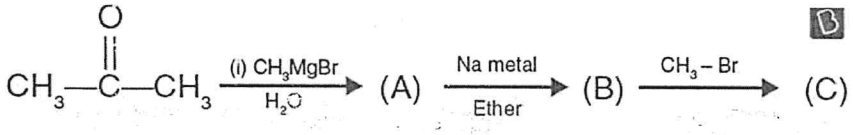


A= CH3MgBr

B= CH3COOMgBr

C= CH4 **(3mks)**

Y



A = 2-methyl propane-2-ol

B = Sodium tert-butoxide

C = 2-methyl-2-methoxypropane **(3mks)**

Q4.a) Classify each of the following organic compounds according to their functional groups

i. CH_3COOH ii. CH_3OH iii.CH3CHO iv. CH_3CH_2-SH v. $CH_3CH_2C{=}O\ (NH_2)$ **(5mks)**

i. carboxylic acid ii.Alcohol iii. Aldehyde iv. Thiol, v. Amide

b) State three important uses of benzene

i *Benzene is a common solvent in many industrial, commercial, and research applications. Manufacturers use benzene-containing products as solvents at various stages of production, and it is used in the production of chemical and plastic products.*

ii *Many people and manufacturers use benzene as a fuel because of its high octane number and natural availability. It has been used as a gasoline additive to help fuel burn more efficiently.*

iii. *Most products used in the printing industry contain benzene. There are products that contain this chemical and are specifically used for cleaning printing equipment, making it last longer and function better.*

(6mks)

C). Complete the following reactions

i. $CH_3CH_2CH_2CH_2OH \xrightarrow[(ii.)dil.H_2SO_4]{(i.)KMnO_4/KOH,\Delta} CH_3CH_2CH_2COOH$

ii $C_2H_6 + Br_2 \xrightarrow{\Delta} C_2H_5Br + HBr$

iii,) $CH_2{=}CH\text{-}COOH \xrightarrow{LiAlH4} CH2{=}CHCH2OH$

iv)

$CH_3{-}CH{=}CH{-}CHO \xrightarrow[\text{Tollen's reagent}]{[Ag(NH_3)_2]^+ OH^-} CH_3CH{=}CHOOH$

But - 2 - enai — But - 2 - enoic acid

(4mks)