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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020 /2021 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHE 104**

COURSE TITLE: **BASIC ORGANIC CHEMISTRY I**

DATE: 29TH JULY 2021 **TIME: 9 – 12 PM**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

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CHE 104e

REGULAR – MAIN EXAM

CHE 104e: BASIC ORGANIC CHEMISTRY 1

STREAM: BED(Sci) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. Answer all questions

Question One

a) Define the following terms as used in organic chemistry. (6 Marks)

i. Hybridization

ii. functional group

iii. homologous series

b) Write the structural formula for each of the following compounds. (6 Marks)

i. 4-ethyl – 2,3 – dimethylhexane

ii. 5,4 – dibromo – 1 – chloro – 2 – pentyne

iii. Trans – 1,2 – dimethylcyclopropane

iv. Cis – 1,2 – dimethylcyclopropane.

v. 2,3,4 – trimethyl – 2 –penten – 1 – ol

vi. Butyl dimethyl amine

c) Draw organic molecules that meet the following descriptions (2 Marks)

i. A secondary alcohol with the formula $C_5H_{13}O$

ii. A compound with molecular formula C_5H_8O that has four sp^3 hybridized carbon and only one sp^2 hybridized carbon.

Question Two

a) Explain the following observations.

i. Alcohols have higher boiling points than aldehydes of corresponding molecular size. (2 Marks)

ii. Boiling points of alkanes increase with increase in carbon atoms. (2 Marks)

iii. Alkenes exhibit geometric isomerism while aliphatic alkanes do not. (2 Marks)

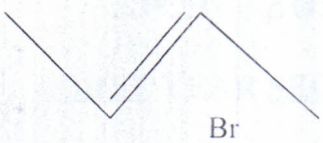
b) Draw at least four isomers of C_5H_{10} (4 Marks)

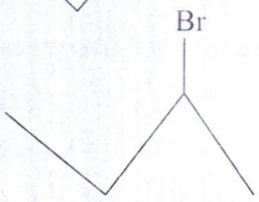
c) Give two uses of alkanes (2 Marks)

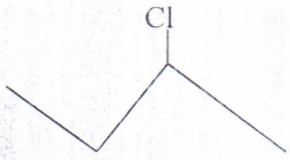
d) Give any two compounds with the molecular formula C_4H_8O each with a different functional group. (2 Marks)

Question Three

a) Give the final structure of compounds formed under conditions given

i.  $\xrightarrow{H_2/Pt}$ A (1 Mark)

ii.  $\xrightarrow{Mg,\ Ether}$ $\xrightarrow{H_2O}$ B ⟶ C (2 Marks)

iii.  $\xrightarrow{Zn/Acid}$ (1 Mark)

iv. $CH_3C = C\overline{H} + 2H_2 \xrightarrow{Ni}$ E (1 Mark)

b) On analysis, an organic compound was found to contain 73.3% carbon, 3.8% hydrogen, 10.7 % nitrogen and oxygen respectively. The relative molecular mass of the compound was 262. (RAM C = 12, H = 1 N = 14 O = 16)

i. Distinguish between empirical and molecular formula. (2 Marks)

ii. Find the empirical formula of the compound. (3 Marks)

iii. Determine the molecular formula of the compound. (1 Mark)

c) Outline the reaction mechanism that leads to monochlorination of methane in the presence of ultraviolet light. (3 Marks)

Question Four

a) Discuss the uniqueness of carbon that makes it very important in organic chemistry. (4 Marks)

b) Compare the reactivity of alkanes to that of the alkynes. (2 Marks)

c) State and explain any two methods that can be used to prepare alkenes. (2 Marks)

d) Differentiate between primary, secondary and tertiary alcohols giving examples in each case. (6 Marks)

Question Five

a) (i) State the two classes of hydrocarbons (2 Marks)

(ii) Using a general example show how a carboxylic acid can be converted into an ester (2 Marks)

(iii) How will you distinguish between hexene & hexane (3 Marks)

b) Using structural formula where possible briefly explain the following:

(i) Alcohols have higher boiling points than ethers of corresponding molecular weight (both have the general formula $(C_nH_{2n+2}O)$ (3 Marks)

(ii) Draw the structure of polyvinyl chloride, a polymer made from vinylchloride. (1 Mark)

c) Classify each of the following reactions as either addition, substitution or elimination (3 Marks)

(i) $CH_3Br + KOH \rightarrow CH_3OH + KBr$

(ii) $CH_3CH_2Br \rightarrow CH_2CH_2 + HBr$

(iii) $CH_2CH_2 + H_2 \rightarrow CH_3CH_3$