THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

SEPTEMBER – DECEMBER 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

REGULAR PROGRAMME

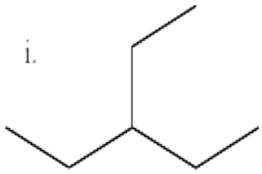
CHEM 101: ORGANIC CHEMISTRY I

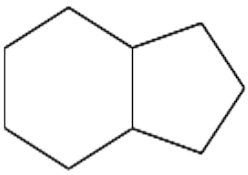
Date: DECEMBER 2019	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and any other Two Questions	

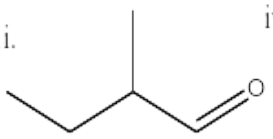
Q1. a) Draw the structures of the following compounds. **(4 marks)**

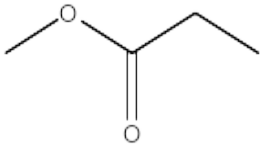
i. Hexan-2-one
ii. 4-(2-floroethyl)-5,5-dimethylnonane
iii. Ethoxybutane
iv. Iodocyclopentene

b) Give the IUPAC names of the following compounds. **(4 marks)**

i. 

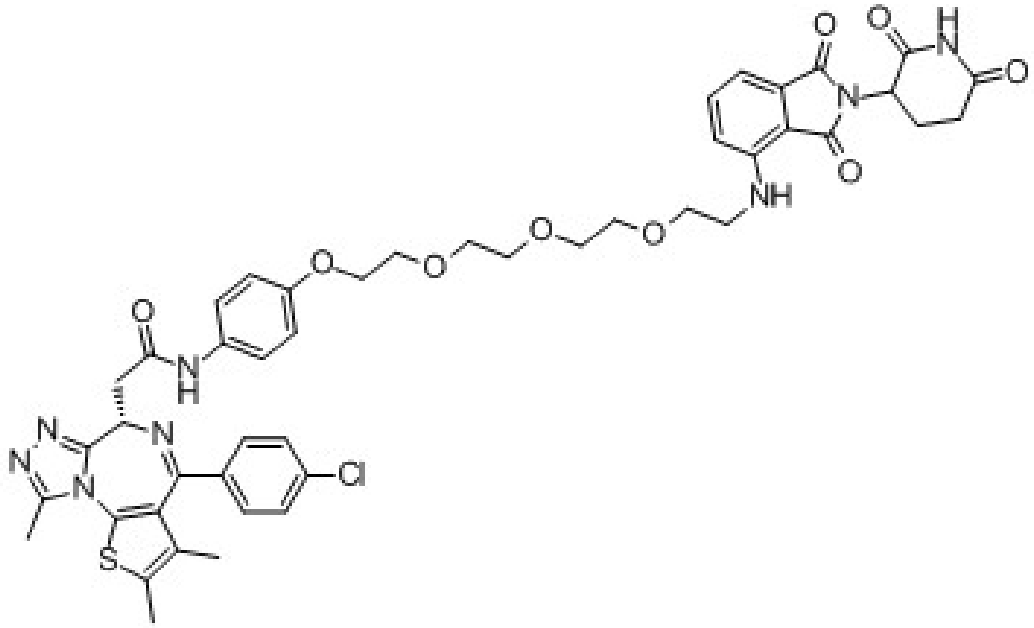
ii. 

iii. 

iv. 

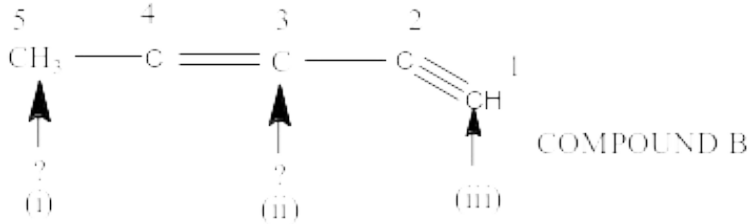
c) State all the functional groups present in ARV-825, a drug used to to inhibit acute myeloid leukemia

(3 marks)



d) Indicate the type of hybridization of each carbon atoms labelled (i), (ii) and (iii) in compound B:

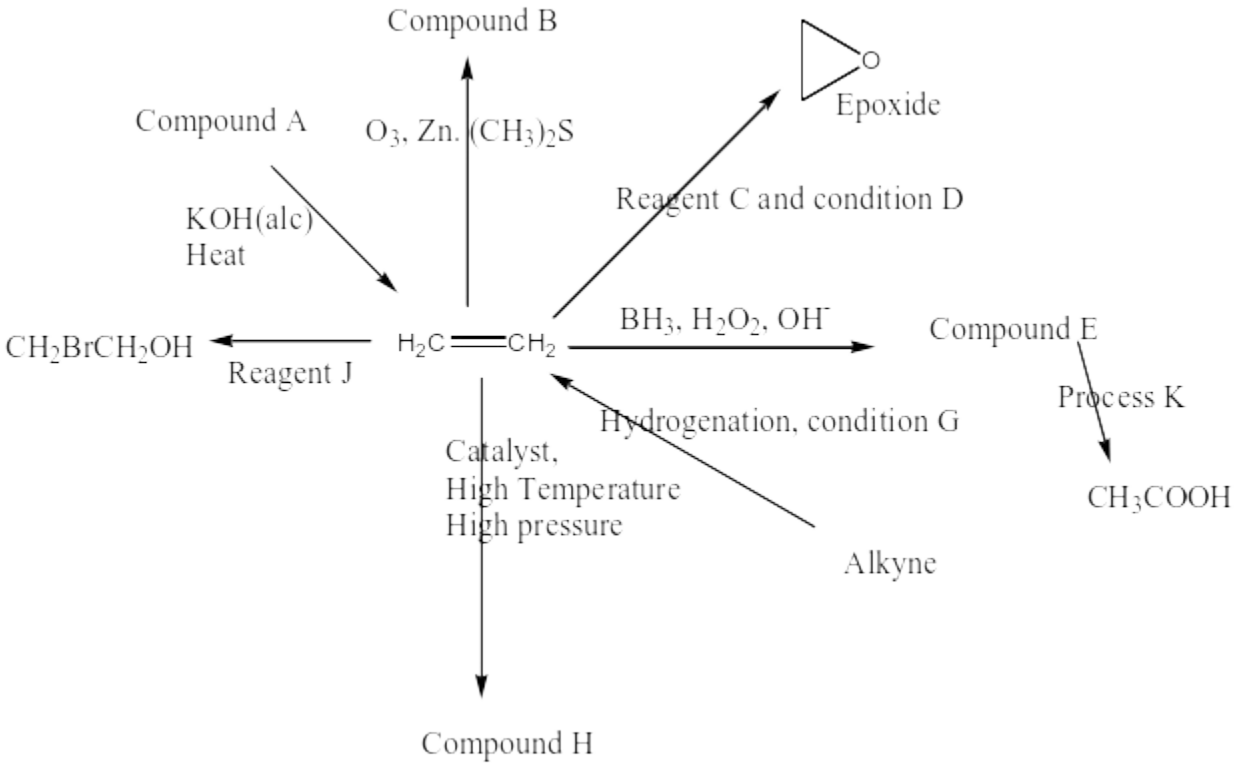
(3 marks)



COMPOUND B

e) Apart from n-hexane and 2-methylpentane, draw the other structural formulas that are isomers of C_6H_{14}. Provide an IUPAC name for each structure you draw **(3 marks)**

f) Study the flow chart below and answer the questions that follow:



g) i. Name compounds A,B,E, and H **(2 marks)**

ii. Identify reagents C and J **(1 mark)**

iii. Identify conditions G **(1 mark)**

h) Draw and name geometric isomers of 3-hexene (C_6H_{12}) using the E, Z nomenclature: **(4 marks)**

i) Write the electronic configuration of Zinc (atomic number = 30) in term of s,p,d and f; **(1 mark)**

j) Complete the following table by filling in the structure of the compound formed when propanal and propanone react separately with each of the indicated reagents. **(4 marks)**

	Reagent	Propanal	Propanone
i.	Acidified potassium permanganate		
ii.	Sodium borohydride		

Q2. a) Discuss the bonding in ethane and ethyne in terms of hybridization. **(5 marks)**

b) Discuss the chemistry of alkanols as a functional group. Under the following:

i) Nomenclature
ii) Three methods of preparing alkanols
iii) Four reactions of alkanols
iv) Classes of alkanols and chemical test to differentiate between different classes of alkanols

(12 marks)

c) A compound is found to contain 85.63% C and 14.37% H by mass. In another experiment its molar mass is found to be 56.1g/mol. What is its (i) Empirical formula (ii) molecular formula?

(3 marks)

Q3. a) Discuss alkenes as a functional group. Under the following:

i. Bonding in alkenes in terms of hybridization
ii. Isomerism (both structural and geometric using butene as an example)
iii. Different ways of hydrating alkenes
iv. Formation of cyclic compounds from alkenes (2 ways)
v. Polymerization **(14 marks)**

b) Define each of the following terms giving an example in each case:

vi. Electrophile
vii. Nucleophile
viii. Carbocation
ix. Free radical
x. Carbonyl compound **(6 marks)**

Q4. a) Describe the nature and use of the different fractions obtained from fractional distillation of crude oil.

(5 marks)

b) Discuss alkanes as a functional group. Under the following: **(10 marks)**

i. Isomerism (use butane as an example in your explanation)
ii. Two methods of preparation.
iii. Mechanism of halogenation of alkanes (use methane in your illustration)

c) Complete the following table by filling in the structure of the compound formed when ethanol and ethanoic acid react with the indicated reagents. **(5 marks)**

	Reagent	Ethanol	Ethanoic acid
i.	Sodium hydrogen carbonate		
ii.	Phosphorus (III) chloride		

Q5. a) Discuss halogen alkanes as a functional group. Under the following: **(6 marks)**

i. Isomerism (use a halo alkane containing five carbon atoms as an example)
ii. Three methods of preparation.
iii. 3 Physical properties

b) An alcohol S, $C_4H_{10}O$ was oxidized to give a carboxylic acid P, $C_4H_{10}O_2$. The alcohol can also be dehydrated to form compound Q, C_4H_8. An isomer of S is resistant to oxidation. Identify compound S, Q, P and the isomer of S. **(4 marks)**

c) $4.8g$ of a sample of compound of Carbon, hydrogen and Oxygen gave on combustion $7.04g$ of $CO_{2(g)}$ and $2.88g$ of H_2O .The relative molecular mass of the compound was found to be 60 C=12, H=1, O=16)

i. What are the masses of carbon, hydrogen and oxygen in the compound? **(2 marks)**
ii. Determine the molecular formula of the compound. **(2 marks)**

d) Complete the following table by filling in the structure of the compound formed when ethene and ethyne react with the indicated reagents.

(6 marks)

	Reagent	Ethene	Ethyne
iii.	Acidified potassium permanganate		
iv.	$[Ag(NH_3)_2]^+$		

v.	Ozone		

END