



# THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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**MAIN EXAMINATION**

**MAY – JULY 2019 TRIMESTER**

**FACULTY OF SCIENCE**

**DEPARTMENT OF CHEMISTRY**

**REGULAR PROGRAMME/SUPPLEMENTARY**

**CHEM 101: ORGANIC CHEMISTRY I**

**Date: JULY 2019**

**Duration: 2 Hours**

**INSTRUCTIONS: Answer Question ONE and any other Two Questions**

- Q1. (a) Using the hybridization theory and relevant diagrams, explain the differences in bonding between ethylene and acetylene (7 marks)
- (b) Nicotine, an alkaloid in the nightshade family of plants that is mainly responsible for the addictive nature of cigarettes, contains 74.02% C, 8.710% H, and 17.27% N. If 40.57 g of nicotine contains 0.25 moles of nicotine, what is the molecular formula? (5 marks)
- (c) Using relevant diagrams and expressions, explain the process of catalytic cracking of alkanes using zeolites (5 marks)
- d) Using relevant structures, explain the reaction that takes place when two molecules of formaldehyde are reacted in the presence of NaOH (5 marks)
- e) Using relevant diagrams describe the term 'optical isomerism' (4 marks)
- f) Using relevant structure, depict the optical isomers of Bromo-fluoro-chloromethane (4 marks)

- Q2. a) Draw line structures for the following molecules:  
 i) methyl-cyclohexane  
 ii) 5-methyl-1-hexanol  
 iii) 2-methyl-2-butene  
 iv) 5-chloropentanal  
 v) 2,2-dimethylcyclohexanone **(10 marks)**
- b) Using relevant structures, explain how the hexa-aqua- aluminium ion could be used to explain the Lewis acid/ base concept **(5 marks)**
- c) Using relevant structures, describe the difference between an aldol, an aldehyde and an alcohol **(5 marks)**
- Q3. a) Draw the structures of five functional groups which have a carbonyl group **(5 marks)**
- b) Illustrate a distillation column used in the fractional distillation of petroleum showing the different fractions and the approximate length of the carbon chains **(10 marks)**
- c) Using the structure of But-2-ene, explain what is meant by geometric isomerism **(5 marks)**
- Q4. a) Write the structural formula for the following:  
 i) (2,2-dimethylpropyl)cyclopentane  
 ii) 1,2,3-tri(chloromethyl)cyclopropane  
 iii) 1,4-dicyclohexylcyclooctane  
 iv) 1-(1-methylcyclopropyl)-1,2,2,3,3-pentamethylcyclopropane **(10 marks)**
- b) What is the empirical formula for isopropyl alcohol (which contains only C, H and O) if the combustion of a 0.255 grams isopropyl alcohol sample produces 0.561 grams of CO<sub>2</sub> and 0.306 grams of H<sub>2</sub>O? **(10 marks)**
- Q5. a) Methane is sp<sup>3</sup> hybridized while ethene is sp<sup>2</sup> hybridized. Using relevant structures, explain **(8 marks)**
- b) Using an equation, explain the formation of an ester from a carboxylic acid and an alcohol **(6 marks)**
- c) Using relevant structures explain why the chlorination of methane is an exothermic reaction **(6 marks)**

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