



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

MAY – JULY 2016 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

SCHOOL FOCUSED PROGRAMME

CHEM 101: ORGANIC CHEMISTRY I

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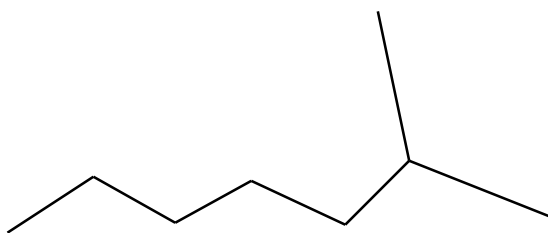
Date: JULY 2016

Duration: 2 Hours

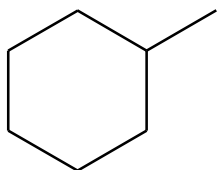
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) Draw the structures of the following compounds
- i 3 – methylhex – 2 – ene (1 mark)
 - ii Hexan – 2 – one (1 mark)
 - iii 3 – chlorocyclobutene (1 mark)
 - iv 1,2,3 – tribromopentane (1 mark)
 - v Z – 2 – Bromo – 3 – chlorobut – 2 – ene (1 mark)
- b) Give the names of the following compounds (5 marks)

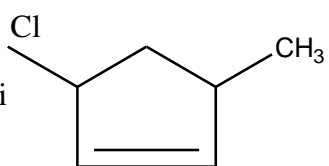
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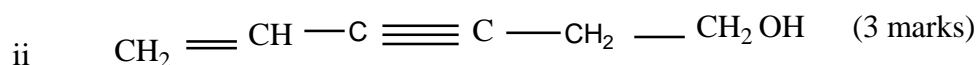
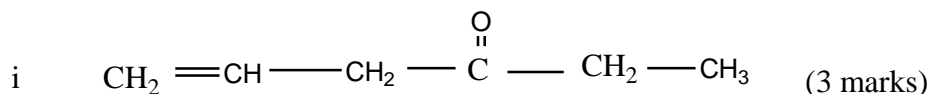
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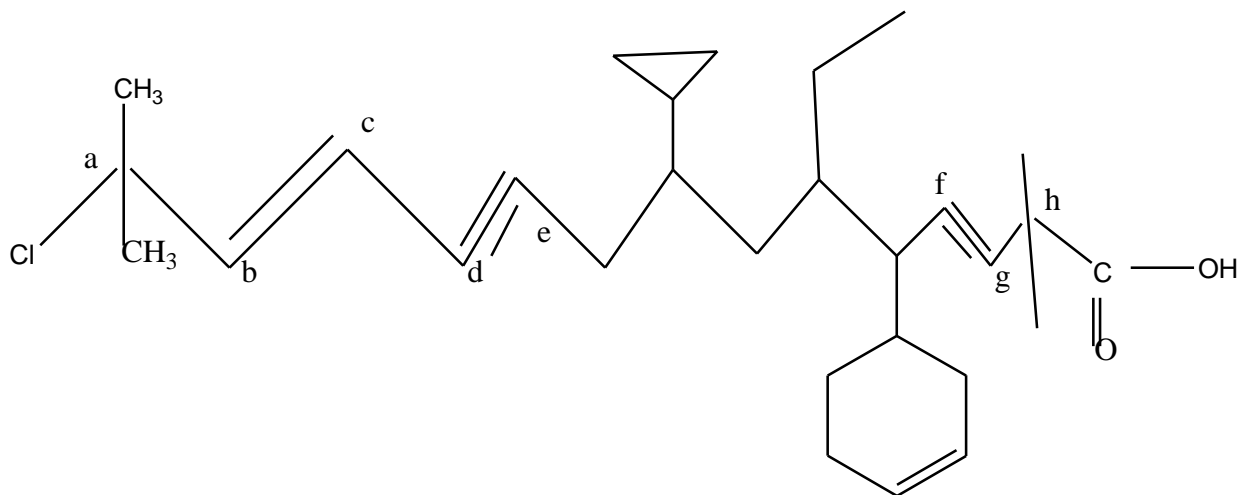


- c) Combustion of 6.51g of a compound gave 20.47g of CO₂ and 8.36g of H₂O. The molecular weight was found to be 84. Calculate (C = 12, H = 1, O = 16)
- Percentage composition of each element making up the compound. **(4 marks)**
 - The empirical formula of the compound. **(3 marks)**
 - Molecular formula of the compound **(2 marks)**
- d) Indicate the type of hybridization for each of the carbon atoms in the following compounds

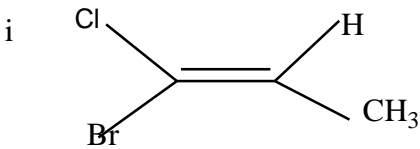
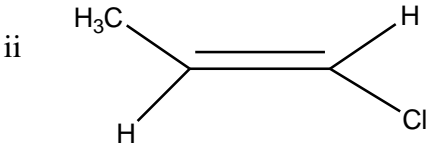


- e) Write the structures and the names of all the alkanes that have the molecular formula C₆H₁₄ **(5 marks)**
- Q2. a) i Give all the FOUR isomeric structures of a compound (except ethers) with a molecular formula C₄H₁₀O **(4 marks)**
- ii Give a simple visual chemical test you would perform to differentiate between the isomers in a (i) above. Explain what happens in each case. **(4 marks)**
- iii For the tertiary isomer, draw the Lewis structure. **(2 marks)**
- b) Briefly describe the THREE common models of hybridization observed in organic compounds. **(6 marks)**
- c) Draw the structures and give the structural relationship (type of isomerism) between the following compounds
- Butane and 2 – methylpropane **(2 marks)**
 - Propan – 1 – ol and methyl ethylether **(2 marks)**
- Q3. a) With clear diagrams and illustration explain the mechanism of bromination of methane **(6 marks)**

- b) 0.402g of an inorganic compound produced 0.914g of carbon (IV) oxide and 0.371g of water. The relative molecular mass of the compound was found to be 88 (C = 12, H = 1, O = 16)
- What are the masses of carbon hydrogen and oxygen in the compound? **(3 marks)**
 - Determine the molecular formula of the compound. **(4 marks)**
- c) Write the structural formula and names of FOUR primary alkyl halides with the formula $C_5H_{11}Br$ **(4 marks)**
- d) Explain why bonding in organic compounds is mostly covalent. **(3 marks)**
- Q4. a) You are provided with the structure of a hypothetical organic compound below.



- Indicate the type of hybridization present on the carbon labeled a, b and d **(3 marks)**
- State the type of bonds between the carbon atoms labeled b and c **(2 marks)**
- Which of the carbon atoms would you classify as primary, secondary, tertiary or quaternary? **(4 marks)**
- Show by drawing the bonding orbitals that form bonds between carbon f and g and use s – p or p – p notation label them. **(3 marks)**

- v How many p orbitals in part (iv) above are unhybridized? **(1 mark)**
- vi Name the functional group in the carbon labeled p **(1 mark)**
- b) Write down Lewis and condensed structures for any TWO possible isomeric compounds with molecular formula C_2H_6O **(4 marks)**
- c) Differentiate between a pi (π) and a sigma (σ) bond. **(2 marks)**
- Q5. a) Differentiate between quantitative and qualitative elemental analysis. **(3 marks)**
- b) Explain the following observation
- Branching in the carbon chain in alkanes decreases the boiling points **(2 marks)**
 - Stability of free radicals of alkanes increases from alkyl to tertiary carbon. **(2 marks)**
- c) Carbon uses hybrid orbitals in bonding with other carbon atoms and hydrogen in the formation of alkanes.
- Define the term hybrid orbitals **(4 marks)**
 - By considering the atomic orbitals of carbon and hydrogen describe the bonding in methane. **(6 marks)**
- d) Name the following compounds using the E,Z nomenclature **(3 marks)**
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- d) Define catenation and give examples of the catenation of carbon. **(3 marks)**

END