



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

DECEMBER SESSION EXAMINATION FOR

BACHELOR OF EDUCATION (SCIENCE)

SCH 102: ORGANIC CHEMISTRY

DATE: 23/4/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS TO CANDIDATES

- The paper consists of **two** sections.
- Section **A** is **compulsory**.
- Answer any **two** questions from section **B**.

SECTION A - COMPULSORY.

QUESTION ONE (30 MARKS)

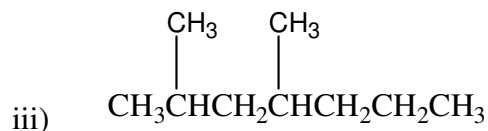
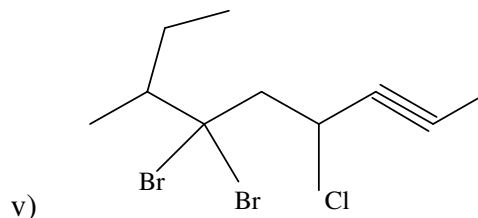
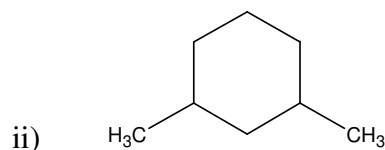
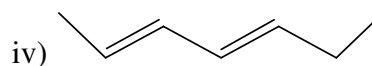
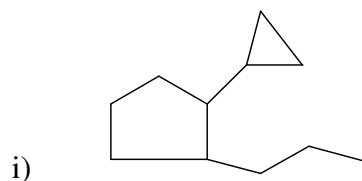
a) Define the following terms: (5 marks)

- i. Markovnikov's rule
- ii. Cracking
- iii. Carbocation
- iv. Regiospecific reaction
- v. Enantiomers

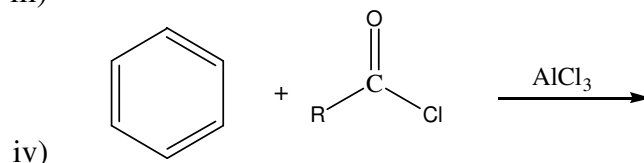
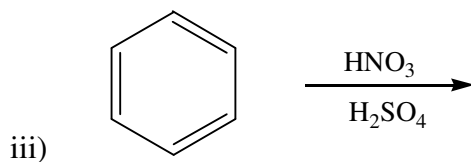
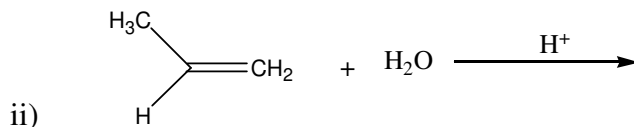
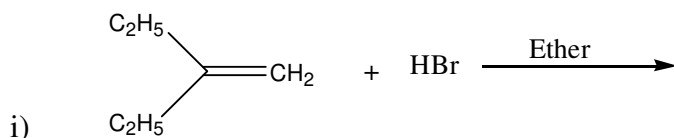
b) Draw the structures of the following named compounds: (5 marks)

- i. 3-Bromo-2,5-dimethylhexane
- ii. 1-ethyl-4,4-dimethylcycloheptane
- iii. 2-chloro-1-penten-4-yne
- iv. 2-ethyl-3,4-dimethyl-1,4-pentadiene
- v. 1-Bromo-5-methyl-1,4-cyclohexadiene

c) Provide the IUPAC names for the following structures: (5 marks)



- d) What are the product(s) of each of the following reactions (more than one compound may be formed). (7 marks)

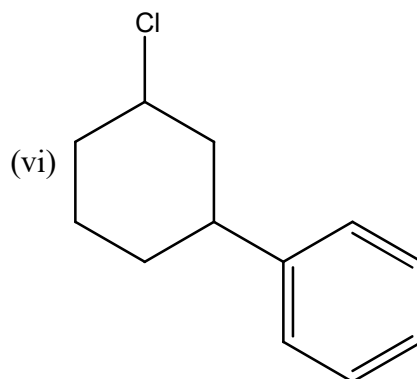
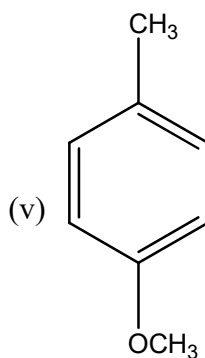
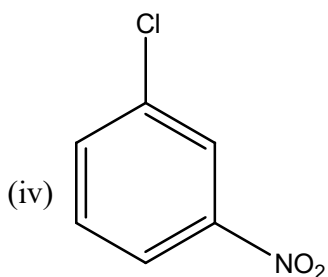
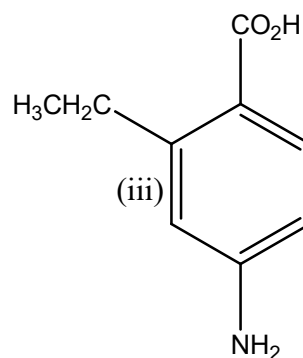
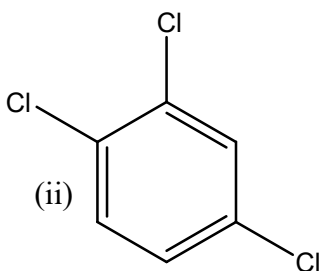
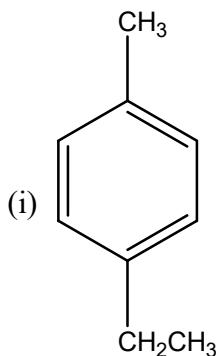


- e) The combustion of an 8.23 mg sample of unknown substance produced 9.62 mg carbon dioxide and 3.94 mg of water. Another sample of the same unknown substance, weighing 5.32 mg, produced 13.49 mg of silver chloride in a halogen analysis.

- Calculate the number of moles of carbon dioxide liberated (C =12, O =16) (1 mark)
- Determine the quantity in grams of carbon element present in the carbon dioxide liberated in 1(e)(i) above. (1 mark)
- Calculate the number of moles of water produced in this experiment (1 mark)
- Determine the quantity in grams of hydrogen gas liberated (1 mark)
- Calculate the number of moles of silver chloride produced and hence the amount of chloride ions produced in grams (atomic weight of Ag and Cl are 108.0 and 35.5 respectively). (2 marks)
- Determine the percent composition for this unknown organic compound (2 marks)

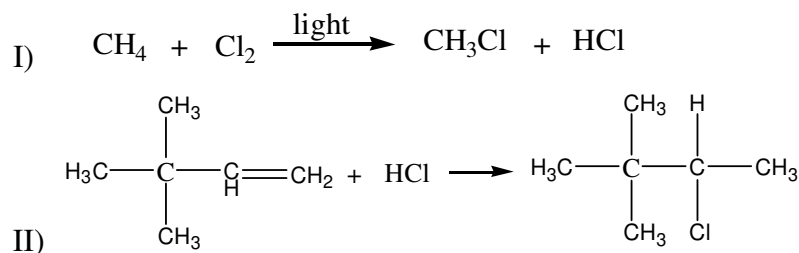
SECTION B
QUESTION TWO (20 MARKS)

- a) i) What are functional groups? (1 mark)
- ii) Write the functional groups of carboxylic acid, esters, ketones and aldehydes (4 marks)
- b) An alcohol and ether have the same molecular formula C_2H_6O . Draw their structural formulae indicating their functional groups. (2 marks)
- c) Account for the concept that n-pentane boils at $36\text{ }^{\circ}\text{C}$ higher than 2-methylbutane and 2,2-dimethylpropane which boils at $28\text{ }^{\circ}\text{C}$ and $9.5\text{ }^{\circ}\text{C}$ respectively. (3 marks)
- d) Highlight two uses of alkenes (2 marks)
- e) List two properties of alkenes (2 marks)
- e) Provide the IUPAC names of the following compounds: (6 marks)



QUESTION THREE (20 MARKS)

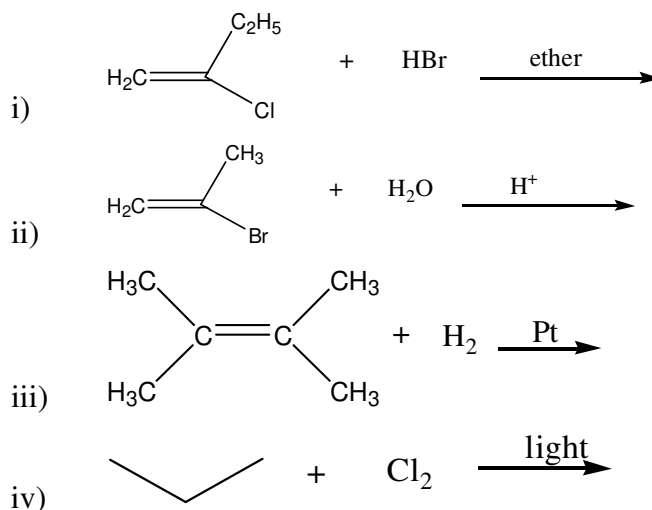
- a) Show the mechanism for the reactions given below: (6 marks)



- b) Describe simple chemical tests that would distinguish between: (4 marks)

- Propane and 1-propene
- 1-pentyne and 1-pentene

- c) Provide the products of the following reactions showing the major and the minor products where appropriate. (7 marks)

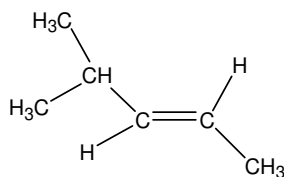


- d) Show how acetylene gas is produced (3 marks)

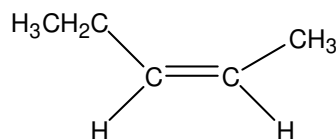
QUESTION FOUR (20 MARKS)

- a) i) Define the term isomerism (1 mark)
- ii) Provide the structures and names of three constitutional isomers of C_6H_{14} (3 marks)
- iii) Draw the two geometric isomers of the following molecule: CHClCHCH_3 (2 marks)

- iv) By assigning *cis* and *trans* name the following structures (4 marks)

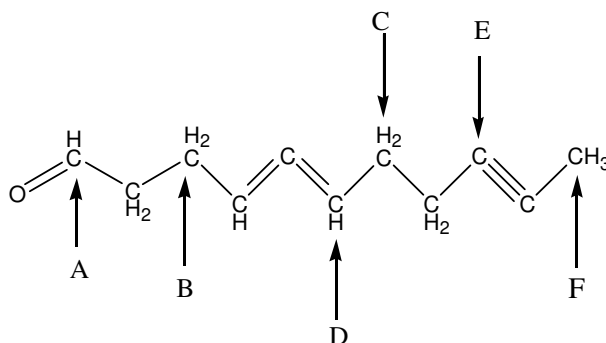


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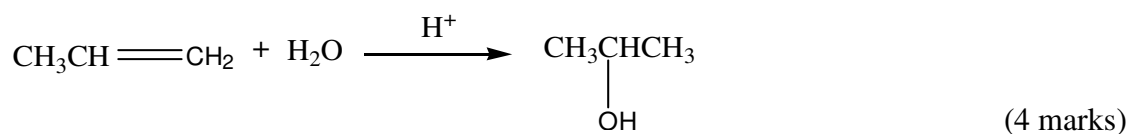
II

- c) Draw the structural formulae for the following molecules. (4 marks)
- Para*-nitrophenol
 - 3-phenylheptane
 - 2,5-dibromobenzoic acid
 - trans*-3-methyl-3-hexene
- d) Identify the type of hybridization for each of the following labeled atoms in the following structure. (6 marks)



QUESTION FIVE (20 MARKS)

- a) Propene react with water in the presence of sulphuric acid to produce 2-propanol as the major product as shown below. Show the reaction mechanism for the reaction.



- b) i) Distinguish the following terms:
- Nucleophile and electrophile
 - $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions (4 marks)
- ii) Explain four factors that influence the rates of $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions (8 marks)
- c) Using illustrations, clearly explain sp^2 and sp hybridization displayed by carbon atom. (4 marks)