



MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

SECOND SEMESTER SUPPLEMENTARY EXAMINATION FOR THE DIPLOMA IN
AGRICULTURAL EDUCATION AND
EXTENSION
SCH 0102: ORGANIC CHEMISTRY

DATE: 18th Oct 2017

TIME: 2:00 -4:00 pm

INSTRUCTIONS:

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

Section A - Compulsory.

1. a) Define the following terms:
- i) Markovnikov's rule
 - ii) Cracking
 - iii) Carbocation
 - iv) Regiospecific reaction
 - v) Enantiomers

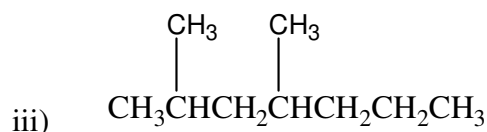
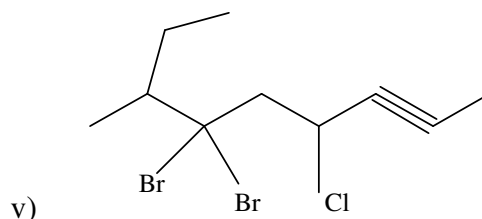
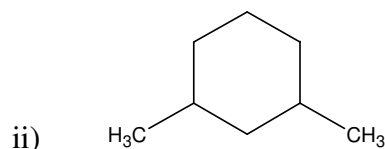
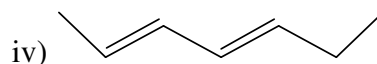
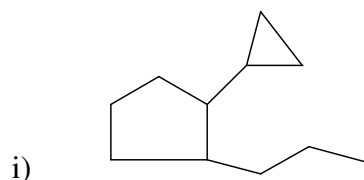
[5 marks]

- b) Draw the structures of the following named compounds:

- 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

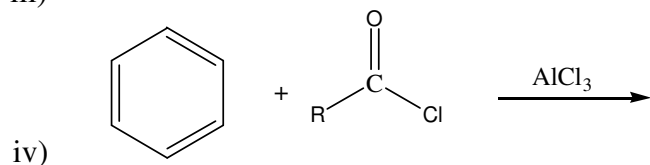
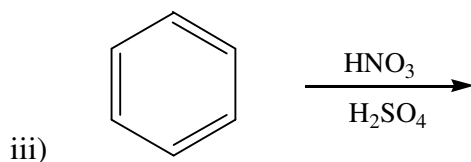
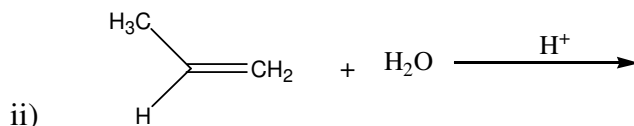
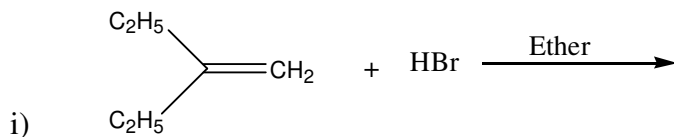
[5 marks]

- 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).



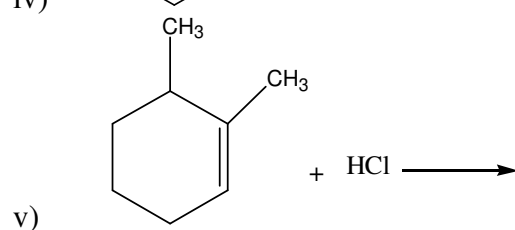
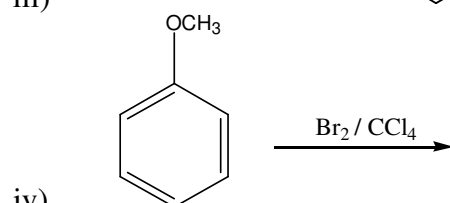
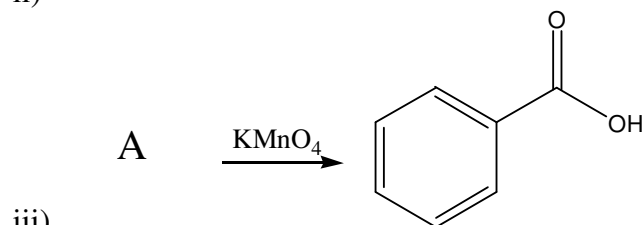
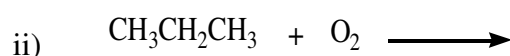
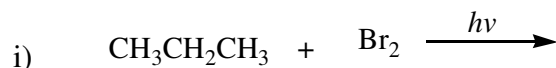
[7 marks]

- 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.

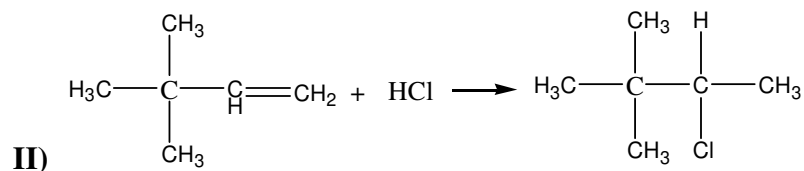
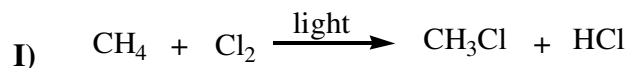
- Calculate the number of moles of carbon dioxide liberated (C =12, O =16)
[1 mark]
- Determine the quantity in grams of carbon element present in the carbon dioxide liberated in 1(e)(i) above.
[1 mark]
- Calculate the number of moles of water produced in this experiment
[1 mark]
- Determine the quantity 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
Answer any two questions

2. a) i) What are functional groups? [1 mark]
 ii) Write the functional groups of acids, 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 $36^\circ C$ higher than 2-methylbutane and 2,2-dimethylpropane which boils at $28^\circ C$ and $9.5^\circ C$ respectively. [3 marks]
 d) Complete the following reactions by giving the structures of the missing reactants and products:



3. a) Show the mechanism for the reactions given below:



[10 marks]

[6 marks]

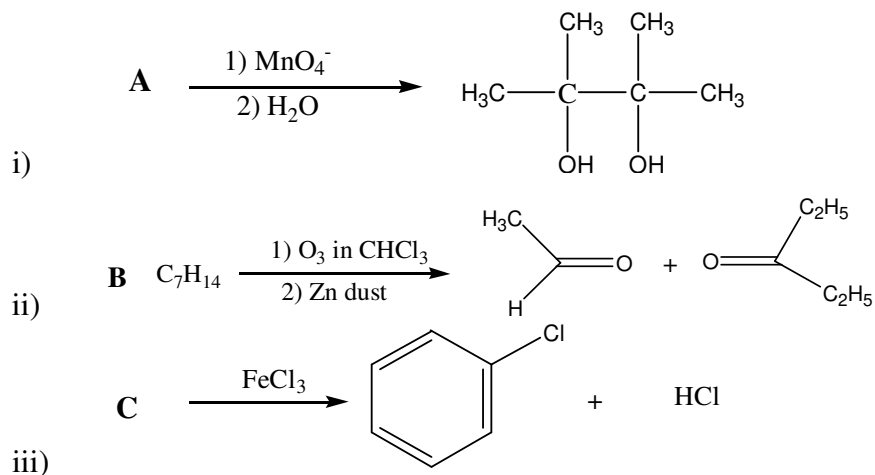
b) Describe simple chemical tests that would distinguish between:

i) Propane and 1-propene

ii) 1-pentyne and 1-pentene

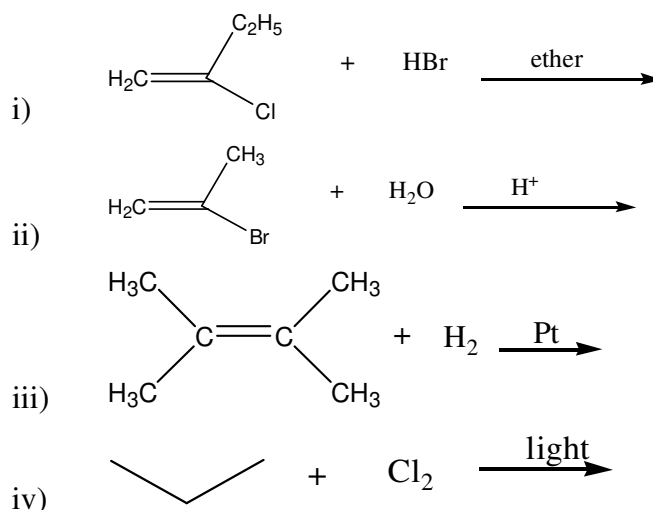
[4 marks]

c) Deduce the structural formulae for the alkenes **A**, **B** and **C** that give the following products:



[3 marks]

d) Provide the products of the following reactions showing the major and the minor products where appropriate.



[7 marks]

4. a) i) Define the term isomerism

[1 mark]

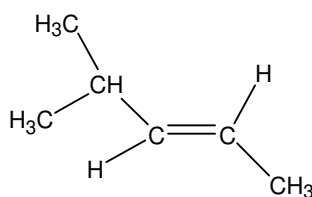
ii) Provide the structures and names of **three** constitutional isomers of C_6H_{14}

[3 marks]

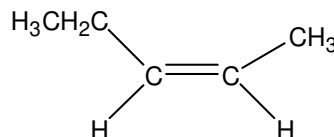
iii) Draw the **two** geometric isomers of the following molecule: CHClCHCH_3

[2 marks]

IV) By assigning *cis* and *trans* name the following structures



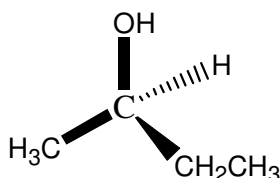
I



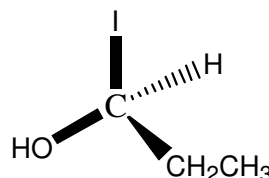
II

[4 marks]

- b) i) Define the term a chiral carbon [1 mark]
 ii) Using the (R) and (S) configurations, name the following compounds:



I



II

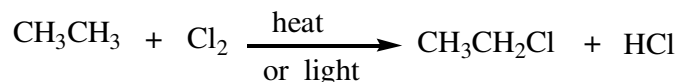
[4 marks]

- c) Draw the structural formulae for the following molecules.

- Para*-nitrophenol
- 3-phenylheptane
- 2,5-dibromobenzoic acid
- Meta*-ethyltoluene
- trans*-3-methyl-3-hexene

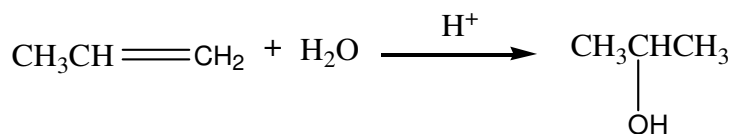
[5 marks]

5. a) i) Define the term chain reaction [1 mark]
 ii) The reaction below proceeds by a mechanism similar to that of chlorination of methane.



Write the equations for the chain-initiating, chain-propagating and chain-terminating steps for the above reaction. [3 marks]

- b) 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.



[4 marks]

- c) i) Distinguish the following terms:
 I) Nucleophile and electrophile
 II) $\text{S}_{\text{N}}1$ 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]