



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

P.O. Box 62157
00200 Nairobi - KENYA
Telephone: 891601-6
Fax: 254-20-891084
E-mail: academics@cuea.edu

AUGUST – DECEMBER 2018 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE (CHEMISTRY)

REGULAR PROGRAMME

CHEM 204: REACTION MECHANISMS

Date: DECEMBER 2018

Duration: 2 Hours

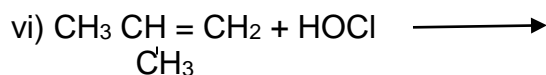
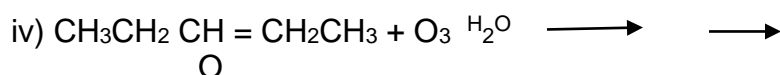
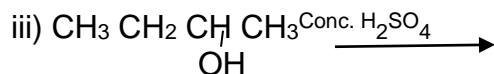
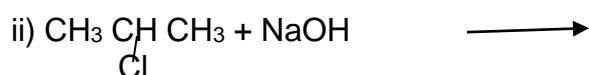
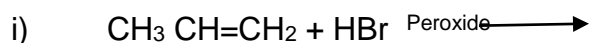
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) Explain each of the following terms as used in reaction mechanisms:
- i) Reaction mechanism.
 - ii) Carbocation.
 - iii) Nucleophile.
 - iv) Peroxide effect.
 - v) Mesomeric effect.
- (10 Marks)**
- b) Explain the relative stability of primary, secondary and tertiary carbonium ions.
- (4 Marks)**
- c) Define electrophiles and nucleophiles, and classify the following as electrophiles and nucleophiles:
- i. CH_3CH_2^+ ii. H_2O iii. NH_3 iv. NO_2^+ v. HO^-
vi. CN^- vii. $\text{CH}_3\text{C}^-\text{HCH}_3$ viii. $(\text{CH}_3)\text{C}^+$
- (6 Marks)**
- d) Explain each of the following terms with suitable examples
- i) Carbanions
 - ii) Lewis base.
 - iii) Free radical.
 - iv) Heterolytic fission.
 - v) Electrophilic substitution.
- (10Marks)**

- Q2. a) i) Why is the reaction of $\text{CH}_3\text{Br} + \text{OH}^- \longrightarrow \text{CH}_3\text{OH} + \text{Br}^-$ nucleophilic displacement. **(4 Marks)**
- ii) Is this an $\text{S}_{\text{N}}1$ or an $\text{S}_{\text{N}}2$ reaction and why? **(4 Marks)**
- iii) Write down the rate law of the above reaction. **(2 Marks)**
- iv) Why does the above reaction not occur with a tertiary alkylhalide? **(3Marks)**
- b) Write down the mechanism for the chlorination of ethane in the presence of ultraviolet light showing all the necessary steps. **(7Marks)**

- Q3. a) How is E^+ generated and what is the base in the following reactions?
- i) Nitration of benzene with a mixture of $\text{HNO}_3/\text{H}_2\text{SO}_4$
- ii) Acylation of benzene in presence of AlCl_3 as a Lewis acid catalyst.
- iii) Reaction of benzene with $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ in presence of FeCl_3 **(9 Marks)**

b) Give the products of each of the following reactions:



(8 marks)

c) What is disproportionation? **(3Marks)**

- Q4. a) What are the similarities and differences between the $\text{C}=\text{O}$ and the $\text{C}=\text{C}$ bonds? **(5 Marks)**

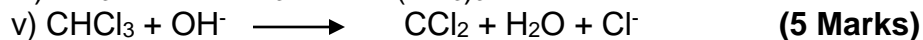
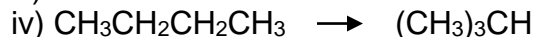
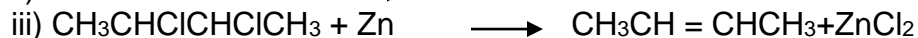
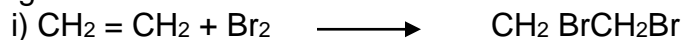
b) Write down the mechanism of the reaction that occurs when $\text{CH}_3\underset{\text{O}}{\text{C}}\text{H}$ is reacted with a dilute solution of NaOH **(7 Marks)**

c) How will you distinguish between acetaldehyde and acetone? **(4 Marks)**

d) Discuss the mechanism of addition of HCN to acetone.

(3 Marks)

Q5. a) Classify the following reactions as addition, substitution, elimination, rearrangement or redox reactions.



b) Write structural formulas for the isomeric hexanes and name them by the IUPAC System. **(5 Marks)**

c) Explain each of the following terms:

i) Optical activity.

ii) Enantiomers.

iii) Walden inversion

iv) Racemization.

v) Geometrical isomerism. **(10 Marks)**

END