



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

JANUARY - APRIL 2017 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

REGULAR PROGRAMME

CHEM 204: REACTION MECHANISMS

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

Date: APRIL 2017

Duration: 2 Hours

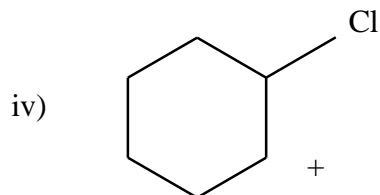
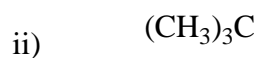
INSTRUCTIONS: Answer Question ONE and any other Two Questions

Q1, a) Define or explain each of the following terms or concepts

- i) Heterolytic bond fission
- ii) Walden inversion
- iii) Nucleophilic substitution
- iv) Mesomeric effect
- v) Free radicals

(10 marks)

b) What are carborium ions? Arrange the following according to their increasing stability and explain your answer.



c) Explain the difference between a transition state and an intermediate in chemical reaction. **(10 marks)**

d) Differentiate between the following terms:

- i) Enantiomers
- ii) $\text{S}_{\text{N}}1$ and $\text{S}_{\text{N}}2$ reactions
- iii) Chiral and a chiral compounds
- iv) Electrophiles and nucleophiles
- v) Diazotization and coupling **(10 marks)**

Q2. a) What is a reaction mechanism and how does it differs from a balanced chemical equation? **(4 marks)**

b) What happens when:

- i) Acetaldehyde is treated with HCN followed by hydrolysis
- ii) Acetaldehyde is treated with phenylhydrazine ($\text{C}_6\text{H}_5\text{NHNH}_2$)
- iii) Acetone is treated with Zn/Hg in an acid medium **(9 marks)**

- c) Explain what is meant by Aldol condensation and write down the mechanism for the reaction between acetaldehyde and aqueous sodium hydroxide. **(7 marks)**
- Q3. a) Compare the products from the addition of HBr to propene in
i) The presence of a peroxide
ii) The absence of a peroxide **(6 marks)**
- b) Radical chlorination of n-pentane is a poor method of preparing i-chloropentane, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$, but radical chlorination of neopentane $(\text{CH}_3)_4\text{C}$ is a good way to prepare neopentyl-chloride. Explain why with appropriate equations? **(10 marks)**
- c) What is the difference between a substrate and a reagent? **(4 marks)**
- Q4. a) What is optical activity and how is it measured? **(4 marks)**
- b) Name the main groups of organic reagents. **(4 marks)**
- c) Write down the mechanism of electrophilic substitution in benzene using acetylchloride in the presence of aluminium chloride as a Lewis acid catalyst **(8 marks)**
- d) Classify each of the following as electrophiles or nucleophiles

i) CN^-

ii) H_2O

iii) Br^+

iv) NH_3

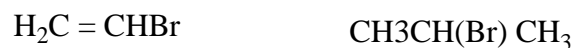
v) NO_2

vi) ROH (5 marks)

(5 marks)

Q5. a) What is the stereochemistry of the product that results from addition of bromine to cyclohexene and is the product optically active and why?

b) Rank the following alkylhalides in order of their reactivity towards $\text{SN}1$ reactions and explain your order.



(6 marks)

c) What effect would you expect on the rate of reaction of ethanol with methylcontane if the concentration of the halide were tripled?

(6 marks)

END