



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

JANUARY – APRIL 2019 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF NATURAL SCIENCE (CHEMISTRY)

REGULAR PROGRAMME

CHEM 204: REACTION MECHANISM

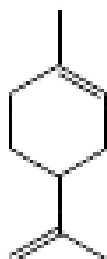
Date: APRIL 2019

Duration: 2 Hours

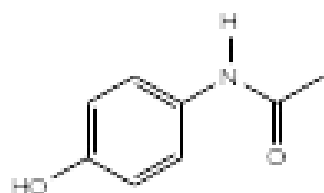
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

Q1. a) Name the functional groups in the following compounds : (5 marks)

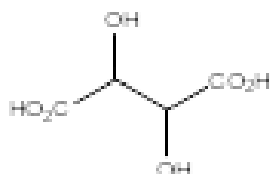
(i) Limonene



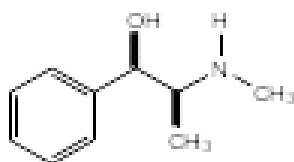
(ii) Paracetamol



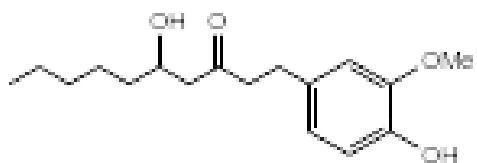
(iii) Tartaric acid



(iv) Ephedrine

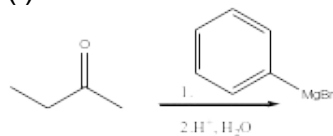


(v) Gingerol

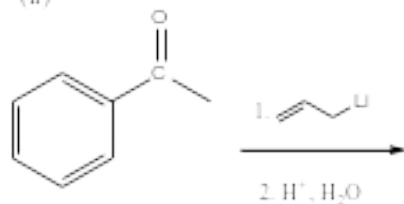


b) Give the organometallic reagents formed with the following reactions :
(5 marks)

(i)



(ii)



(iii)



(iv)



(v)

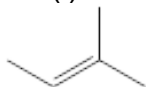


- c) i) What is the difference between an electrophile and a nucleophile in reaction mechanisms? **(1 mark)**
- ii) Give the reason (s) why vinyl and alkynyl organometallic compounds are formed more easily than the corresponding alkyl compounds. **(2 marks)**
- iii) Explain the difference in the polarization of carbon when bonded to a metal such as Lithium or Magnesium with that of carbon when it is bonded to a halogen such as Cl. **(2 marks)**

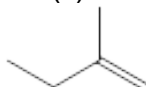
- d) Explain the concept of chemical bonding by illustrating it with the Kössel and Lewis approach. **(7 marks)**
- e) Explain different types of covalent bond formed and give each an example. **(5 marks)**
- f) State the Markovnikov's rule and give one examples. **(3 marks)**

Q2. a) Write the structure of the principal organic compound formed in the addition of HCl. **(5 marks)**

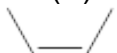
(i) 2-methyl-2-butene



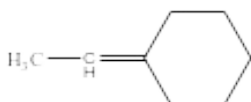
(ii) 2-methyl-1-butene



(iii) Cis-2-butene



(iv) Ethylidenecyclohexane

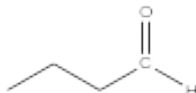


(v) 1-butene

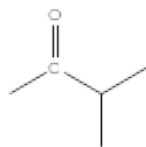
b) Give the structural formula for the carbocation intermediate that leads to the principal product in each of the above reactions **(5 marks)**

c) The aldehyde and ketone below are self-condensed with aqueous NaOH. Write a detailed condensation mechanism of each one of them. **(10 marks)**

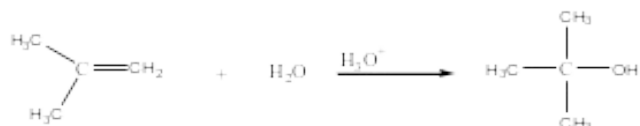
(i)



(ii)

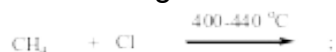


- Q3. a) Give the product (s) formed when 1-butene react with HBr in the presence of peroxide and in the absence of peroxide. **(4 marks)**
- b) Give a detailed mechanism of action when 1-butene react with HBr in the presence of peroxide. **(10 marks)**
- c) Propose a mechanism for the following reaction: **(6 marks)**



- Q4. a) Write chemical equations for the reaction that takes place between each of the following pairs of reactants: **(10 marks)**
- 2-butanol and hydrogen bromide
 - 1-ethyl-3-pentanol and hydrogen bromide
 - 2,3-dimethyl-2-hexanol
 - Cyclohexanol and hydrogen bromide at 100 °C
 - 2-methyl-2-propanol and hydrogen chloride
 - 4-ethyl-2-methyl-2-heptanol

- b) From the following reaction: **(5 marks)**

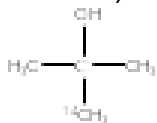


List all the possible products that you may synthesized

- c) Write a detailed mechanism of the chlorination of methane and the sequential substitution of the Hydrogen (H) atom by the Chlorine (Cl). **(5 marks)**
- Q5. a) Identify the alkene obtained on dehydration of each of the following alcohols: **(10 marks)**
- 3-ethyl-3-pentanol
 - 1-propanol
 - 2-propanol
 - 2,3,3-trimethyl-2-butanol
 - Cyclohexanol

b) Show how the following labelled compounds might be prepared by using Grignard and related organometallic reagents with $^{14}\text{CH}_3\text{I}$, H^{14}CHO or $^{14}\text{CO}_2$ as the source of label: **(10 marks)**

- i) $^{14}\text{CH}_3\text{COOH}$
- ii) $\text{Me}^{14}\text{COOH}$
- iii) $^{14}\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- iv) $\text{MeCH}_2^{14}\text{CH}_2\text{OH}$
- v)



END