JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY UNIVERSITY EXAMINATIONS 2013

4TH YEAR 1ST SEMESTER EXAMINATION OF BACHELOR OF EDUCATION (SCIENCE)

REGULAR

COURSE CODE: SCH 405

COURSE TITLE: SYNTHETIC ORGANIC CHEMISTRY

DATE: 12/8/13 **TIME: 9.00 -11.00 AM**

DURATION: 2 HOURS

INSTRUCTIONS

1. **This paper contains five (5) questions.**
2. **Answer question 1 (compulsory) and ANY other TWO questions.**
3. **Write all answer in the booklet provided.**

SECTION A: ANSWER ALL QUESTIONS

Question 1

(a) Define the following terms: (2 marks)

(i) Organic synthesis

(ii) Retrosynthetic analysis

(b) What is the significance of "organic synthesis." Discuss any **TWO** counts. (2 marks)

(c) Name the four interrelated aspects which need to be considered in planning and designing synthesis. (2 marks)

(d) Distinguish between the following terms; (4 marks)

(i) Convergent and divergnent synthesis

(ii) Carbocation and carbene

(e) What are the limitations of organic synthesis? (4 marks)

(f) Starting with 1-bromopropane and 1,2-dibromoethane outline the synthesis of 2-pentanone. (6 marks)

(g) Isopropyl methyl ether [$(CH_3OCH(CH_3)_2$] may be prepared by any one of the following reactions. Which reaction would give the better yield? Explain your choice.

(I) $CH_3ONa + (CH_3)_2CHI \rightarrow CH_3OCH(CH_3)_2$

(II) $(CH_3)_2CHONa + CH_3I \rightarrow CH_3OCH(CH_3)_2$ (5 marks)

(h) Synthesis of symmetrical ethers is achieved by dehydration of primary alcohols. An exception to this restriction is the synthesis of unsymmetrical ether from tert-butyl alcohol with a primary alcohol in sulphuric acid at room temperature. Give a likely mechanism for this reaction and explain why it is successful. (5 marks)

SECTION B (40 MARKS): ANSWER ANY TWO QUESTIONS FROM THIS SECTION

EACH QUESTION CARRIES 20 MARKS

Question 2

(a) Synthesis of n-propylalcohol from n-propylbromide follows SN^2 mechanism while synthesis of tert-butly alcohol from tert-butyl bromide follows SN^1.

(i) Outline **THREE** differences between SN^1 and SN^2 (3 marks)

(ii) Give the mechanisms for the SN^1 hydrolysis with hot silver hydroxide and the SN^2 hydrolysis with hot potassium hydroxide. (7 marks)

(b) Which of the alkyl halides given below would you expect to react more rapidly by an SN^2 mechanism.

Explain your answer. (4 marks)

(I) $CH_3CH_2CH_2CH_2Br$ vs $CH_3CH_2\underset{\displaystyle Br}{\underset{|}{C}}HCH_3$

(II) $CH_3CH_2CH_2Cl$ vs $CH_3CH_2CH_2Br$

(c) With the aid of energy-reaction path diagrams, explain why the energy profile of SN^2 has only one transition state while SN^1 has two transition states. (6 marks)

Question 3

(a) Explain each of the following observations:

(i) Regiospecificity of hydrogenation of alkenes fails without a peroxide in the reaction matrix. (3 marks)

(ii) P-2 catalyst is preferred in place of Nickel metal. (2 marks)

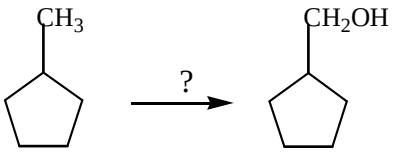
(iii) Acetylene is synthesizable from calcium carbonate. (3 marks)

(iv) Proton of acetylene is easily replaced by a metal. (2 marks)

(b) Outline the synthesis of 1-bromobutane from 1.2-dibromoethane and ethylbromide. Show all the necessary steps and the reaction mechanisms involved. (10 marks)

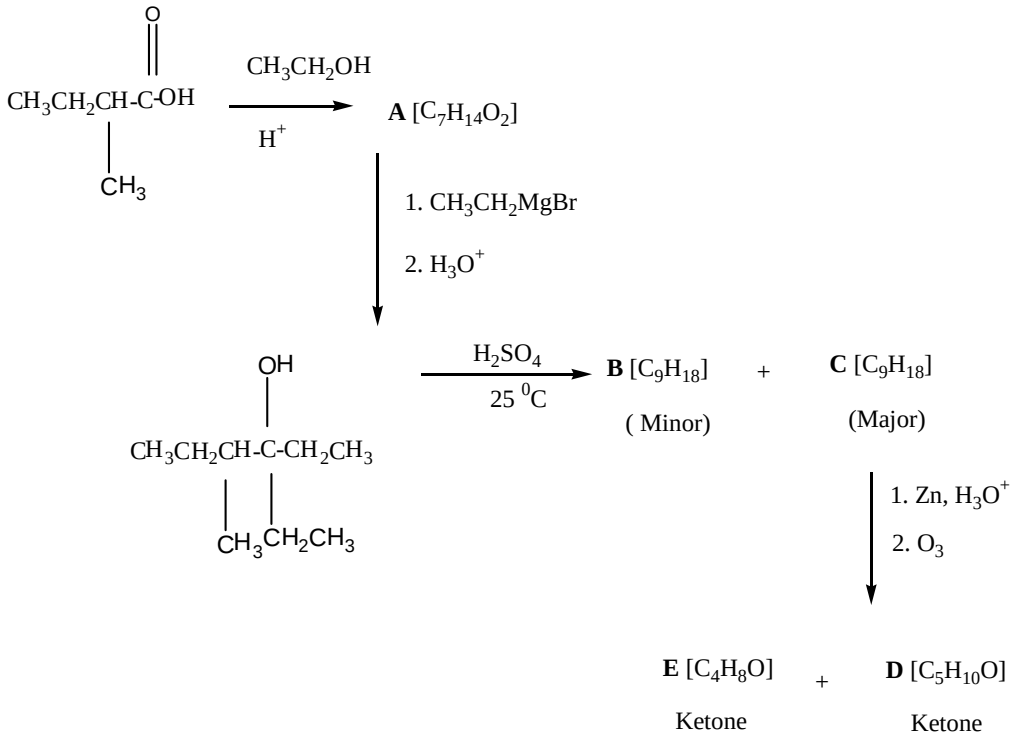
Question 4

(a) Outline the multistep synthesis of methylenehydroxycyclopentane from Methylcyclopentane: (8 marks)



(b) Why is chlorination not a preferred route. (2 marks)

(c) Give the structures and names for compounds **A-E.** (10 marks)



Question 5

a) Briefly discuss the synthetic pathway of any **ONE** of the following compounds. (15 marks)

(i) Quinines

(ii) Nicotine

(iii) Chloroquine

(iv) Pyrethrins

b) Discuss how organic chemical reactions can be classified with respect to structural change. (5 marks)

E ***N*** ***D***