KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BSc and B.ED (SCIENCE)

COURSE CODE: SCH 230

COURSE TITLE: ORGANIC CHEMISTRY I

DURATION: 2 HOURS

DATE: 12TH JANUARY 2018 TIME: 2 – 5PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **5** printed pages. Please Turn Over

QUESTION ONE

a) Draw the structures of the following molecules **(6 marks)**

i) Ethyl-2-bromo-4,4-dicyanobut-3-enoate

ii) 4-methyl-5-oxo-2-phenylhaxanoic acid

iii) 2-amino-4-hydroxypentanal

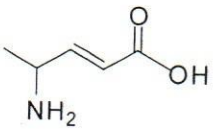
iv) 4-hydroxy-4-methylpentan-2-one

v) 3,6-dimethylcyclohexa-2,4-dienone

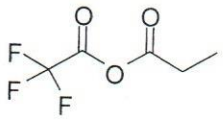
vi) (*Z*)-pent-2-enal

b) Give the IUPAC names of the following molecules **(6 marks)**

i)



ii)



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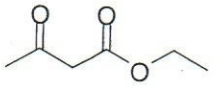

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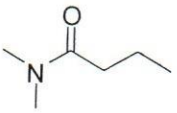

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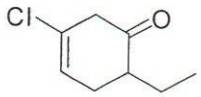

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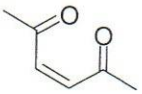


c) Draw all the possible resonance structures and the resonance stabilized hybrid of these organic molecules.

i) O_3 **(1½marks)**

ii) CH_2NH_2 **(1½marks)**

d) Give the functional groups for each of the following **(5 marks)**

i) Thiols

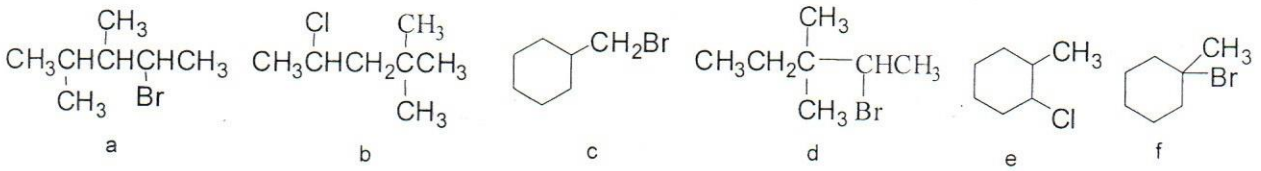
ii) Amines

iii) Esters

iv) Carboxylic acids

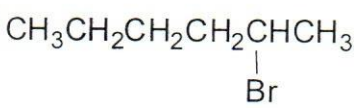
v) Ketones

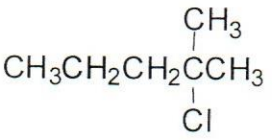
e) Which of the following alkyl halides forms a substitution product in an SN1 reaction that is different from the substitution product formed in an SN2 reaction? **(2 marks)**



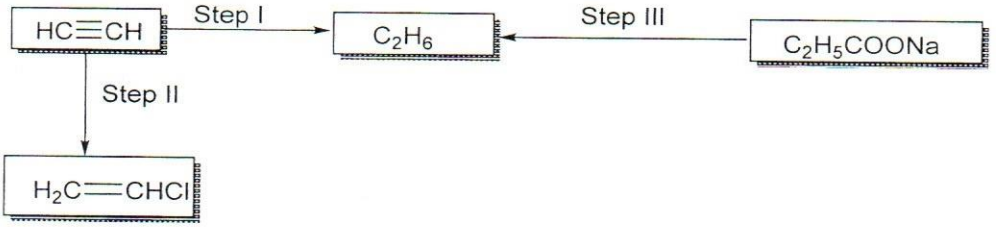
a b c d e f

f) For each of the following alkyl halides, indicate the major product formed when the alkyl halide undergoes an E1 reaction. Show the stereochemistry of the major products. **(4 marks)**

i) 

ii) 

g) Study the scheme below and answer the questions that follow.



i) Name the reagents in: **(3 marks)**

Step I

Step II

Step III

ii) Write an equation for the complete combustion of $HC{\equiv}CH$ **(1 mark)**

iii) Give two uses of methane **(2 marks)**

QUESTION TWO

a) Differentiate between an S_N1 and an S_N2 reaction. **(5 marks)**

b) For each of the following pairs of S_N2 reactions, indicate which reaction occurs faster and give explanation. **(8 marks)**

a. $CH_3CH_2Br + H_2O$ or $CH_3CH_2Br + HO^-$

b. $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2Br + HO^-$ or $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HBr + HO^-$

c. $CH_3CH_2Cl + CH_3O^-$ or $CH_3CH_2Cl + CH_3S^-$
(in ethanol)

d. $CH_3CH_2Cl + I^-$ or $CH_3CH_2Br + I^-$

c) Show all the carbocations formed, processes involved and name the products produced when 3-bromo-2,2-dimethylbutane undergoes S_N1 reaction with H_2O and also when it undergoes S_N2 with
^-OH. **(6 marks)**

QUESTION THREE

a)i) Draw all the isomers of C_5H_{12}, give their IUPAC names and arrange them in order of decreasing boiling points. **(7 marks)**

ii) Give a reason for the order of boiling points **(1 mark)**

b) i) Give the major and minor products for the bromination of propane **(1 mark)**
ii) Explain this **(1 mark)**

c) Define the following terms **(4 marks)**

i) Chiral center
ii) Diastereomers
iii) Electrophile
iv) Nucleophile

d) Draw the E and Z isomers of the following molecules. **(6 marks)**

i) 1-bromo-1-chloropropene
ii) 2-bromo-1-chloropropene
iii) 1-bromo-1,2-dichloroethene

QUESTION FOUR

a)The reaction of *tert*-butyl bromide with water to form 2-methylpropene is an example of an E_1 reaction. Write the mechanism of this reaction. **(3 marks)**

b) i) Write an equation showing the products of reaction 2-bromopentane in methanol proceeding via an E2 reaction mechanism. **(1 mark)**

ii) Name the major and minor products **(2 marks)**

c)State Zaitsev's rule **(1 mark)**

d) State the rate law for the E1 and E2 reactions respectively. **(2 marks)**

e) i) Using radical substitution reaction mechanism, show the steps involved in the bromination of methane. **(9 marks)**

ii) Name the type of cleavage that occurs to bromine molecule in presence of light. **(1 mark)**

QUESTION FIVE

a)State how to distinguish the following organic compounds with relevant chemical reactions

i)Aldehyde and ketones **(2 marks)**
ii) Alkenes and alkanes **(2 marks)**

iii) Primary and tertiary alcohols **(2 marks)**

iv) Alcohols and ether **(2 marks)**

b) Give the products or reagents required in the following reactions **(8 marks)**

i) $H_3CC{\equiv}CH \xrightarrow[2)\ CH3CH2Br]{1)\ NaNH_2}$

ii) $H_3CC{\equiv}CH \xrightarrow{2\ HBr}$

iii) $H_3CHC{=}CH_2 + Cl_2 + H_2O \longrightarrow$

iv) $+ H_2 \xrightarrow[25^0C,\ 3atm]{Pd}$ 

v) $H_3CHC{=}CH_2 +$ $\longrightarrow$ $CH_3\underset{OH}{C}HCH_3$

vi) $3\ CH_3C{\equiv}CCH_3 + BH_3 \xrightarrow[2)HO^-,\ H_2O_2]{1)\ THF} H_2O$

c) Arrange in order of increasing cabocation stability. Give a reason for the stability. **(4 marks)**

methyl, ethyl, isopropyl, *tert*-butyl