KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2015/2016 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 230

COURSE TITLE: ORGANIC CHEMISTRY I

DURATION: 2 HOURS

DATE: 12/05/2016 **TIME: 11.30 - 1.30PM**

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 **6** printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

Question 1

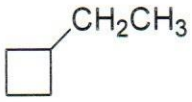
a) Give the systematic (IUPAC) names for each of the following compounds **(5 marks)**

i) $CH_3CH_2CHClCH_2CH_3$

ii) $CH_3CH_2OCH_2CH_3$

iii) $CH_3NHCH_2CH_2CH_3$

iv) 

v) 

b) Draw the structures of the following compounds. **(4 marks)**

i) 3-methyl-3-heptene

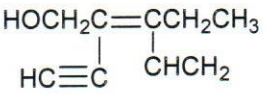
ii) 6-bromo-4-ethyl-2-heptanol

iii) 4-methyl-2-hexyne

iv) 1,3-dimethylcyclohexane

c) Draw and label the E and Z isomers of the following compounds **(4 marks)**

i) $CH_3CH_2CClCHCH_2CH_3$

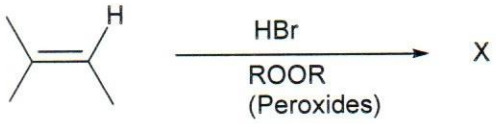
ii) 

d) Draw the structures of: **(2 marks)**

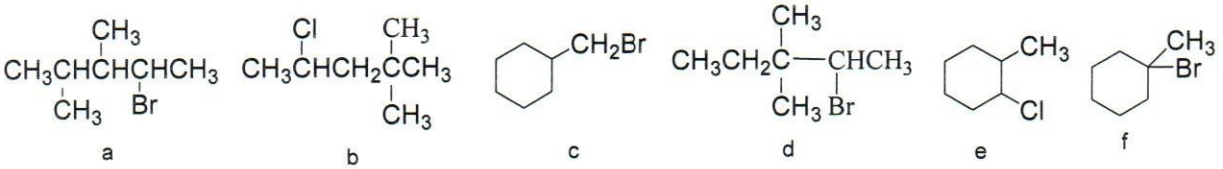
i) *Cis*-1,2-dimethylcyclopentane

ii) *Cis*-but-2-ene

e) Draw the structure of the product X. Give a reason. **(3 marks)**

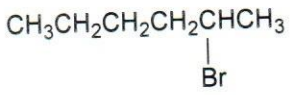


f) Which of the following alkyl halides forms a substitution product in an SN1 reaction that is different from the substitution product formed in an SN2 reaction? **(2 marks)**

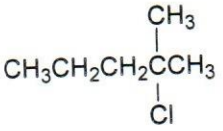


g) For each of the following alkyl halides, indicate the major product formed when the alkyl halide undergoes an E1 reaction. Show the stereochemistry of the major products. **(4 marks)**

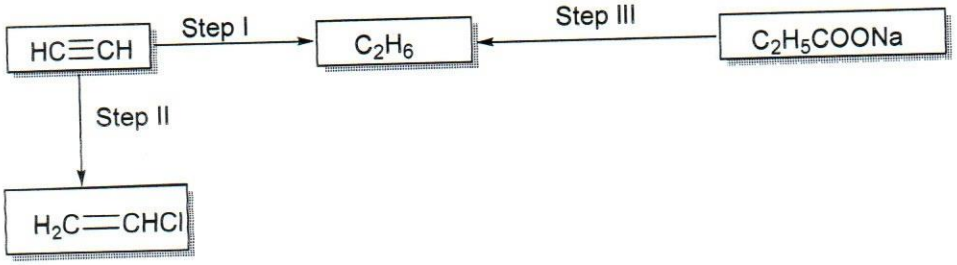
i)



ii)



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



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

Step I

Step II

Step III

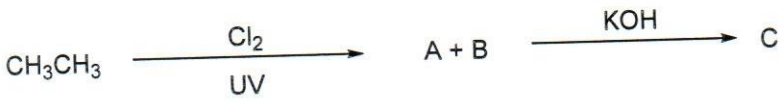
ii) Write an equation for the complete combustion of $HC\equiv CH$ **(1 mark)**

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

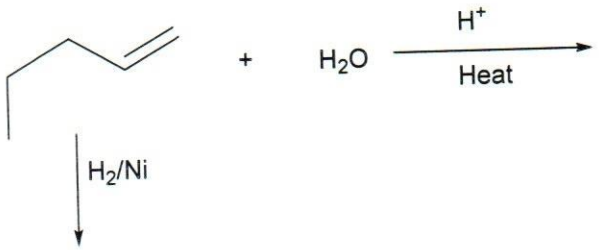
Question Two

a) Complete the reactions below:

i) **(3 marks)**



ii)



(2 marks)

b) Label and show the steps of the monohalogenation reaction leading to products A and B above using curly arrows **(6 marks)**

c) Explain the following:

i) 1,3-pentadiene is more stable than 1,4-pentadiene **(2 marks)**

ii) Ethers generally have a higher boiling points than alkanes of comparable molecular weight **(1 ½ marks)**

iii) Alkanes have lower boiling points than alcohols of comparable molecular weight **(1 ½ marks)**

iv) Amines have lower boiling points than alcohols of comparable molecular weight **(2 marks)**

v) Primary amines are more soluble in water than secondary amines with same number of carbons **(2 marks)**

Question Three

a) Write the ground-state electron configuration for the following (indicate the orbitals that are being filled) **(5 marks)**

i) Ca

ii) Ar

iii) Mg^{2+}

iv) O

v) C

b) Give the hybridization of the central atom and the shape of the molecule in each of the following species **(5 marks)**

i) BH_3

ii) CO_2

iii) CH_4

iv) H_2O

v) NH_3

c) Using curved arrows, show how an equally stable resonance structure can be generated for each of these anions **(5 marks)**

i) NO_3^-

ii) CO_3H^-

iii) BO_3^-

iv) $[CH_2NH_2]^+$

d) i)Define isomerism **(1 mark)**

ii) Draw and name the isomers of C_4H_6 **(4 marks)**

Question Four

a) Consider the isomers:

A) 1-bromo-3-methylbutane

B) 2-bromo-2-methylbutane

C) 12-bromo-3-methylbutane

i) Select the isomer that will be most reactive in an SN2 reaction and illustrate its SN2 and E2 mechanisms when it reacts with sodium methoxide ($NaOCH_3$). **(6 marks)**

ii) Select the isomer that will be most reactive in an SN1 reaction and illustrate its SN1 and E1 mechanisms when it reacts with methanol (CH_3OH) **(9 marks)**

b) Calculate the formal charge of each atom in the ions/molecules below: **(2 marks)**

i) NO_3^- **(1 marks)**

ii) NH_3 **(1 marks)**

iii) H_2O **(1 marks)**

iv) CH_4

Question Five

a) Give the products of the following reactions

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

ii) $H_3CC{\equiv}CH \xrightarrow{2\ HBr}$ **(1 mark)**

iii) $H_3CHC{=}CH_2 + Cl_2 + H_2O \longrightarrow$ **(1 mark)**

iv)  $+ H_2 \xrightarrow[25^0C,\ 3atm]{Pd}$ **(1 mark)**

v) $H_3CHC{=}CH_2 + H_2O \longrightarrow$ **(1 mark)**

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

b) Draw Lewis structures for the four alcohols with molecular formula $C_4H_{10}O$. Classify each as a 1^0, 2^0 or 3^0 alcohol **(8 marks)**

c) Use δ^- or δ^+ symbols to indicate polarity in these covalent bonds **(6 marks)**

i) N—O

ii) H—S

iii) C—N

iv) O—H

v) C—Cl

vi) C=O