KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2015/2016 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE DEGREE

COURSE CODE: SCH 212

COURSE TITLE: BASIC ORGANIC CHEMISTRY

DURATION: 2 HOURS

DATE: TUESDAY 5TH MAY 2016 **TIME:** 8 – 10AM

INSTRUCTIONS TO CANDIDATES

- Answer Question one and any other two of your choise.
- 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 **3** printed pages. Please Turn Over

KIBU observes ZERO tolerance to examination cheating

SECTION A. (30 MARKS)

COMPULSORY

1. a) Define the following terms:

   (i) Atomic orbitals **(1 mark)**

   (ii) Hybridization **(1mark)**

   (iii) Alicyclic **(1mark)**

   (iv) Functional group **(1mark)**

   (v) Electronegativity **(1mark)**

   b) Differentiate between a resonance hybrid and a hybrid orbital? **(4 marks)**

   c) Write the complete structural and condensed structural formulas for the following.

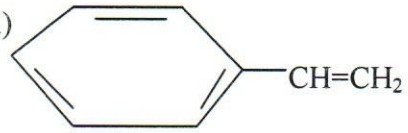
   (i) 2-methyl -2- propanol **(2marks)**

   (ii) 1,2-dichloro-1,1,2,2- tetrafluoro ethane **(2marks)**

   d) State the functional group(s) in the structural formulas of each of the following compounds and give the class (or classes) of compounds to which each belongs.

   (i) $ClCH_2CH_2OH$

   (ii)



   (iii)$CH_3CH_2COOCH_2CH_3$

   (iv)CH_3CH_2Br

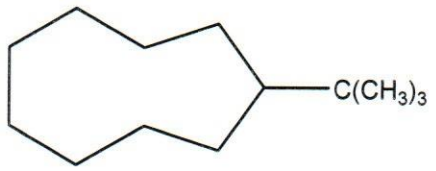
   (v) $HCON(CH_3)_2$

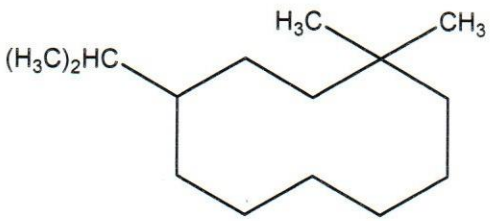
(5marks)

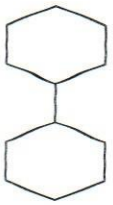
   e) Predict the product of the following reaction, which takes place by the $S_N2$mechanism.

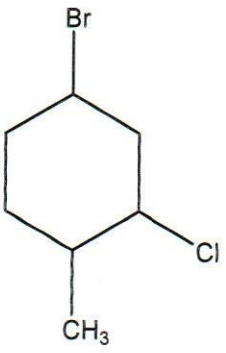
   $CH_3CH_20^-+CH_3CH_2CH_2Br \longrightarrow$ **(4marks)**

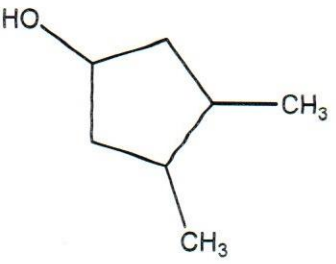
   f) Give the IUPAC names of the following compounds. **(8marks)**

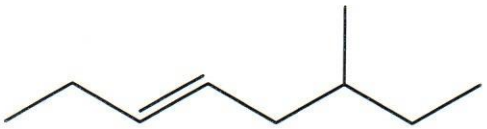
(i) 

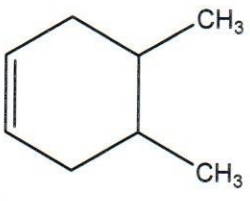
(ii) 

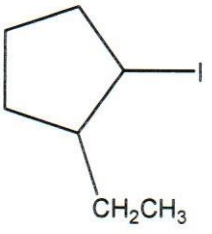
(iii) 

(iv) 

(v) 

(vi) 

(vii) 

(viii) 

SECTION B (40 MARKS)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO

a). Write structural formula for a substrate that could be used to make $C_6H_5CH_2CN$ by an S_N2 reaction and show the nucleophile that would be used. **(3marks)**

b) Explain any **three** reasons why carbon is uniquely important. **(3marks)**

c) Write structural formula for:

i) Heptane

ii) 2-chloro-3-methylhexane

iii) 3-bromo-2-chloroheptane

iv) Pentan-2-ol

v) Hex-2-ene

vi) Butanoic acid **(6marks)**

c. Explain the difference between

(i) Homolytic fission and heterolytic fission, giving an example of each. **(4marks)**

(ii)A substitution reaction and an addition reaction, giving an example of each **(4marks)**

QUESTION THREE

(a) Draw dot-and-cross diagrams for

i) F_2

ii) HF

iii) SIF_4

iv) SCl_2

(4marks)

b). Draw and name the E/Z isomers for

$CH_3CH=CHCH_2CH_3$. **(3marks)**

c). i).Write and name the possible isomers of $C_2H_4Cl_2$ **(2 marks)**

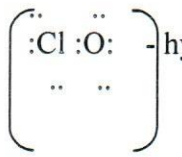
ii) Name the type of isomerism exhibited in c (i) above **(1mark)**

iii) Explain how one of the isomers above reacts with potassium hydroxide. Indicate the equation(s) of the reaction and mechanism for the reaction. **(2 marks)**

d). i) Define formal charges? **(2marks)**

ii).Calculate the formal charge on each atom in the following Lewis formula and determine the net charge:

(A) (:C::O: - carbon monoxide

(B)  hypochlorite

(6marks)

QUESTION FOUR

a) State the **three** principles used to distribute electrons in orbitals. **(6marks)**

b) Show the distribution of electrons in the atomic orbitals of: (i) carbon, (ii) oxygen and (iii) nitrogen. **(3marks)**

c) Identify each of the following as (1) carbocations, (2) carbanions, (3) radicals or (4) carbenes **(4 marks)**

(i) $(CH_3)_2C:$

(ii) $(CH_3)_3C\cdot$

(iii) $(CH_3)_3C^+$

(iv) $(CH_3)_3C:^-$

(v) $CH_3\dot{C}H_2$

(vi) $CH_3CH{=}\dot{C}H$

(vii) $C_6H_5\dot{C}HCH_3$

(viii) $CH_3\ddot{C}H$

d) Classify the following reactions as substitution, addition, elimination, rearrangement, or redox. (A reaction may have more than one designation.) **(7marks)**

(a) $CH_2{=}CH_2 + Br_2 \longrightarrow CH_2BrCH_2Br$

(b) $C_2H_5OH + HCl \longrightarrow C_2H_5Cl + H_2O$

(c) $CH_3CHClCHClCH_3 + Zn \longrightarrow CH_3CH{=}CHCH_3 + ZnCl_2$

(d) $NH_4^+(CNO)^- \longrightarrow H_2NCNH_2$ (O)

(e) $CH_3CH_2CH_2CH_3 \longrightarrow (CH_3)_3CH$

(f) $H_2C(CH_2)CH_2 + Br_2 \longrightarrow BrCH_2CH_2CH_2Br$

(g) $3CH_3CHO + 2MnO_4^- + OH^- \xrightarrow{\Delta} 3CH_3COO^- + 2MnO_2 + 2H_2O$ (Δ means heat.)

(h) $HCCl_3 + OH^- \longrightarrow :CCl_2 + H_2O + Cl^-$

(i) $BrCH_2CH_2CH_2Br + Zn \longrightarrow H_2C(CH_2)CH_2 + ZnBr_2$