TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4204 : STEREOCHEMISTRY AND CONFORMATIONAL

ANALYSIS

PAPER 2

SERIES: APRIL 2016

TIME: 2 HOURS

DATE:

Instructions to Candidates
You should have the following for this examination
  -*Answer Booklet, examination pass and student ID*
This paper consists of FIVE questions. Attempt Question ONE and any other TWO.
Do not write on the question paper.

Question ONE

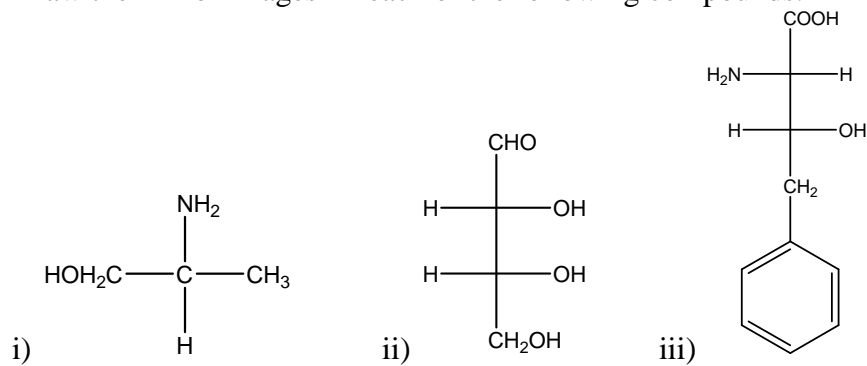   a)   Differentiate between the following terms
        i)   R- and S- stereocentre
        ii)   Symmetric and assymmetric centre
        iii)   (+) and (-) stereoisomer
        iv)   Meso compound and erythro enantiomer

                                                            (8marks)
   b)   Describe the following pairs of compounds using E- or Z- , cis or trans, R- or S-
        and D- or L-.

i) and

ii) and

iii) and

iv) and
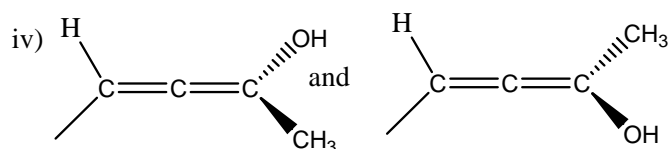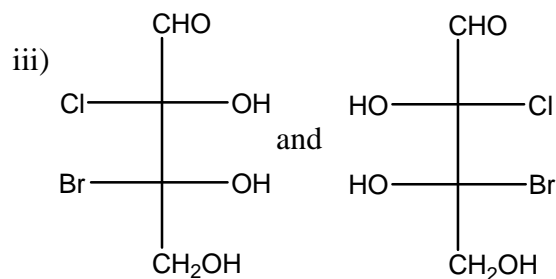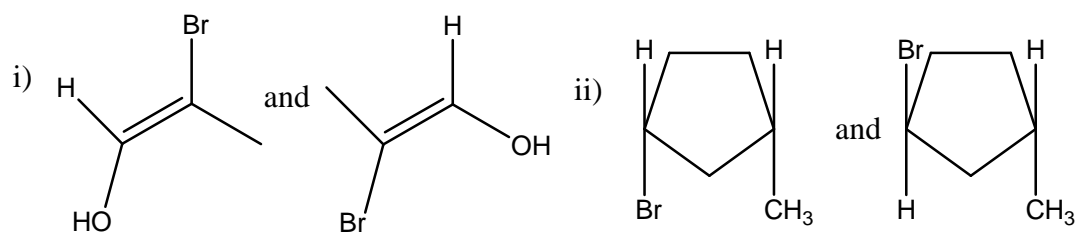
(8marks)

c) Draw the mirror images in each of the following compounds.

i)

ii)

iii)

(4.5marks)

d) Describe the chair and boat conformations of cyclohexane showing clearly the positions of hydrogens.
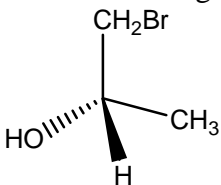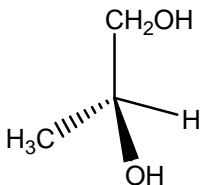
(6marks)

e) The conformational free energy of a nitro group is -4.6 $KJmol^{-1}$ at 25^0C. Calculate the conformational equilibrium constant of nitrocyclohexane.

(3.5marks)

Question TWO

a) Explain the following terms
   i) Configuration
   ii) Racemic mixture

   (4marks)

b) 2.0mg of a sample of (-) - glyceraldehyde was dissolved in 10 ml of water and the solution placed in a 100 mm long polarimeter cell. An optical rotation of -1.74^0 was measured at 25^0C.

   i) Calculate the specific rotation of the sample.　　　　　(3marks)
   ii) If the specific rotation of pure (-) – glyceraldehydes is -13.5^0 work out the % optical purity .　　　　　(3marks)
   iii) Calculate the % of (+)- and (-)- glyceraldehyde in the sample.

   (4marks)

c) Using Newmann projections draw the conformations of butane and suggest the preferred conformation.

   (6marks)

Question THREE

a) i) Explain the term exocyclic double bond.　　　　　(2marks)
   ii) Describe the steps followed in assigning R and S to exocyclic compounds.

   (4marks)

b) Draw enantiomers of 2-chloropropanol using the 3-D perspective formulae.

   (4marks)

c) Convert the following perspective formula into Fischer projection and show the stereogenic centre using an asterisk *.

i)　　　　　　　　　　ii)

(5marks)

d) State the factors that affect the angle of rotation of plane polarised when passed through enantiomeric solutions.

   (5marks)

Question FOUR

a) Explain the following terms
    i)   Stereospecific reaction
    ii)   Stereoselective reaction
    iii) Regioselective reaction

                                                                (6marks)

b) Using equations involving cis and trans stilbene and meta-chloroperoxybenzoic acid (m-CPBA) describe the stereospecific formation of
    i)   Cis – epoxide
    ii)   Trans-epoxide

                                                                (6marks)

c) At 25^0C the ratio of anti- and gauche conformations of 1,2- dichloroethane from dipole moments results was found to be 8:1. Calculate
    i)   Draw the anti- and gauche- conformers of 1,2- dichloroethane using Newman projection.

                                                                (4marks)

    ii)   The equilibrium constant K.

                                                                (2marks)

    iii) The Gibbs free energy difference (G) between the two conformations given that G = -RTln K and R= 8.314Jmol^{-1}K^{-1}

                                                                (2marks)

Question FIVE

a) Use the compound below to answer questions that follow
        $CH_3CH(Br)CH(Br)CH_3$

    i)   Determine the maximum number of stereoisomers possible for this compound.   (2marks)
    ii)   Draw the Fischer projections of the stereoisomers.

                                                                (6marks)

    iii) Which of the isomers in (ii) above are optically inactive. Explain your answer.   (2marks)

b) i)   Explain the term cycloaddition reaction.

                                                                (2marks)

    ii)   Differentiate between [4+2] and [2+2] – cycloaddition reaction giving an example of each.

                                                                (6marks)

c)   Explain how *Penicilium glaucum* bacteria act as resolving agents in resolution of enantiomeric mixture of 2-hydroxypropanoic acid.

                                                                (2mks)