MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

……SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF ……

SCH 303: STEREOCHEMISTRY, CONFORMATIONAL STUDIES AND REACTION MECHANISM

DATE: **TIME:**

INSTRUCTIONS:

Answer question **ONE** which is compulsory and any other **TWO**

QUESTION ONE

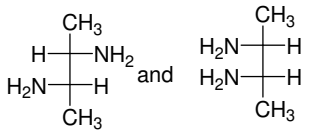
a) Define the following terms as used in stereochemistry. (4 marks)

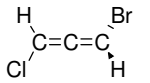
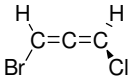
(i) Diastereomers ii) Enantiomers iii) Racemization

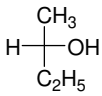
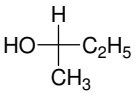
iv) Chiral carbon

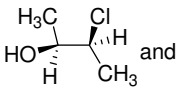
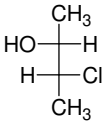
b) Indicate whether each of the following pairs of compounds is identical, enantiomers, diastereomers

or constitutional isomers. (6 marks)

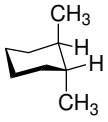
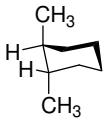
a)  and

b)  and 

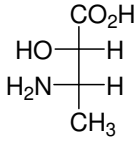
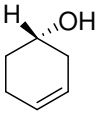
(c)  and 

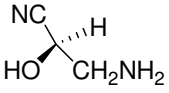
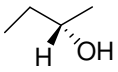
(d)  and 

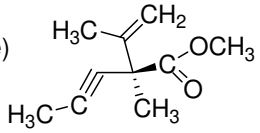
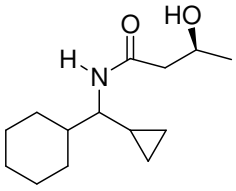
(e)  and 

(f)  and 

c) Indicate the configuration (R or S) of the stereogenic centres in the following compounds. (8 marks)

a)  b) 

c)  d) 

(e)  (e) 

d) 2.0g of a sample of 1-chloro-2-methylbutane were dissolved in 10ml of ethanol and the solution placed in a 100cm polarimeter tube. If the observed rotation of -11.5^{o} was measured at 25^{o}C with light wavelength 598nm.

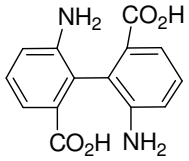
i) Calculate the specific rotation of the sample. (3marks)

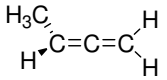
ii) If the specific rotation of the pure (S)-(+)- chloro-2-methylbutane is+14.375^{o}. Determine

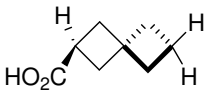
a) The optical purity. (2 marks)

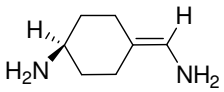
b) What is the percentage of R- and S-isomer present in the solution? (2 marks)

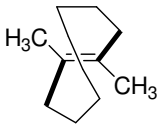
e) Indicate whether the following compounds are chiral or achiral. (5 marks)

(a) 

(b) 

(c) 

(d) 

(e) 

QUESTION TWO

a) Draw the chair conformations of each of the following compounds and indicate with reasons which will be the most stable in each case.(10 marks)

(i) *Trans*-1,2-dimethylcyclohexane

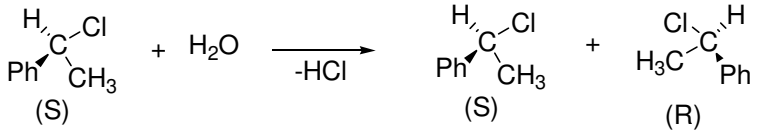
(ii) *Cis*-1-methyl-3-ethylcyclohexane

(iii) *Cis*-1,4-dimethylcyclohexane

(iv) *Trans*-1-ethyl-3-methylcyclohexanone

(v) *Trans*-1,4-difluorocyclohexanone

b) When the (S)-alkylbromide (2) is hydrolysed with water, a racemic mixture of the (R)- and (S)-alcohol (3) are obtained. Explain using a reaction mechanism why equal amounts of the enantiomers are obtained.(5marks)



2 **3**

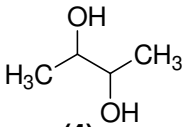
c) Using compound **4** below

(i) Determine the maximum no of stereoisomers. (1mark)

(ii) Using Fischer projections, Draw all the possible stereostructures of compound **4**.

(3 marks)

(iii) Which of the isomer(s) in (ii) above are optically inactive?(1 mark)



(4)

QUESTION THREE

a) Using Newman Projections draw the preferred conformation(s) of the following compounds and give reasons for your choice.(8 marks)

(i) $CH_3CH_2CH_2F$

(ii) $OHCH_2CH_2OH$

(iii) $OHCH_2CH_2Br$

(iv) $ClCH_2CH_2Br$

b) Discuss any 3 resolutions methods.(8marks)

c) Distinguish between the following:

(i) Stereoisomers and Epimers (2 marks)

(ii) Conformational and configurational isomers (2 marks)

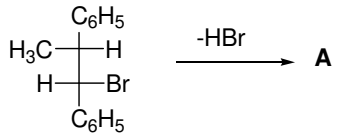
QUESTION FOUR

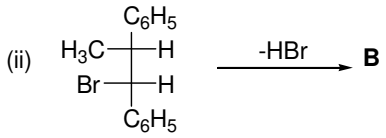
a) Differentiate between the following.(4 marks)

(i) Stereospecific and stereoselective reaction

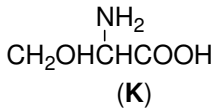
(ii) Enantioselective and regioselective reaction

b) Write the structure of the major products of elimination from each of the following reactions. Give reason for your choice in each case.(4 marks)

(i) 

(ii) 

c) Draw the Fischer projections for the compound (**K**) below and assign D and L configuration in each case. (4 marks)



(**K**)

d) If the conformational free energy of the methoxy group –(OCH_3) is -3.1 at 25°C. Calculate;

e) i) The conformation equilibrium constant of the system. (4 marks)

ii) The percentages of the axial and equatorial methoxy groups. (4 marks)

$\Delta G^{o} = -RTLnK$: R = 8.314Jmol/^{o}K

QUESTION FIVE

a) By use of an Energy profile diagram explain the 4 differentconformations of cyclohexane. (10 marks)

b) In Ethane, all the staggered or eclipsed conformations are of equal energy. Explain why in 1,2-dibromoethane the staggered or eclipsed conformations have different amount of energies or different stability.(6 marks)

c) Classify with reasons the Ha and Hb in the following compounds as enantiotopic, homotopic or diastereotopic.(4 marks)