JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL & PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF EDUCATION SCIENCE

4th YEAR 1st SEMESTER 2015/2016 ACADEMIC YEAR

REGULAR - RESIT

COURSE CODE: SCH 411

COURSE TITLE: STEREOCHEMISTRY

EXAM VENUE: LAB 1 **STREAM: (BEd. Science)**

DATE: 5/05/2016 **EXAM SESSION: 2.00-4.00PM**

TIME: 2 HOURS

Instructions:

1. **Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Section A Question One COMPULSORY (30 marks)

A. Describe the following terms (5 marks)
   i. Chirality
   ii. Enantiomers
   iii. Racemic mixture
   iv. Specific rotation
   v. Levorotatory

B. Name two chiral compounds with no stereogenic centres (6 marks)

C. The term chiral center refers to an atom in the molecular structure while the term chiral molecule refers to the entire molecule. From this points differentiate between *cis*- and *trans*-1,2-dimethylcyclohexane as chiral and achiral molecules while showing the chiral centres. (4 marks)

D. Differentiate between torsional strain and angle strain and (5 marks)

E. Using a potential energy diagram carry out a conformational analysis for ethane (6 marks)

F. What is the necessary and sufficient condition for (4 marks)
   i. the existence of enantiomers?
   ii. The existence of trans and cis isomers?

Section B: This section contains FOUR questions. Answer ONLY TWO questions.

Question Two (20 Marks)

A. By drawing Newman projection formulas show how potential energy changes occur in Propane when the molecule is rotated around C1-C2 bond axis through a complete cycle. (10 marks)

B. Draw the optically active and *meso* form of 1,3-cyclohexane dicarboxyllic acid (4 marks)

C. With an example explain whether geometrical isomers is possible for single bonded compounds. (6 marks)

Question Three (20 Marks)

A. Name and explain the main causes of the differences in the relative stabilities of cyclopropane, cyclobutane, cyclopentane and cyclohexane. (10 marks)

B. Deduce the structural formula for an optically active alkene, C_6H_{12}, which reacts with H_2 to form an optically inactive alkane, C_6H_{14}. (4 marks)

C. Draw the structures of three *meso* diastereomers of $C_6H_{12}Br_2$ (6 marks)

Question Four (20 Marks)

A. With an example explain whether geometrical isomers is possible for single bonded compounds. (4 marks)

B. With reference to *tert*-butylcyclohexane explain the meaning of 1,3-diaxial interaction. (6 marks)

C. Draw the structures of three *meso* diastereomers of $C_6H_{12}Br_2$ (6 marks)

D. What is a sawhorse formula? How does it differ from Newman projection? (4 marks)

QUESTION FIVE (20 Marks)

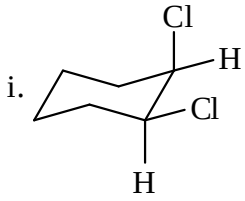
A. Answer True or False to each of the following statements and explain your choice. (6 marks)

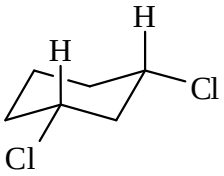
i. There are two broad classes of stereoisomers.

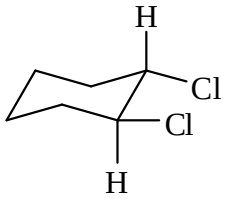
ii. Achiral molecules cannot possess chiral centers.

iii. Racemization of an enantiomer must result in the breaking of at least one bond to the chiral center.

B. Consider each of the following conformational structures and tell whether each is *cis* or *trans*: (6 marks)

i. 

ii. 

iii. 

C. i. With the aid of structures indicate the possible types of isomerisms exhibited by the following compounds (4 marks)

a. C_5H_{10} b. C_3H_6O c. $CH_3C{\equiv}CCH_3$ d. $ClCH{=}CHCl$

ii. Explain why substitution reactions are not very common for substituted cyclohexane (4 marks)