



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2015/2016 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS
FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: SCH 333

**COURSE TITLE: STEREOCHEMISTRY, CONFORMATIONAL STUDIES AND
REACTION MECHANISMS**

DURATION: 2 HOURS

DATE: 27TH SEPTEMBER 2017 TIME: 11:30 AM – 1:30 PM

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 5 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

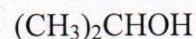
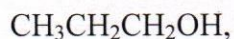
SECTION A (Compulsory)
QUESTION ONE (30 Marks)

1. a) Define the following terms: (2 marks)

- I. A stereogenic centre
- II. Polarimeter

b) Why does a racemic mixture have a specific rotation of Zero? (2 marks)

c) Rank the following compounds in order of increasing boiling points (from the highest to the lowest).



d) Draw the structures of (i) (S)-2-bromopentane.

(ii) (R)-1-Chloroethanol

(iii) meso-Tartaric acid (3 marks)

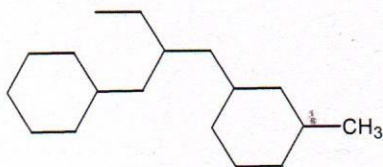
e) Indicate Whether each of the statements below is true or false for enantiomers. (4 marks)

- A. They have a non-superimposable mirror image
- B. They have no asymmetric carbon atom
- C. They are chiral
- D. They do not rotate the plane of polarized light

f) write the rate law for an $\text{S}_{\text{N}}2$ reaction mechanism? (2 marks)

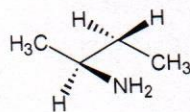
a) g). A 3.0 g sample of an was dissolved in 10.0 ml of ethanol and placed in a sample with a path length of 5.0 cm. the observed rotation at the sodium D line was $+1.21^\circ$. Calculate the specific rotation $[\alpha]_{\text{D}}$ for this compound. (3 Marks)

h) Consider the structure below:



- I. Label the stereogenic centers in the structure above using an asterisk (*) (3 marks)
- II. How many possible stereoisomers can be generated for this structure? (3 marks)

- i). Consider the chemical structure of 2-aminobutane shown below. Citing down the C-2 -C-3 bond, draw a Newman projection specifically for this structure. (3 marks)



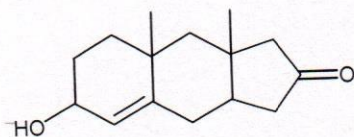
SECTION B: Answer any TWO questions from this section.

QUESTION TWO (20 Marks)

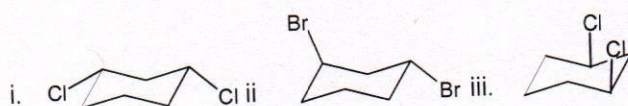
2.a) Using a specific example in each case, Explain the meaning of the following terms:

- | | |
|-----------------------|-----------|
| I. Zaitzeff product | (2 marks) |
| II. Stereospecificity | (2 marks) |
| III. Enantiomers | (2 marks) |
| IV. Racemic mixture | (2 marks) |

- b) Draw the preferred conformation for each of the two stereoisomers of 1-fluoro -4-ethylcyclohexane. Indicate, with an explanation the more stable of the two stereoisomers (5 marks)
- c) Label all stereocenters in the molecule below with asterisk (*). How many stereoisomers are possible for this molecule? (4 marks)

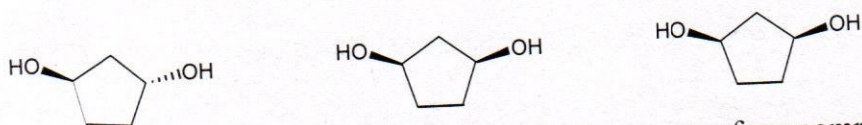


- d) State whether the molecule below is cis or trans? (3 marks)



QUESTION THREE (20 MARKS)

3. a) what is a meso compound? (2 marks)
- b) Which one of the following compounds represents a meso compound and why? (3 marks)

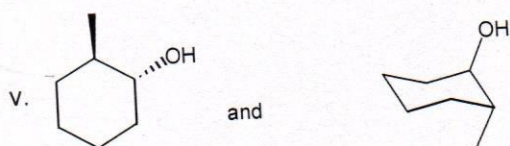
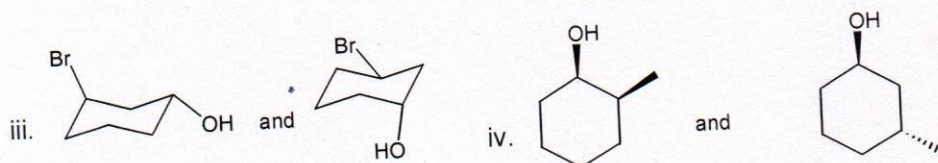
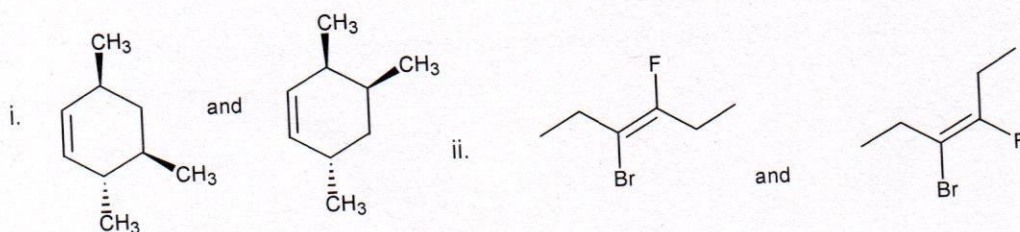


c) what is the maximum number of stereoisomers for a compound with 3 stereogenic centers, if one of the isomers is a meso compound? (3 marks)

d) Is the following statement True or False?

Mirror images of a molecule are enantiomers. (1 marks)

e) Indicate whether the two compounds in each pair below are identical compounds, conformers, enantiomers, meso compounds, diastereomers, constitutional isomers or different compounds. Give a reason for your answer. (10 marks)

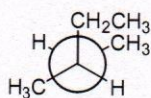
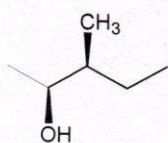


QUESTION FOUR (20 MARKS)

4a) Consider the following 5 statements about substitution and elimination reactions. Indicate whether each statement is TRUE or FALSE. (12 marks)

- I. Hofmann elimination yields the less substituted alkene as the major product. TRUE or FALSE
- II. E_2 reactions are often favoured over S_N2 reactions at higher reaction temperature. TRUE or FALSE
- III. Doubling the concentration of the base in an E_1 reaction does not affect the rate of the reaction. TRUE or FALSE

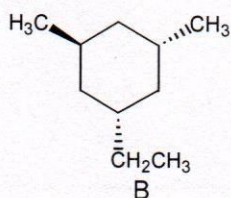
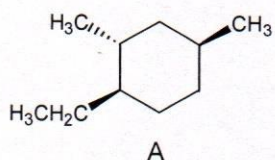
- IV. Both S_N2 and E_2 reaction mechanisms involve a carbocation intermediate. TRUE or FALSE



- V. In S_N1 mechanism, the stereochemistry involves inversion of configuration at the site of substitution. TRUE or FALSE

- VI. The two compounds below are identical TRUE or FALSE

- b) Using clearly drawn structures and some concise words, explain which of the two compounds below is the most stable. (8 marks)



QUESTION FIVE (20 MARKS)

- 5a) Which of the following cycloalkanes has the least angle strain? Explain. (4 marks)



- b) A mixture of 2-butanol has a specific rotation of 6.75° at 25°C .

The specific rotation of the pure enantiomer is $+13.5$.

(8 marks)

- Which enantiomer is in excess, (+)- or (-)-enantiomer?
- What is the enantiomeric excess of this sample?
- What is the total % (+)-enantiomer?
- What is the total % (-)-enantiomer?

- c) Shown below are four numbered Newman projections (1-4) for 1,2-dibromoethane and a rotational energy profile diagram. At each energy minimum and maximum (letters A-D), on the diagram, write in the number of the Newman projection that

corresponds to that energy.

