



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF BSC (CHEMISTRY)

COURSE CODE: SCH 325

COURSE TITLE: STEREOCHEMISTRY

DURATION: 2 HOURS

DATE: 18/1/2022

TIME: 8-10AM

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

QUESTION ONE (30 MARKS)

a) Define the following terms

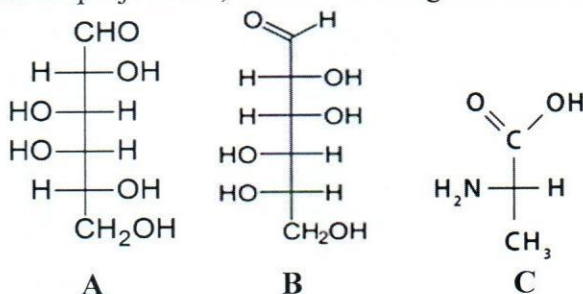
(5 marks)

i. Stereochemistry ii. Enantiomers iii. Asymmetric carbon iv. Diastereomers v. Optical activity

b) List five properties of enantiomers

(5 marks)

c) Study the following Fischer projections, A and B are sugars while C is an amino acid.



i. Name the structures as D or L

(3 marks)

ii. Sketch and name the mirror images of the sugars above as L or D sugars

(3 marks)

iii. Are A and B enantiomers? Explain your answer

(2 marks)

iv) Calculate the number of stereoisomers present in structures A and C

(4 marks)

d) Chiral molecules can be drawn on paper in 2 dimensional structures referred to as projections.

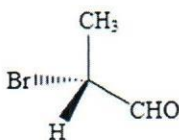
Name the four projections

(4 marks)

e) Explain why *trans*-1,2-Dimethylcyclobutane is more stable than *cis*-1,2-dimethylcyclobutane.

(2 marks)

f) The molecule shown below in dash wedge formula, convert it to Fischer projection (2 marks)



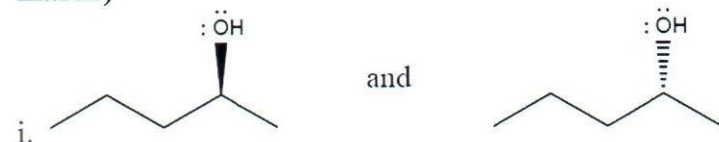
QUESTION TWO (20 MARKS)

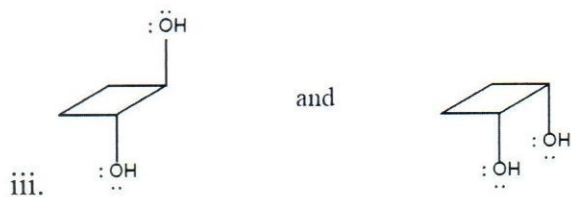
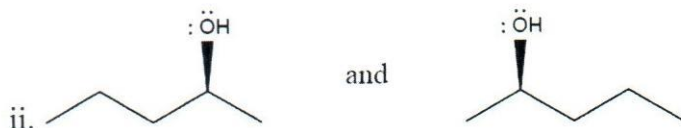
a) Name and discuss the different types of strain experienced by organic molecules (20 marks)

QUESTION THREE (20 MARKS)

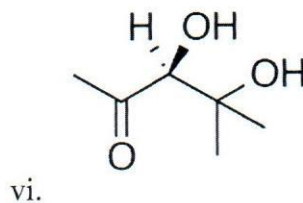
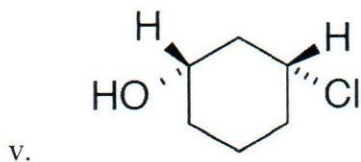
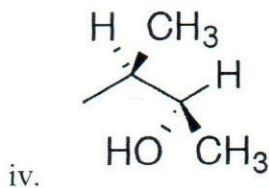
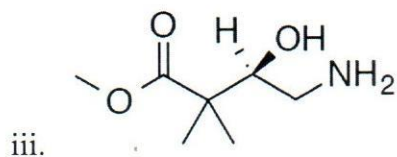
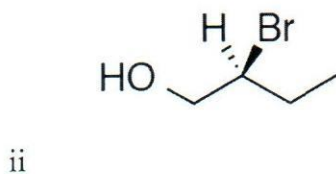
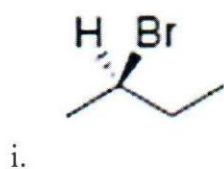
a) Indicate whether each of the following pairs of molecules is: a pair of enantiomers, two different views of the same molecule or neither:

(4 marks)





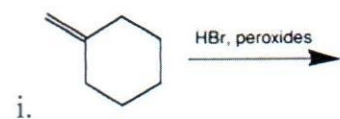
b) Designate the R/S configuration for any chiral centers in the following molecules (7 marks)



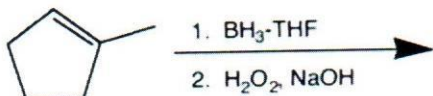
c) If you have a 2° carbocation next to a tertiary carbon that has a hydrogen why do you do a 1,2-hydride shift vs a 1,2-alkyl shift? (3 marks)

d) Explain if a two consecutive 1,2-hydride shifts, which would result in a 3° carbocation possible or NOT. (2 marks)

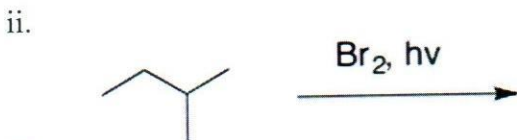
e) Draw the major product for the reactions shown. (There may be some side products or isomers formed in addition to the major products, but you don't need to draw them.)



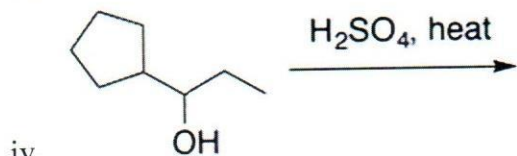
(1 mark)



(1 mark)



(1 mark)



(1 mark)

QUESTION FOUR (20 MARKS)

a) Label the following compounds as dextrorotatory or levorotatory.

(4 marks)

i. Sucrose ($[\alpha]_D = +66.7$)

ii. Cholesterol ($[\alpha]_D = -31.5$)

iii. Cocaine ($[\alpha]_D = -16$)

iv. Chloroform ($[\alpha]_D = 0$)

b) 3.20 g sample of morphine ($[\alpha]_D = -132$) dissolved in 10.0 mL of acetic acid ($[\alpha]_D = 0$). If it is put into a sample tube, a path length of 2.00 cm. what would be its observed rotation (α)? (3 marks)

c) The specific rotation of (*S*)-carvone is $(+61^\circ)$, measured 'neat' (pure liquid sample, no solvent). The optical rotation of a neat sample of a mixture of *R* and *S* carvone is measured at (-23°) .

i. Which enantiomer is in excess

(2 marks)

ii. What are the percentages of (*R*)- and (*S*)-carvone in the sample?

(3 marks)

iii. What is its ee?

(2 marks)

d) A sample containing a single enantiomer of fluoxetine is placed in a polarimeter. The observed rotation is 9.06° clockwise. The sample was made by dissolving 1.24 g of fluoxetine in a solution with a total volume of 2.62 mL. The light source was a sodium D line and the temperature was 25°C . The length of the sample tube was 1.25 dm.

(2 marks)

- e) Given that (S)-bromobutane has a specific rotation of $+23.1^\circ$ and (R)-bromobutane has a specific rotation of -23.1° . What is the optical purity and % composition of a mixture whose specific rotation was found to be $+18.4^\circ$? (4 marks)

QUESTION FIVE (20 MARKS)

- a) Name and draw four possible “extreme” conformations of butane (8 marks)
- b) Draw the potential energy diagram showing all the conformers of butane at different angles viewing along the C2-C3 bond (10 marks)
- c) What is the name of conformers at -60° and at 60° and explain why they are not quite the same (2 marks)