JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
BACHELOR OF SCIENCE EDUCATION WITH IT
THIRD YEAR FIRST SEMESTER EXAMINATIONS
SCH 411: Organic Strereochemistry
UNIVERSITY EXAMINATIONS: 2018/2019 ACADEMIC YEAR

ANSWER ALL QUESTIONS IN SECTION A AND ANY TWO QUESTIONS IN SECTION B

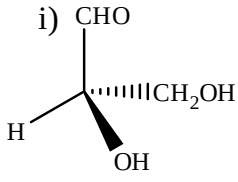
SECTION A: ANSWER ALL QUESTIONS

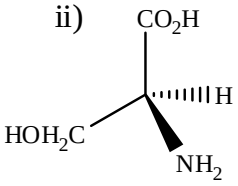
QUESTION 1 (30 MARKS)

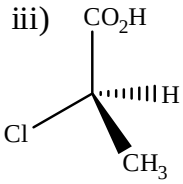
a) Define the following terms; (10 marks)

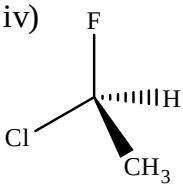
i) Diatereomerism
ii) Homotopicity
iii) Enatiomerism
iv) Stereogenicity
v) Molecular geometry

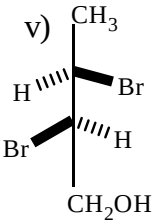
b) Give the CIP names of the following stereoisomers. (5 marks)

i) 

ii) 

iii) 

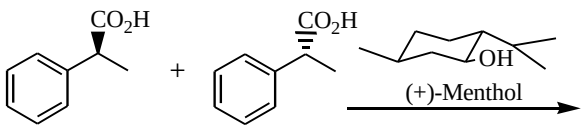
iv) 

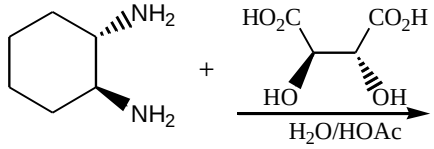
v) 

c) Give the 3D-structures of the following stereoisomers; (10 marks)

i) (2S)-2-ethylpentane
ii) (2S,3R)-2,3-dichlorohexane
iii) (3R)-octan-3-ol
iv) (2R,3S)-2,3-dibromononanal

d) Complete the following reactions; (5 marks)

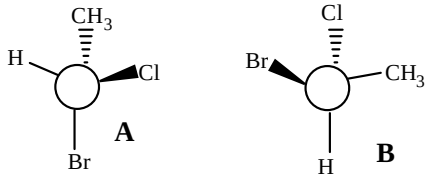
i) 

ii) 

SECTION B (40 MARKS):
ANSWER ANY TWO QUESTIONS FROM THIS SECTION:
EACH QUESTION CARRIES 20 MARKS

QUESTION 2 (20 marks)

a) Consider the following pair of structures; are they enantiomers or two molecules of the same compound in different orientations? Explain your answer. (4 marks)



b) (2S)-2-iodobutane has a specific rotation, $[\alpha]^{24}_{D,} = 22.4°$. Interpret the observed result. (2 marks)

c) At 24°C, a sample of (2S)-2-iodobutane in (b) above was put in a 1 dm sample vial of solution of 1.0 gml^{-1} and showed a specific rotation of +3.975°;
- i) What is the optical purity of the sample? (4 marks)
- ii) What is the enatiomeric excess? (4 marks)

d) Using examples, explain the following molecular geometries; (6 marks)
- i) Tetrahedral
- ii) Trigonal planar

QUESTION 3 (20 marks)

a) In a chronological order, describe the CIP system of naming enantiomers. (5 marks)

b) Draw the Fischer projection of L-(+)-tartaric acid and identify the stereocenter (4 marks)

c) Briefly discuss the biological significance of chirality. (5 marks)

d) Give and name the 3D-structures of product(s) of the following reactions (6 marks)
- i) CH_2= CHOH + Cl_2 →
- ii) CH_3-CH = CH-C_3H_7 + Br_2 →

QUESTION 4 (20 marks)

a) Give a brief history of the origin of stereochemistry (4 marks)

b) Draw all the stereoisomers of $CH_3CH(OH)CH(OH)COOH$ (4 marks)

c) Discuss the energetics of the conformational isomers of cyclohexane (6 marks)

d) Which of the following are chiral and, therefore, capable of existing as enantiomers? (6 marks)
- i) 1,3-Dichlorobutane
- ii) 1,2-Dibromopropane
- iii) 1,5-Dichloropentane
- iv) 3-Ethylpentane
- v) 2-Bromobicyclo[1.1.0]butane
- vi) 2-Fluorobicyclo[2.2.2]octane

QUESTION 5 (20 marks)

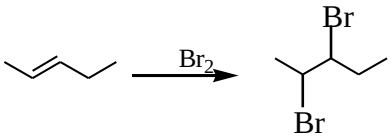
a) Draw a schematic diagram representing a polarimeter (5 marks)

b) Discuss the kinetic resolution technique of separating enantiomers (10 marks)

c) Calculate the observed rotation of a solution of 0.5245 g of (S)-1-amino-1-phenylethane diluted to a volume of 10.0 ml with methanol at 20°C, using the Sodium D Line lamp and 1.00 dm tube. Specific rotation of this material is: (4 marks)

$$\left[\ a\ \right]_D^{23} = -30.0^o$$

d) Consider the reaction below; (5 marks)



How many stereoisomers of the product are possible? Draw them. Are the products optically active?