UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS

FOR THE DEGREE OF EDS & BSC (CHEMISTRY)

COURSE CODE: SCH 325

COURSE TITLE: STEREOCHEMISTRY

DATE:21/8/2023 **TIME:** 8:00-10:00AM

INSTRUCTIONS TO CANDIDATES:

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

QUESTION ONE (30 MARKS)

a. Define the following terms **(5 marks)**

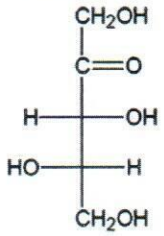
i. Polarimeter ii. Chiral center iii. Diastereomers iv. Levorotatory v. Racemic mixture

b. Name two types of optical isomers **(2 marks)**

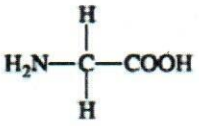
c. List two types of configurational isomers **(2 marks)**

d. State three properties of diastereomers **(3 marks)**

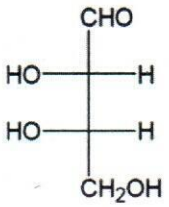
e. Use an asterick (*) to indicate the asymmetric centers on the molecules below **(5 marks)**



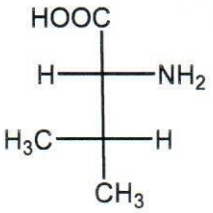
A



B



C

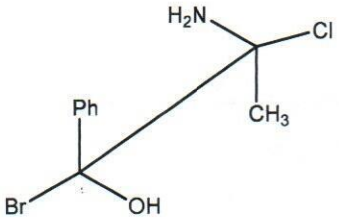


D

f. Identify the relative configuration of the molecules in e. above **(4 marks)**

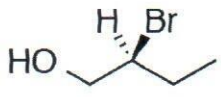
g. Calculate the number of stereoisomers present for structures A and B in e above **(4 marks)**

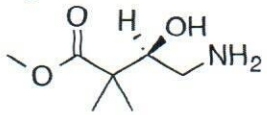
h. Convert the molecule below from Sawhorse formula to Newmann projection to Fischer projection **(3 marks)**



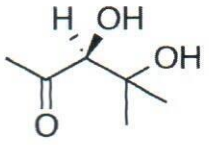
QUESTION 2 (20 MARKS)

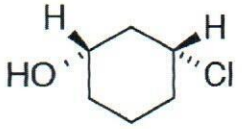
a. Designate the absolute configuration for the chiral centers in the molecules **(7 marks)**

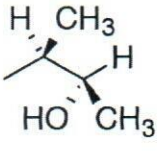
i. 

ii 

iii. 

iv. 

v. 

vi. 

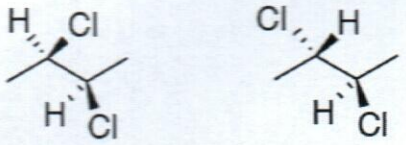
b. Given the absolute configurations, draw the corresponding **Fischer projections** **(4 marks)**

i. (2S, 3R)-2-hydroxy-3-chlorobutanoic acid ii. (2R, 3S)-2-bromo-3-chloropentane

iii. (2S, 3R)-3-bromo-2-butanol iv. (2S, 3R)-2,3-dichloropentane

c. State the relationships between the following structures as either "**same**", "**enantiomers**", or "**diastereomers**" **(5 marks)**

i. 

ii. 

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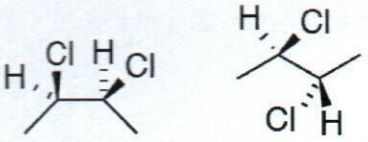
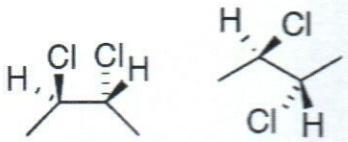
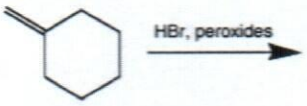
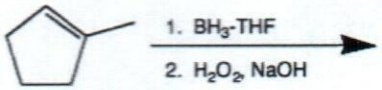
iv. 

v. 

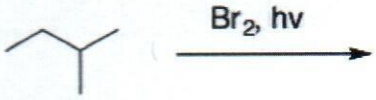
d. Draw the major product for the reactions shown. (There may be some side products or isomers formed in addition to the major products, but you don't need to draw them.)

i. 

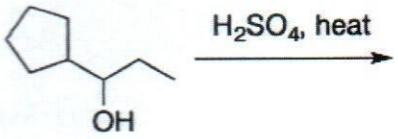
(1 mark)

ii. 

(1 mark)

iii. 

(1 mark)

iv. 

(1 mark)

QUESTION 3 (2 MARKS)

a. Use a potential energy chart (-60° through 0° to +60°) to illustrate and name all conformers of 3,3-dimethylhexane from by viewing along the **C3-C4 bond** **(8 marks)**

b. Name the two conformers with the highest and lowest potential energy **(2 marks)**

c. Draw name three conformations of cyclopentane **(6 marks)**

d. Show four types of strain experienced by the molecule in c above **(4 marks)**

QUESTION 4 (20 MARKS)

a. A student prepared compound D in lab. She was sure the compound contained no impurities; a number of physical analyses confirmed the structure and purity of the compound. A sample of compound D (0.10 g) is dissolved in methanol (2.0 mL) and the solution is placed in a 1.0 dm cell. Three polarimetry readings are recorded with the sample: 0.9950°, 0.904° , 0.936° .

i. Calculate [α]? **(6 marks)**

ii. The optical rotation of D pure has previously been reported as 25°. What is the optical purity of this sample? **(2 marks)**

iii. What is the enantiomeric excess of this sample? **(2 marks)**

iv. What is the composition of this sample? **(3 marks)**

v. Why did the previous analyses show that there was only one compound present? **(2 marks)**

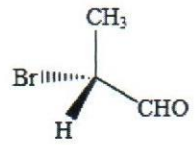
b. Given that (S)-bromobutane has a specific rotation of +23.1° and (R)-bromobutane has a specific rotation of -23.1°. What is the optical purity and % composition of a mixture whose specific rotation was found to be +18.4°? **(5 marks)**

QUESTION 5 (20 MARKS)

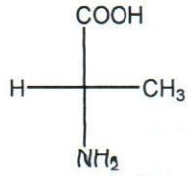
a. If you have a 2° carbocation next to a tertiary carbon that has a hydrogen why do you perform a 1,2-hydride shift or a 1,2-alkyl shift? **(5 marks)**

b. Explain if a two consecutive 1,2-hydride shifts, which would result in a 3° carbocation possible or **NOT**. **(5 marks)**

c. The molecule shown below in dash wedge formula, convert it to Fischer projection **(3 marks)**



d. Given the Fischer projection below, convert it to dash wedge formula **(2 marks)**



e. Convert the molecule to Newman projection and finally to Sawhorse Formula. Name the conformers that are formed in the process **(5 marks)**