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**UNIVERSITY EXAMINATIONS
2022/2023 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF EDS & BSC (CHEMISTRY)

COURSE CODE: SCH 325

COURSE TITLE: STEREOCHEMISTRY

DATE: 25/04/2023

TIME: 9:00-11:00AM

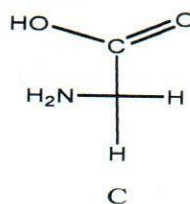
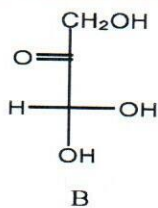
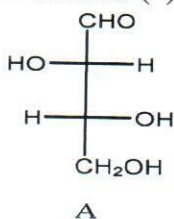
INSTRUCTIONS TO CANDIDATES:

TIME: 2 Hours

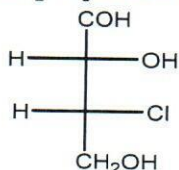
Answer question ONE and any TWO of the remaining

QUESTION ONE (30 MARKS)

- a. Define the following terms (5 marks)
 i. Stereochemistry ii. Stereogenic center iii. Optical activity iv. Enantiomers v. Dextrorotatory
- b. Name the 3D representations of organic molecules (4 marks)
- c. Identify the two broad classes of isomers (2 marks)
- d. State five properties of enantiomers (5 marks)
- e. Use an asterick (*) to indicate the achiral centres on the molecules below (5 marks)

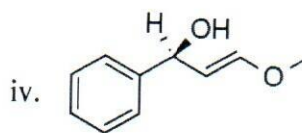
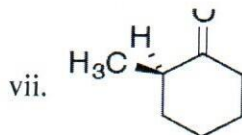
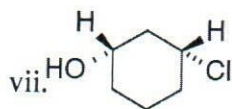
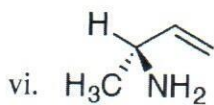
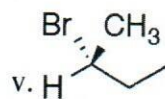
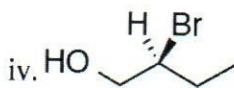
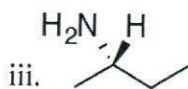
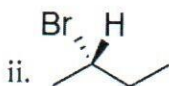
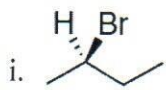


- f. Identify the relative configuration of the molecules in e. above (3 marks)
- g. Calculate the number of stereoisomers present for structures B and C in e above (3 marks)
- h. Convert the molecule below to **Newman projection** then to **Sawhorse formula** (3 marks)

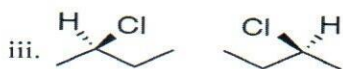
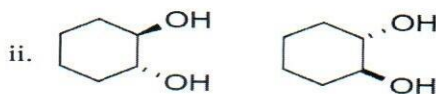


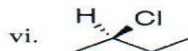
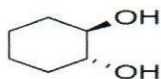
QUESTION 2 (20 MARKS)

- a. Designate the absolute configuration for the chiral centers in the molecules (10 marks)



- b. State the relationships between the following structures as either "same", "enantiomers", or "diastereomers" (6 marks)



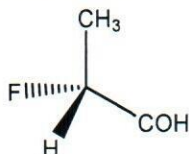


c. State four applications of stereochemistry in biology and medicine **(4 marks)**

QUESTION 3 (20 MARKS)

a. Name and discuss the different types of strain experienced by organic molecules **(17 marks)**

b. Given the dash wedge formula below, convert it to Fischer projection **(3 marks)**



QUESTION 4 (20 MARKS)

a) State the optical activity of following compounds **(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. A pure sample of the chiral compound B (0.540 g) is dissolved in ether (2.0 mL) and the solution is placed in a 1.0 dm cell. Three polarimetry readings are recorded with the sample: 1.225, 1.106, 1.182. Calculate $[\alpha]$ **(6 marks)**

c. A pure sample of the (+) enantiomer of compound C shows $[\alpha] = 42^\circ$. What would be the observed rotation if a solution of the sample was made by dissolving 0.250 g in 2.0 mL of acetone and was then placed in a 0.5 dm cell? **(5 marks)**

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

QUESTION FIVE (20 MARKS)

a. Consider 3,3-dimethylpentane. Using Newman projection, name and draw four possible "extreme" conformations viewing along **C2-C3** bond **(8 marks)**

b. Draw a potential energy diagram showing conformers 3,3,4-trimethylhexane at different angles from $0-360^\circ$ viewing along the **C2-C3** bond **(7 marks)**

c. Cyclohexane has five different conformations with different strain energy. Use an energy level diagram to illustrate the position and strain energy of each conformer **(5 marks)**