

**UNIVERSITY EXAMINATIONS****1ST SEMESTER 2022/2023 ACADEMIC YEAR****FOURTH YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF EDUCATION (SCIENCE)****CHEM 412: ADVANCED STEREOCHEMISTRY*****STREAM: R******TIME: 2 HRS******DAY: THURS [11.30AM – 13.30]******DATE: 08/12/2022*****THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES****PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.**

INSTRUCTIONS: - Attempt ALL the Questions**QUESTION ONE**

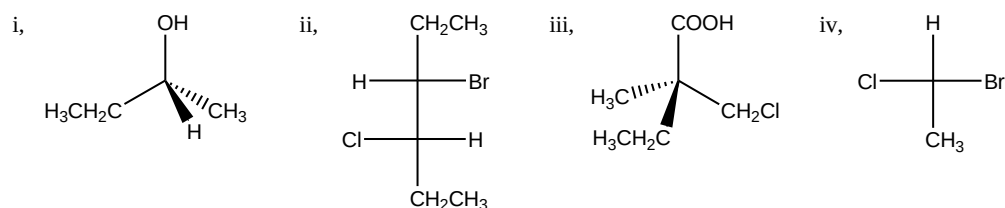
(a) Define the following terms: - (2 marks)

- (i) Stereoisomers
- (ii) Cycloaddition reaction

(b) Use Fischer projections to draw the following compounds. (4 marks)

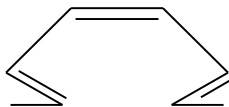
- (i) (S)-3-Chlorohexane
- (ii) (R)-2-Butanol
- (ii) (2S,3R)-2,3-Bromopentane
- (iv) (2R,3S)-2,3-Fluoropentane

(c) Assign R and S to all the chiral carbons and write the IUPAC name of the following compounds. (5 marks)



(d) Determine the percentage of Methoxycyclohexane with the substitution equatorially placed at 25°C (298K). $-\Delta G^\circ = 2.15 \text{ KJ/mol}$, $R = 8.314 \text{ J/mol/K}$. (8 marks)

(e) (i) Show the product that is formed when the following compound undergoes thermal electrocyclic and photochemical ring closure. (5 marks)

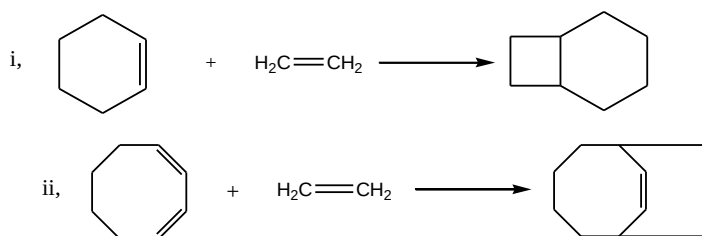


(ii) Indicate whether the process is conrotatory or disrotatory and clearly indicate the stereochemistry around the tetrahedral stereogenic centers and double bonds. (4 marks)

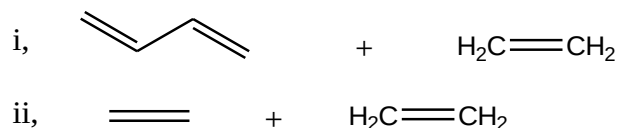
(iii) Name the reactants and the products. (2 marks)

QUESTION TWO

(a) By use of arrows, show the type of cycloaddition in each of the following reactions (3 marks)



(b) Draw the products including stereochemistry formed including the condition from each pair of reactant in a thermal [2 + 2] and [4 + 2] cycloaddition reaction. (8 marks)



(c) Use a table to show a summary of the stereochemical rules for pericyclic reactions. (9 marks)

QUESTION THREE

(a) A sample of pure (S)-2-Butanol was placed in 1 dm Polarimeter tube, Using D line of Na Lamp, the observed rotation at 20°C was $\alpha = +104^\circ$. The density of this compound is 0.805 g/ml. What is the specific rotation of (S)-2-Butanol. (3 marks)

(b) Consider 360° rotation about the bond shown and sketch a Potential Energy versus Rotation curve for: (Assume PE max = 6.1 Kcal/mol.) (8 marks)



(c) Draw the molecular orbitals for 1,3,5-Hexatriene, Label the HOMO and the LUMO in both the ground and the excited state (9 marks)