

Stereochemistry and Asymmetric Synthesis (CH3104)

Department Chemical Sciences, IISER Kolkata

End - Semester Exam

Total marks: 100

Time: 3 h

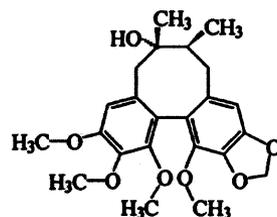
30 December 2018

Answer Part A and Part B separately

Part A

Answer all questions (6 x 5 = 30 marks)

Q1. The following natural product has a *R*-configured chirality axis. Draw the structural formula of this isomer. Also assign the absolute configuration of all the stereogenic centers.



Q2. Reaction of 3-methyl-1,4-cycloheptadiene with excess perbenzoic acid forms diepoxide products. Draw the structure of all the possible stereoisomers and mention the stereochemical relationships between the molecules.

Q3. Write all the structures that fit the following descriptions:

a) Chair conformation of an achiral isomer of cyclohexanediol that has the hydroxy groups on different carbons.

b) A compound of formula C_4H_6O that has just one double bond and is chiral.

Q4. Draw the structural formula of 2-methyl-2-(3-oxopentyl)cyclopentane-1,3-dione and determine the prochirality centres and the topicities of the hydrogen atoms present on the same carbon.

Q5. a) Which of the following isomeric dienes is chiral?

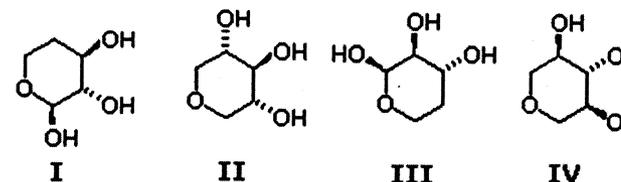
i) 2,3-pentadiene

ii) 3-methyl-1,2-butadiene

iii) 2-methyl-1,3-butadiene

iv) none, all are achiral

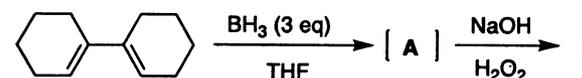
b) Which two of the following compounds are diastereomers?



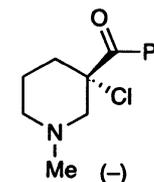
Part B

Answer all questions (10 x 4 = 40 marks)

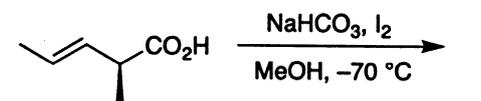
Q1. Predict the major product with appropriate stereochemistry in the following hydroboration reaction.



Q2. Explain why the following cyclic amine undergoes racemisation during resolution?



Q3. Identify the the major product with stereochemistry in the following reactions using appropriate transition state model/intermediates.



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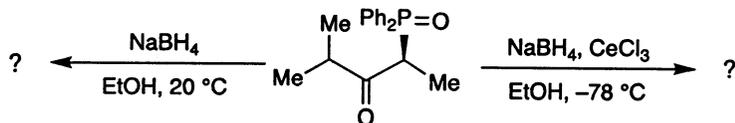
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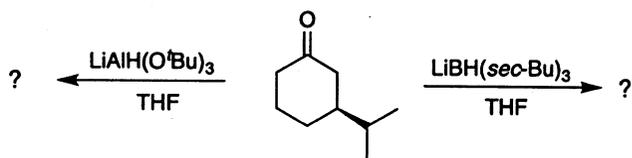
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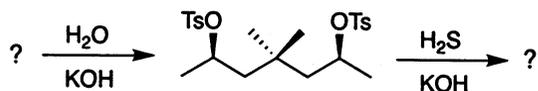
Q4. Derive the the major products with stereochemistry in the following reduction reactions using appropriate model.



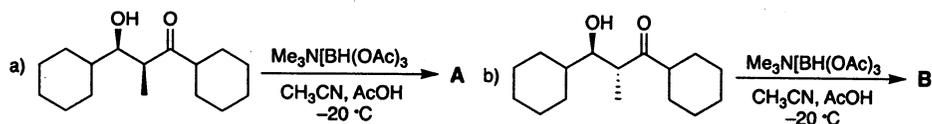
Q5. Predict the major products with stereochemistry in the following diastereoselective reduction reaction.



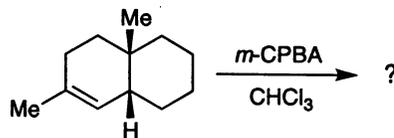
Q6. Determine the major product with appropriate stereochemistry in the following reactions and explain whether this reaction is diastereospecific or selective?



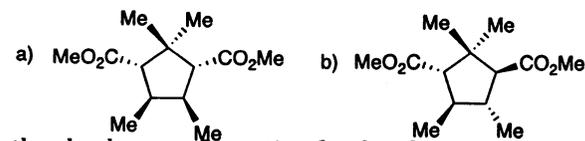
Q7. Derive the the major products formation A and B with stereochemistry in the following reactions using appropriate model/intermediate.



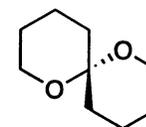
Q8. Explain the the major product formation in the following reaction with stereochemistry using appropriate conformation.



Q9. Comment on optical activity of the following compounds and explain how many methyl peaks will be seen in ^1H NMR?

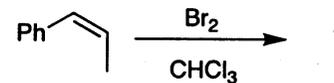


Q10. Assign the absolute configuration for the pheromone, Olean and draw most stable conformation of the same.

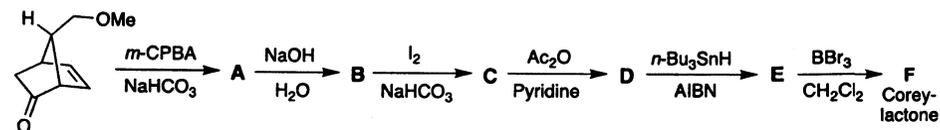


Answer all questions (3 x 10 = 30 marks)

Q11. In the following bromination reaction, identify all stereoisomeric products and explain whether this reaction is diastereospecific or selective.



Q12. In the following diastereoselective Corey-lactone synthesis, identify the intermediate products with absolute stereochemistry.



Q13. Explain kinetic and thermodynamic products formation A and B respectively in the following diastereoselective bromination reaction at 25°C using appropriate conformations and energy profile diagram. Assume de of this reaction is 98%, calculate $\Delta\Delta G^\ddagger$ of this reaction.

