



UNIVERSITY OF NAIROBI

THIRD YEAR FIRST SEMESTER EXAMINATIONS 2016-2017
FOR THE DEGREE OF
BACHELOR OF SCIENCE (INDUSTRIAL CHEMISTRY)

SCH 302: STEREOCHEMISTRY AND SYNTHESIS OF ORGANIC
COMPOUNDS

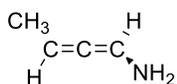
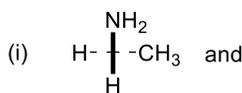
DATE:

TIME: 2 HOURS

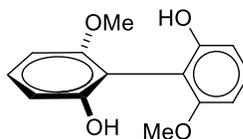
Answer ALL Questions

Q1.

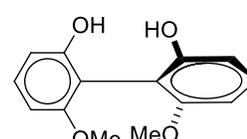
- (a) What stereochemical term precisely describes the relationship between each of the following pairs of molecules? (2 Marks each)



(ii)



and



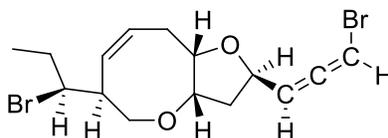
(Total Marks: 4 Marks)

- (b) Differentiate between the following terms: (2 Marks each)

(i) Chiral centre and chiral axis (ii) Asymmetric synthesis and racemic synthesis

(Total Marks: 4 Marks)

- (c) Nipponallene, a brominated marine natural allene, was isolated from the Japanese red algae (*Laurencia nipponica*).



- (i) Assign the absolute configuration of the chiral axis of the nipponallene based on both the R_a/S_a and P/M. (4 Marks)

- (ii) How many stereoisomers of nipponallene are possible? (2 Marks)

(Total Marks: 6 Marks)

Q2.

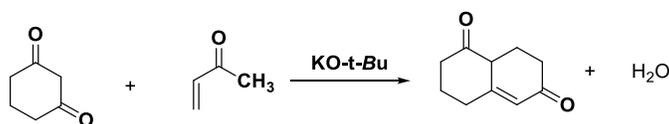
(a) Hardly are regular alkyl ethers used as protecting groups for alcohols, yet benzyl ethers are common protecting groups for alcohols.

(i) What are the qualities of a good protecting group (3 Marks)

(ii) Why is it possible to use benzyl ethers as protecting groups for alcohols? (2 Marks)

(Total Marks: 5 Marks)

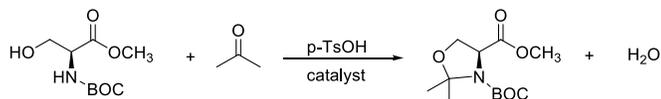
b(i) Propose a reasonable and stepwise reaction mechanism for the reaction shown below. (8 Marks)



(ii) What is the name given to reactions like the one in b (i) above? (2 Marks)

(Total Marks: 10 Marks)

(c) Propose a reasonable and stepwise reaction mechanism for the reaction shown below. (6 Marks)



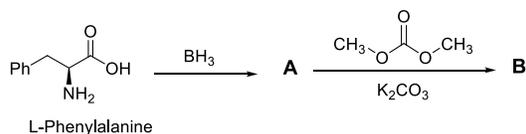
(Total Marks: 6 Marks)

Q3.

(a) Chiral auxiliaries are commonly employed in asymmetric synthesis:

(i) List four qualities of a good chiral auxiliary (4 Marks)

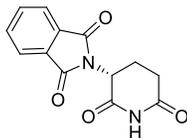
(ii) Refer to the partial synthesis of a chiral auxiliary shown below and identify the structures of compounds **A** and **B**. (2 Marks each)



(Total Marks: 8 Marks)

(b) The sedative, R-thalidomide, was once used to address symptoms of morning sickness in expectant mothers, however, when it was discovered that S-

thalidomide causes deformities in infants, the use of R-thalidomide as a sedative was discontinued.



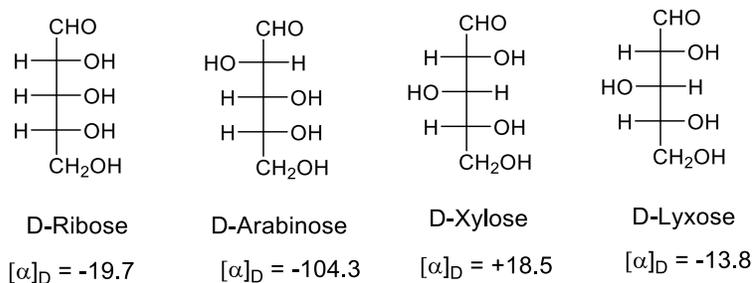
With the help of a reaction mechanism, explain why enantiopure R-thalidomide can not be safely used as a sedative without affecting infants (5 Marks)

(Total Marks: 5 Marks)

(c) A research scientist developed a method of preparing unnatural L-sugars from naturally occurring D-sugars. In one of the breakthrough experiments, the researcher observed that 0.25 g of a new tetrose sugar dissolved in 2 mL of water measured in a cell of path length 10 cm gave an optical rotation of +13.04 degrees.

(i) Determine the specific rotation of the new sugar (2 Marks)

(ii) By referring to the structures of the natural tetroses, shown below, and their specific rotations, draw the Fischer projection of the new sugar (2 Marks).



(iii) What would be the name the new sugar? (2 Marks)

(Total Marks: 6 Marks)

Q4.

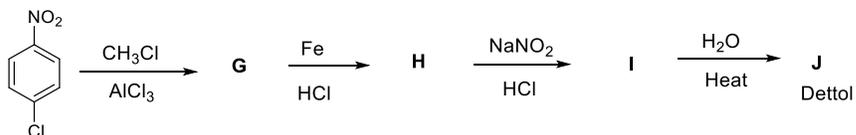
(a) Differentiate between the following terms: (2 Marks each)

(i) Retrosynthesis and synthesis

(ii) Chiral pool approach and chiral auxiliary approach to asymmetric synthesis

(Total Marks: 4 Marks)

- (b) 4-Chloro-3,5-dimethylphenol (**J**), the active ingredient responsible for the antiseptic properties of Dettol, can be prepared from 4-chloronitrobenzene as outlined below:



- (i) Provide the structures of the missing intermediate compounds **G**, **H**, **I** and the antiseptic **J**. (2 Marks each)
- (ii) Propose a retrosynthetic pathway for the antiseptic agent that is consistent with synthetic scheme above. (4 Marks)

(Total Marks: 12 Marks)