UNIVERSITY OF VICTORIA

CHEMISTRY 335, A01

SYNTHETIC METHODS IN ORGANIC CHEMISTRY

FINAL EXAM — APRIL 22, 2009

NAME:_____ **STUDENT ID:**_____

INSTRUCTOR: FRASER HOF

TOTAL MARKS = **70**

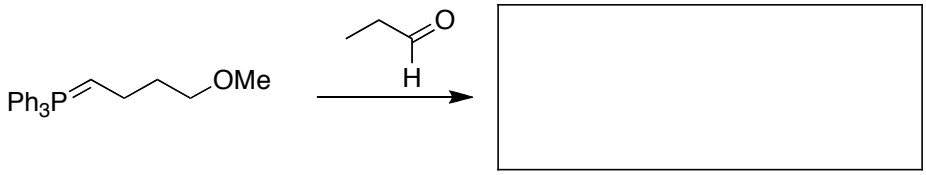
DURATION: **3 HOURS (9:00 AM – 12:00 PM)**

THIS EXAMINATION PAPER HAS **9** PAGES, INCLUDING THIS COVER PAGE. COUNT THE NUMBER OF PAGES IN THIS EXAMINATION PAPER BEFORE YOU START TO WRITE, AND REPORT ANY DISCREPANCY IMMEDIATELY TO THE INVIGILATOR.

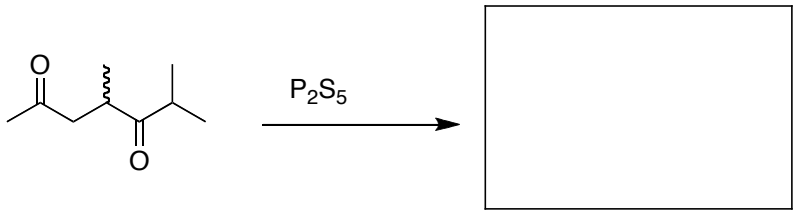
QUESTIONS ARE TO BE ANSWERED IN THE SPACE PROVIDED ON THE EXAM FORM.

1. (26 marks total) Fill in the boxes with the missing reagents, starting materials, or products **(1 mark each)**. For boxes with reaction products, show only the majo stereoisomer produced by the given reaction and *indicate whether it is achiral, racemic, or a single enantiomer* **(0.5 marks each)**.

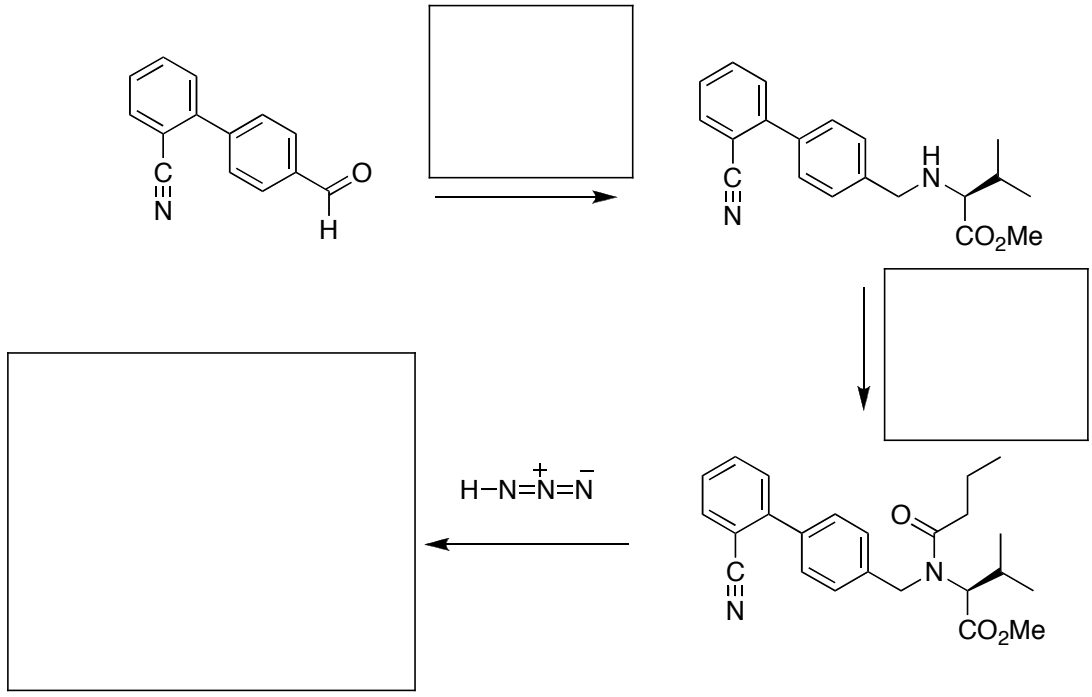
a)



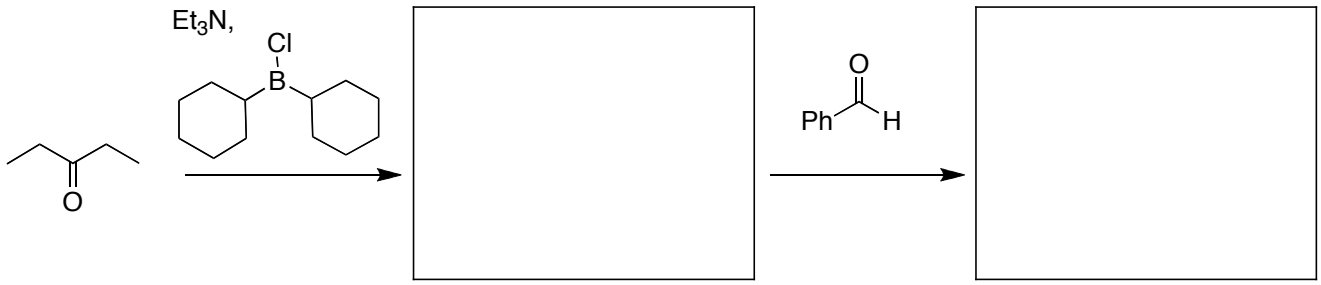
b)



c)

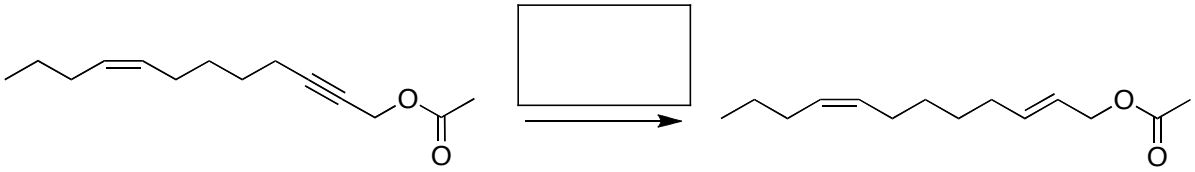


d)



Problem 1 continued...

e)



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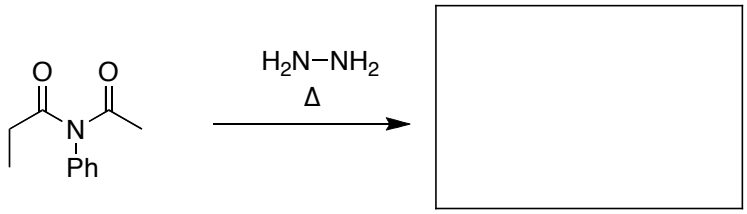
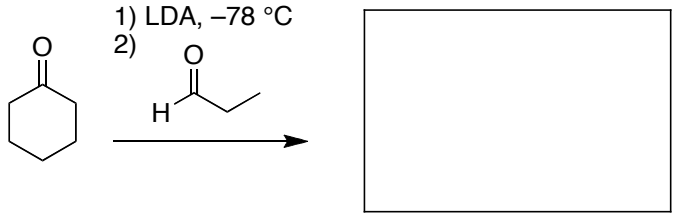
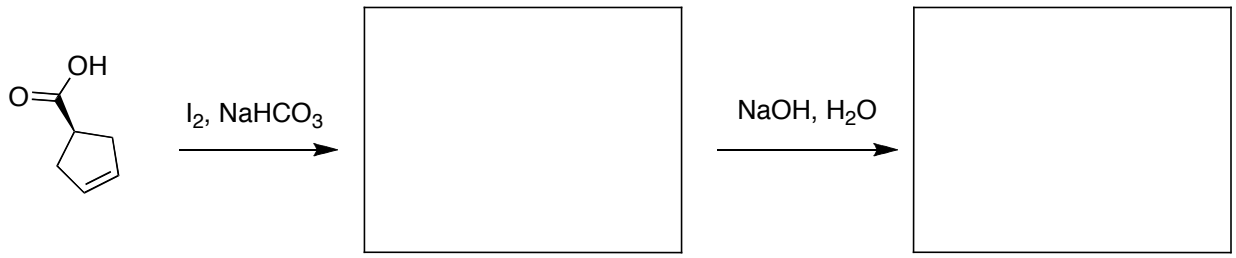


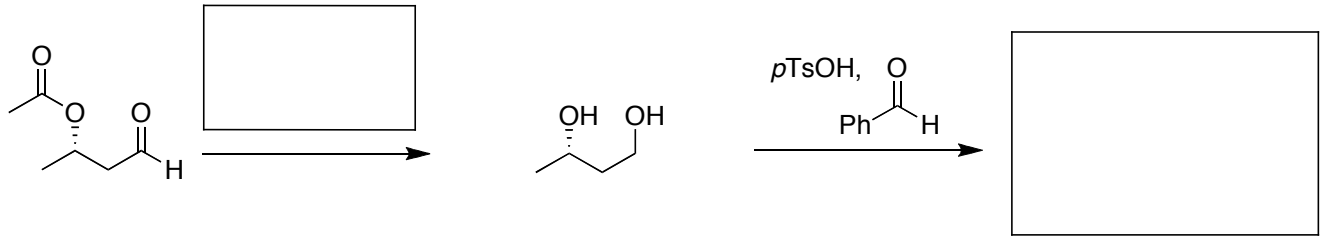
g)



h)

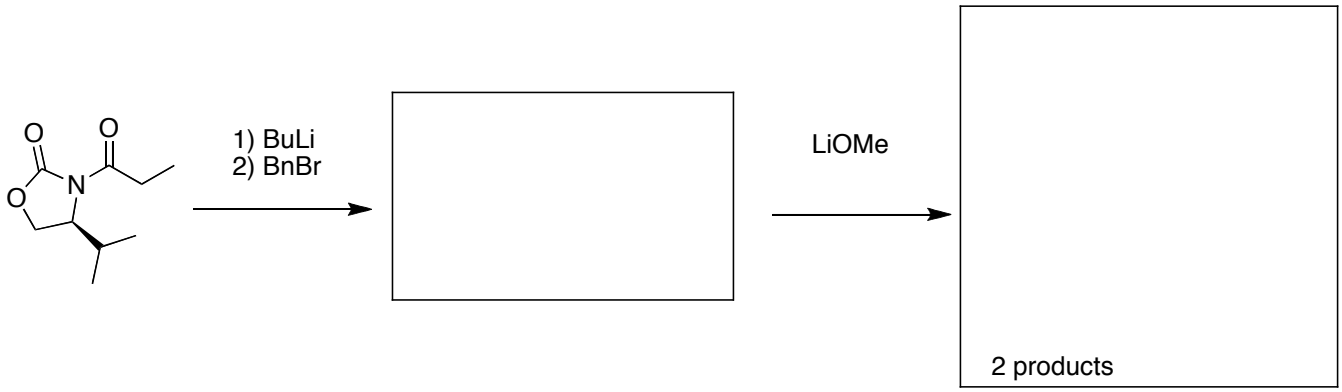


i)

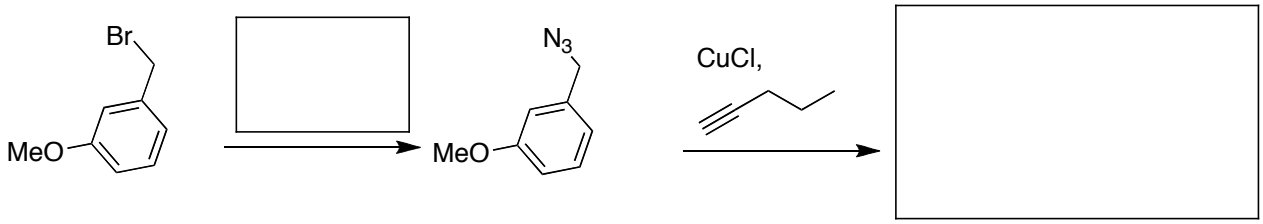


Problem 1 continued...

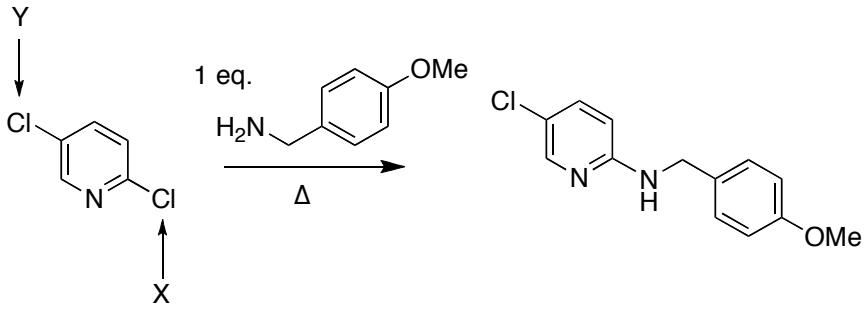
j)



k)

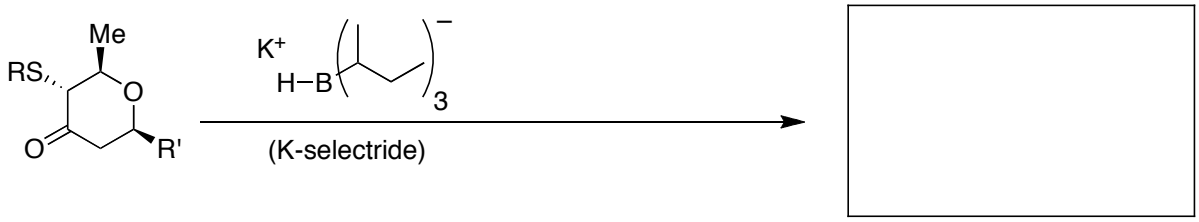


2. (4 marks) a) Give the mechanism for this reaction, including all proton transfers and intermediates. b) State why it proceeds at site X and not at site Y. Use a diagram to illustrate your point.



3. (4 marks each, 8 marks total) ANSWER ONLY TWO OF THE THREE PARTS. Give the product of the reaction. Explain the origin of the observed stereoselectivity in one short phrase, and draw 3D stereochemical diagrams of starting materials and products to illustrate your point.

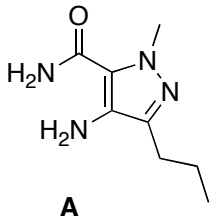
a)



b)

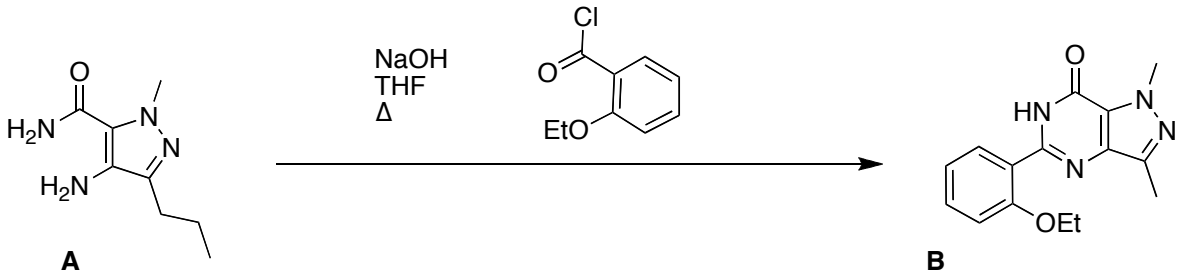
c)

4. (8 marks) The following building block **A** is used in the synthesis of Viagra. Plan the synthesis of **A** from *acyclic starting materials with 5 or fewer carbon atoms*. Whether you go in the forward or reverse direction, clearly indicate the reagents and conditions that would be required for each reaction in the forward direction.



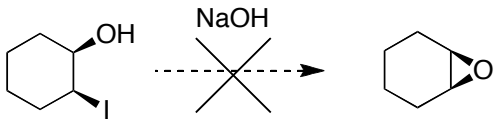
A

5. (10 marks) The intermediate **A** from question 4 is reacted with an acid chloride under basic conditions to give key Viagra precursor **B**. *Give the detailed mechanism for this reaction. Explicitly show all starting materials, proton transfers, intermediates, and byproducts.*

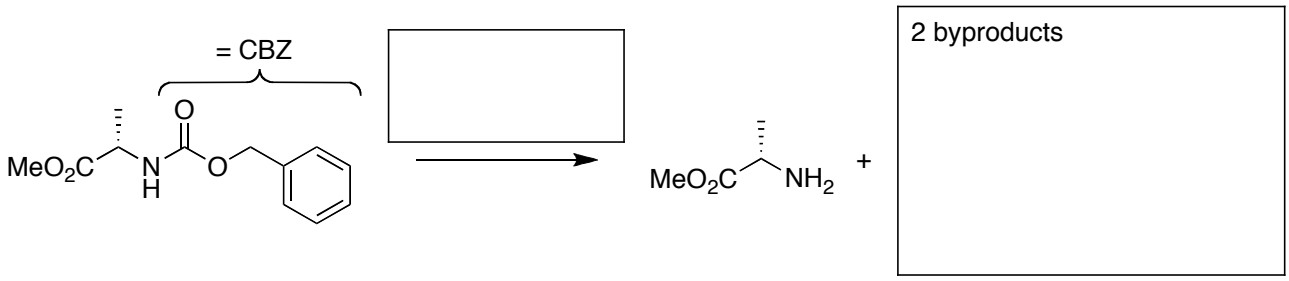


A **B**

6. (3 marks) The epoxidation reaction shown below does *not* proceed. Show why this is the case with a detailed 3D diagram of the starting material that explicitly shows the orbitals involved in this reaction.

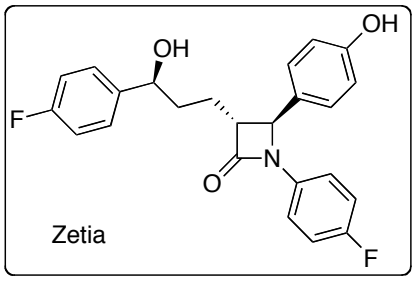


7. (3 points) The CBZ protecting group, pictured below protecting a simple amino ester, is a common protecting group for amines. Based on your knowledge of the reactivity of related groups, indicate which conditions should be used for deprotecting the amine, and show which two byproducts would be produced.

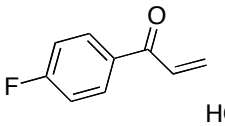


8. (8 marks) Plan the synthesis of the cholesterol absorption blocker Zetia (pictured below, left). You have the three key building blocks **A**, **B**, and **C** available to you. Whether you picture the synthesis in the forward or retro direction, include reagents and conditions above each arrow.

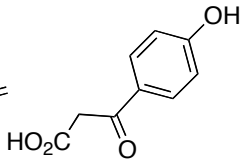
You must control the stereochemistry at all three stereocenters, but this is a special day in the lab and you get to use Group 9's special reagent "magic" as an additive to a normal reaction that will provide absolute stereocontrol in the formation of ONE of the three stereocenters. For the other two make it clear how you are setting the stereochemistry, without resorting to magic.



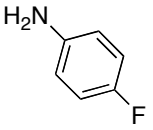
Zetia



A



B



C

END