Breakdown

~A [>90 - 6
~A [80-90 - 15
~B [70-80 - 19
~B [60-70 - 21
~C [50-60 - 21
~C [40-50 - 10
~D [30-40 - 12
~F [<30 - 18

high Score
94

average
57

median
62

Fall Semester Organic Chemistry I
Final Exam

Name (print): Answer Key

Name (Sign) :

Instructions:

1. Keep the exam closed until you are instructed to begin.

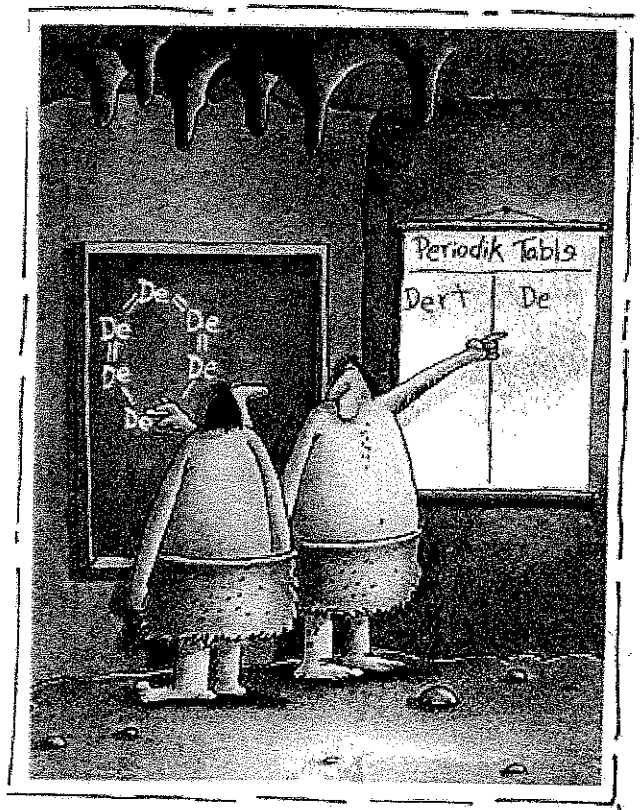
2. The exam consists of 9 questions. The first thing you should do is make sure that no pages are missing. If a page is missing, notify a proctor immediately.

3. You will have **2 hrs** to complete the exam, at which time pencils must be put down. Budget your time wisely.

4. Make sure to show all of your work, and make it clear what your thought process was. Answers should fit in the space provided. If you need to use the back of the sheet of paper, you must make note of it in the space allotted for credit.

Breakdown

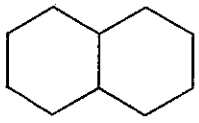
1. Nomenclature (~~10~~ points)	_____ / 12
2. Newman Projection (~~10~~ points)	_____ / 8
3. Acid/Base Chemistry (~~10~~ points)	_____ / 8
4. Chair Conformation (~~10~~ points)	_____ / 10
5. Reactions (~~10~~ points)	_____ /12
6. Mechanism (~~15~~ points)	_____ /15
7. Synthesis (~~15~~ points)	_____ / 15
8. NMR (~~10~~ points)	_____ /10
9. General Spectroscopy (~~10~~ points)	_____ /10
total	**_____ / 100**



Early chemists describe the first dirt molecule. (Farside Comics)

1) Nomenclature (12 points)

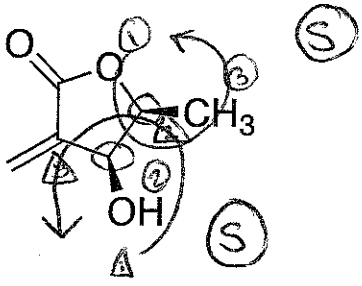
a. Give the IUPAC name of the following molecule (3 points)



name: bicyclo[4.4.0]decane

b. Draw 4-methylpentanol in line-angle notation (3 points)

c. Circle all of the stereogenic centers (chiral centers) on the following molecule and name them as R or S. Is this molecule chiral or achiral, and if achiral is it meso (6 points)?

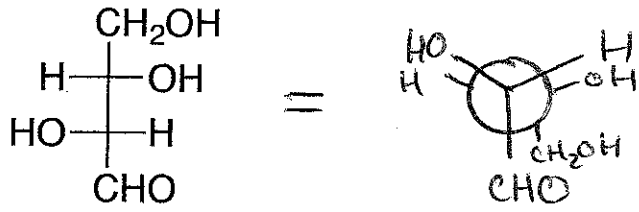


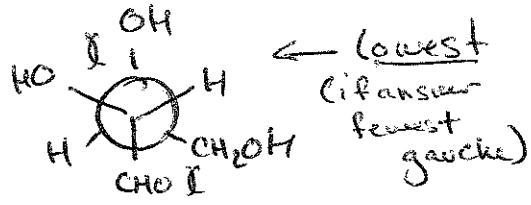
Chiral

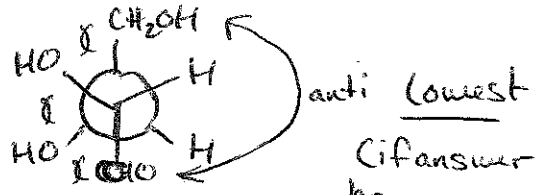
2) Newman Projections (8 points)

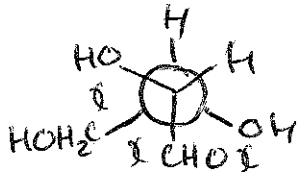
Convert the following molecules into a Newman projection and convert them into their lowest energy conformations. Important to explain answer.

a) Down middle C-C bond (4 points)

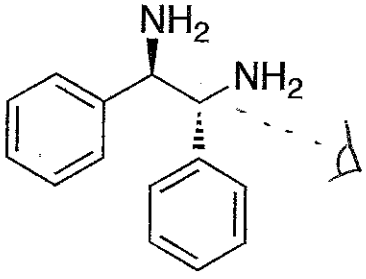


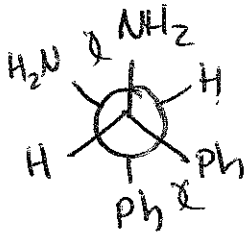




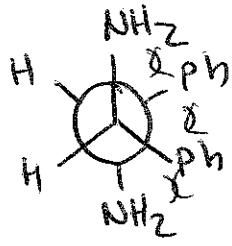


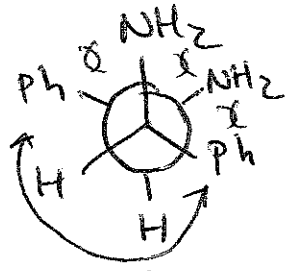
b) (4 points)





↑ lowest if answer fewest gauche



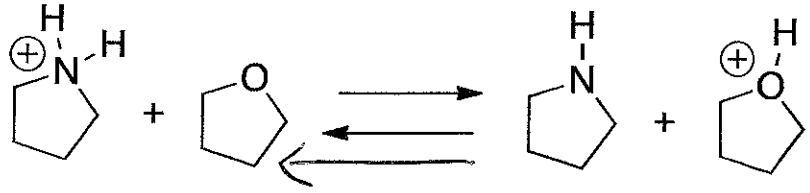


↑ lowest if answer large groups anti

3) Acid/Base Chemistry (8 points, 4 points each)

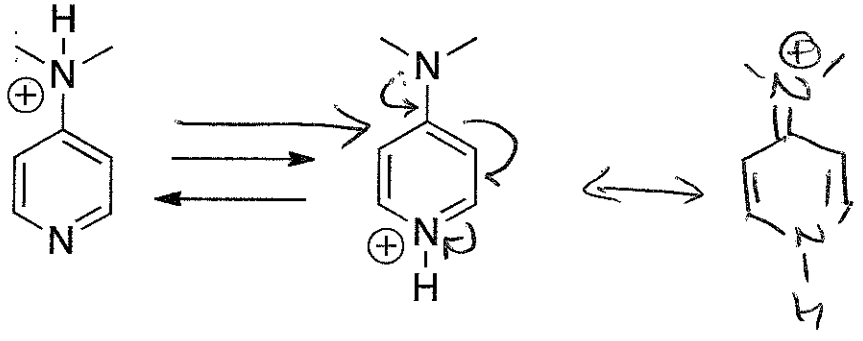
Predict which way the equilibrium of the following reactions would lie and explain your answer.

a)



N less electronegative than oxygen. More likely to take on + charge

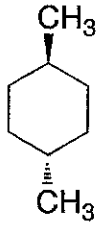
b)



N resonance stabilized on right

4) Chair Conformation (~~12~~ 10 points)

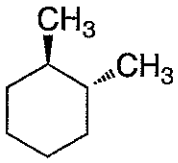
a. Draw both chair conformations of 1,4-dimethylcyclohexane, and circle the one that is lower in energy (5 points).



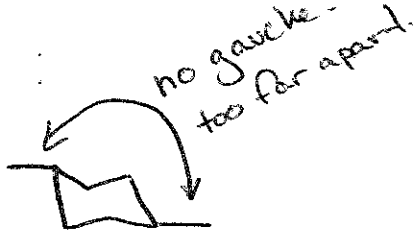
1,4-dimethylcyclohexane

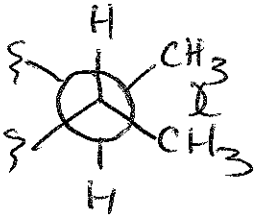
lowest
equitorial

b. The difference in energy between the two chair conformations of 1,2-dimethylcyclohexane is significantly less than that of 1,4-dimethylcyclohexane. Explain this difference, using structures to support your answer. (5 points)



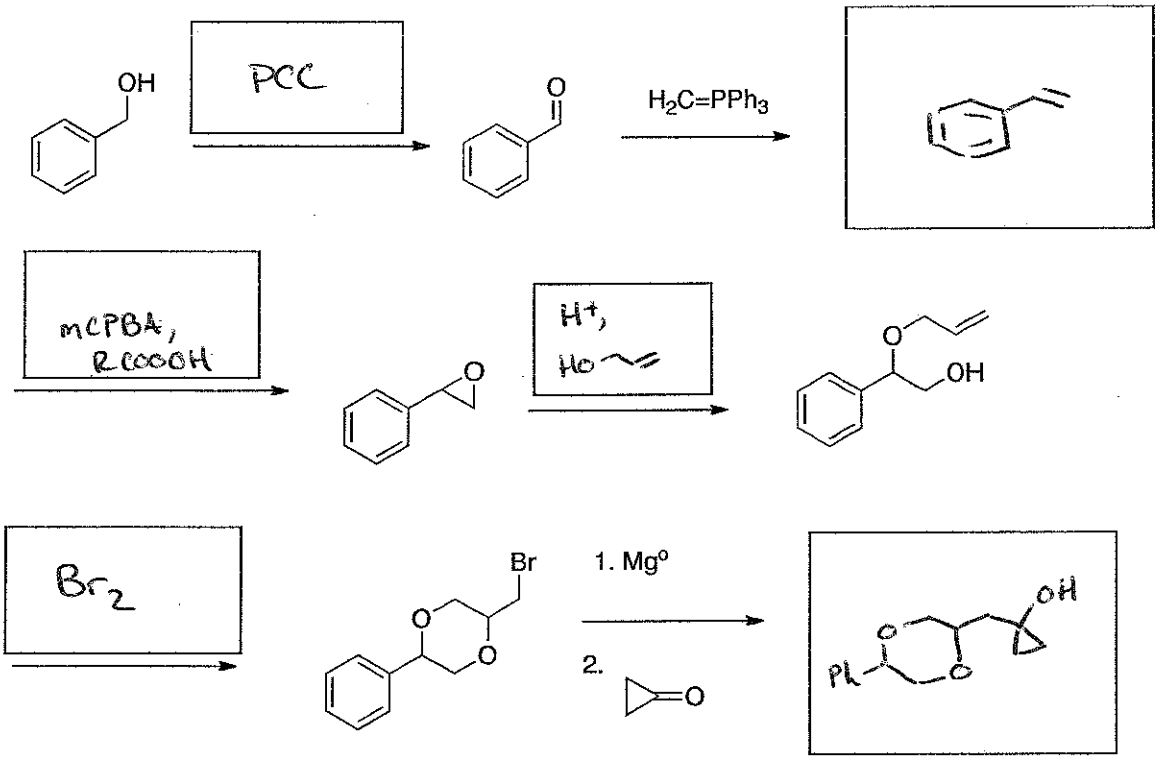
1,2-dimethylcyclohexane





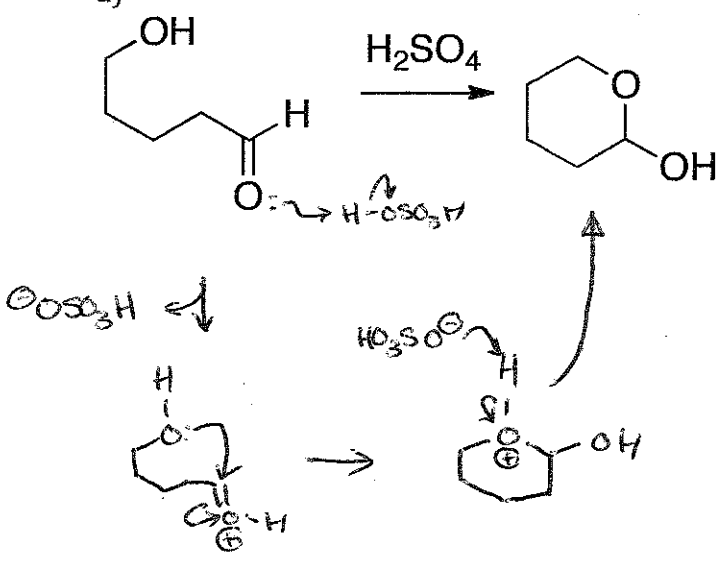
gauch interaction exists in equitorial 1,2 dimethylcyclohexane. This raises energy of that chair, making it closer to energy of ~~the~~ diaxial.

5) Reactions (12 points)

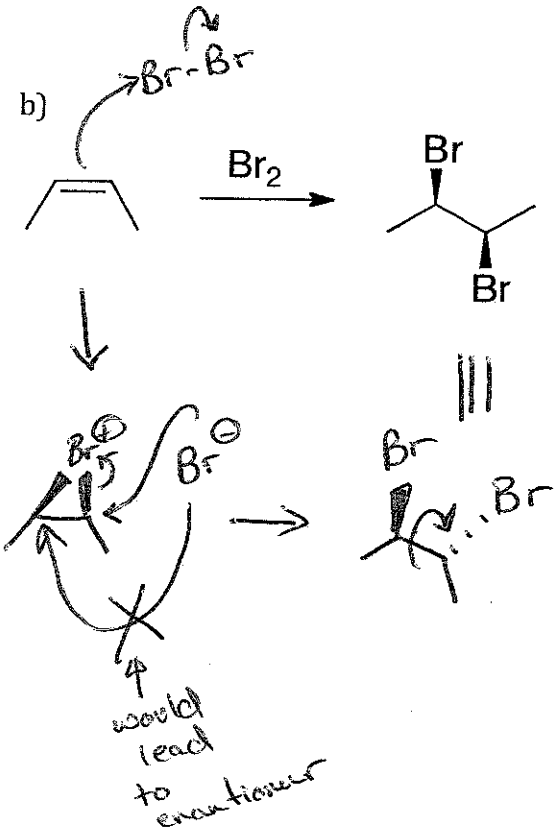


6) Mechanisms (15 points, 5 points each)

a)

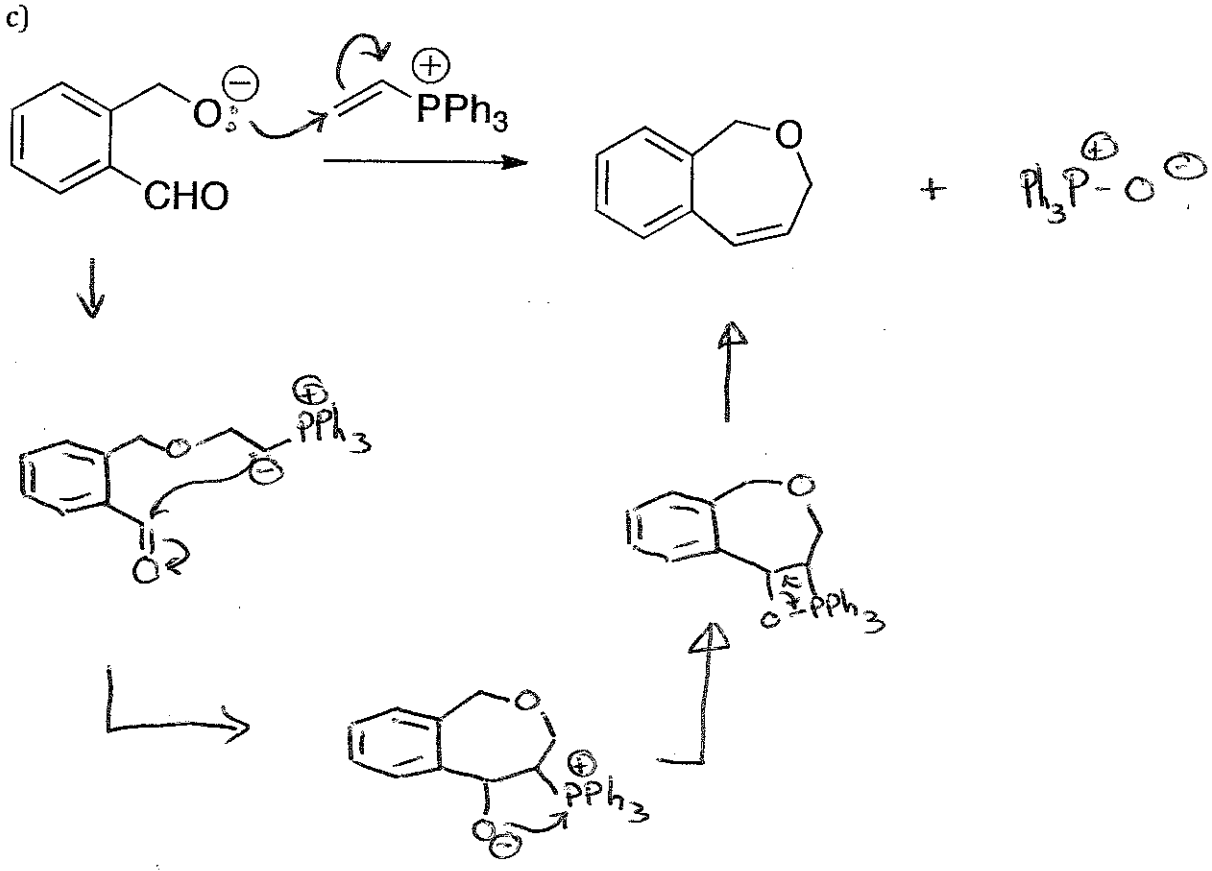


b)



Important to adress stereochemistry

c)

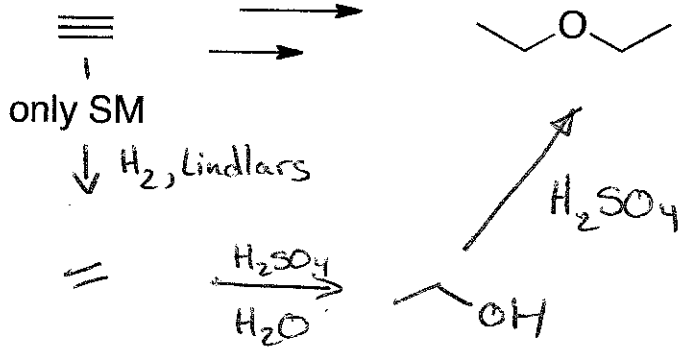


7) Synthesis (15 points, 5 points each)

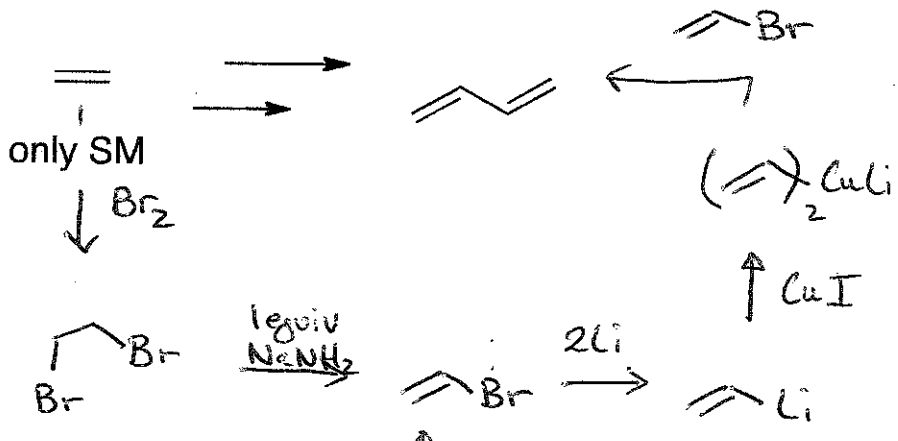
Propose a synthesis of the following molecules using the starting materials shown as your only carbon-based starting material. ***Show all of your intermediates.***

potential answer shown. multiple answers possible

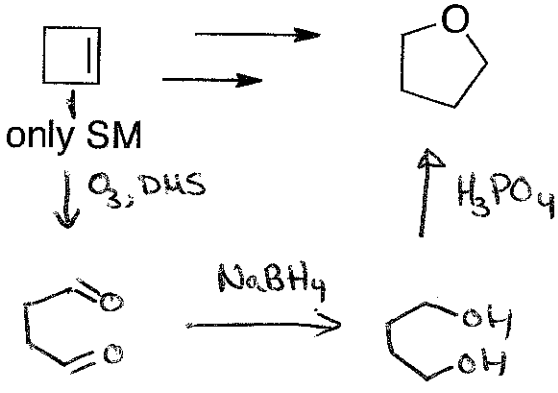
a)



b)

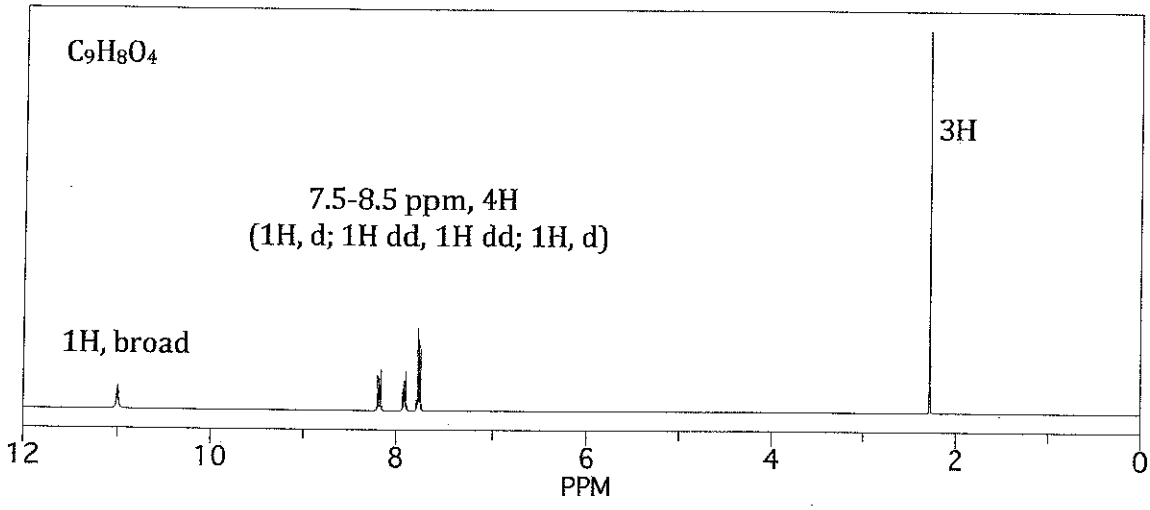


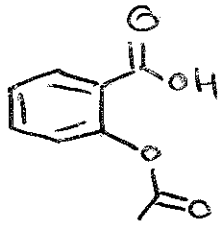
c)



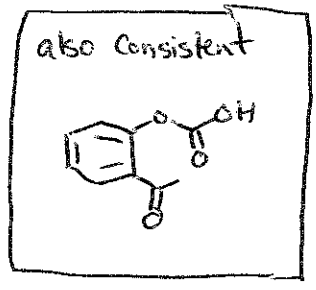
8) NMR question

Hint: You may need to take some of this compound once you are done with the exam.





Aspirin



9) Spectroscopy (general)
Using 2 types of spectroscopy of your choosing (IR, NMR, MS), explain 2 key, specific and noticeable differences that you would expect to observe spectroscopically between the starting material (**A**) and product (**B**).

A **B**

NMR

(A) would show an aldehyde (doublet ~ 9-10 ppm)

(B) would show ether protons (doublet ~ 3-4 ppm)

Both have alkene protons, but these might be difficult to distinguish. Some coupling differences do exist.

IR

(A) would show distinct C=O stretch ~ 1700. This would not exist in (B)

MS

(A) would have distinct α cleavage peaks.