

Fall Semester Organic Chemistry I
Fall 2012 Final Exam

Name (print): *Key*

Name (Sign) :

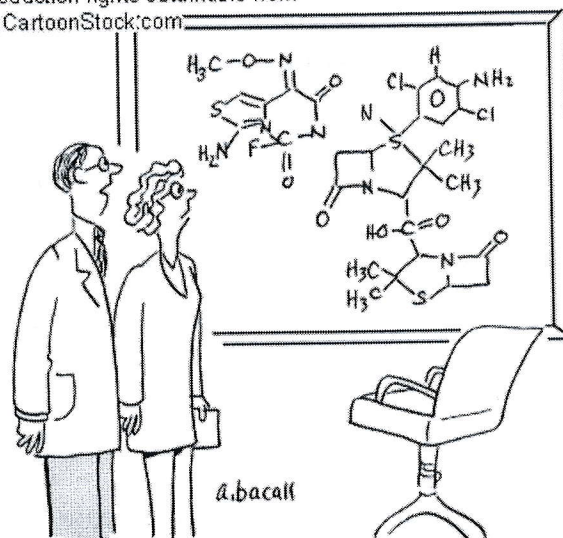
Instructions:

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2. The exam consists of 8 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. IUPAC	_____ / 6
2. Stereochemical Nomenclature	_____ / 14
3. 3D representations	_____ / 20
4. Reactions	_____ / 40
5. Synthesis	_____ / 30
6. Mechanisms	_____ / 40
7. NMR	_____ / 20
8. General Spectroscopy	_____ / 30
total	_____ / 200

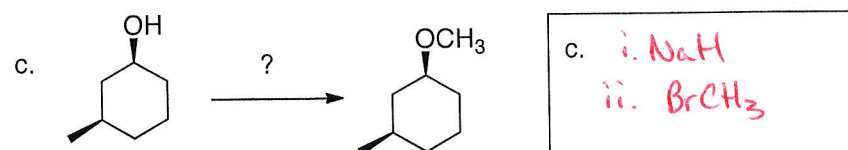
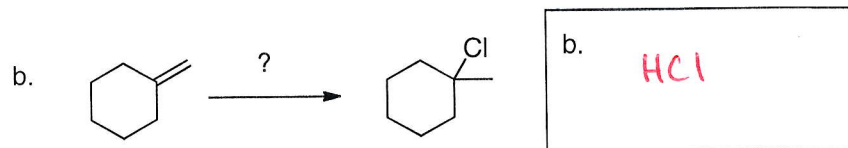
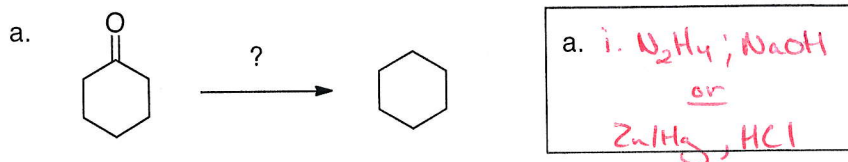
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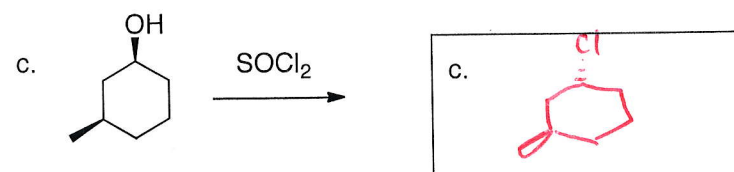
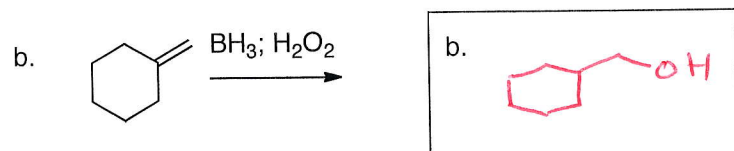
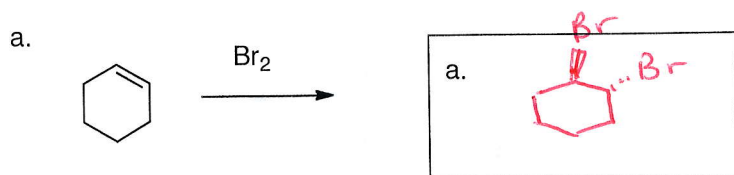
"Let's agree to dispense with the rules of nomenclature and call it compound X."

4) Reactions (40 points)

4a. Show the reagents necessary to carry out the following reaction (12 points, 4 points each)

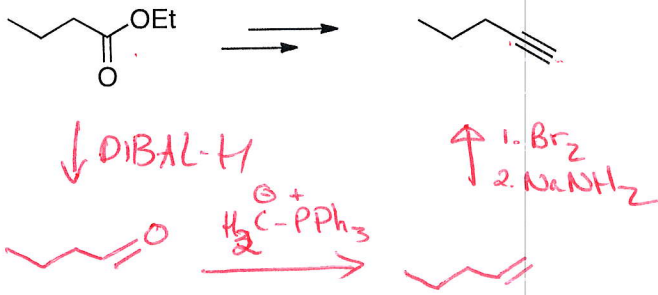


4b. Show the products of the following reactions (12 points, 4 points each)

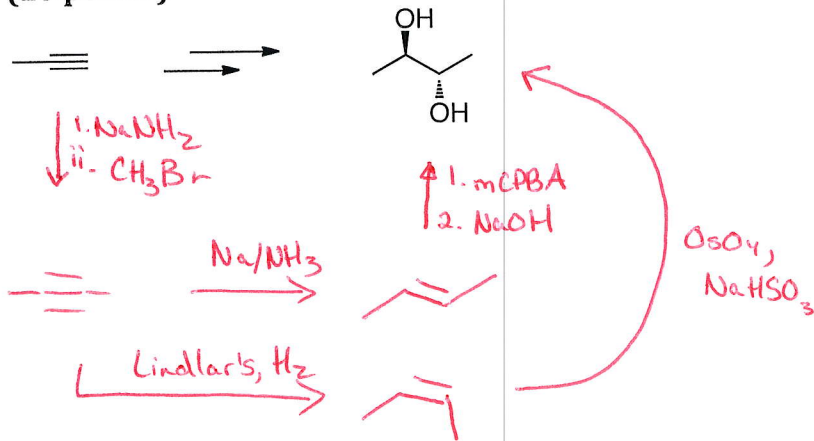


5. Synthesis (30 points)

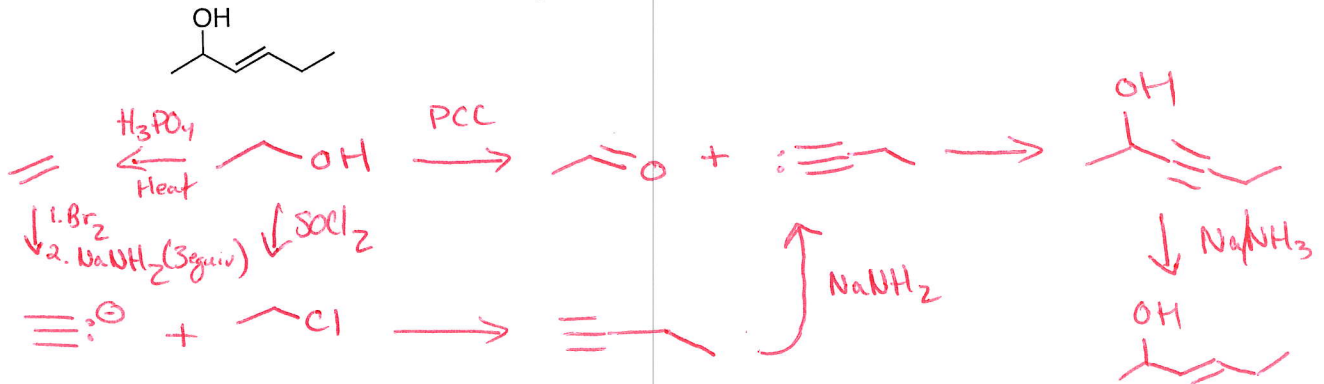
a. (10 points)



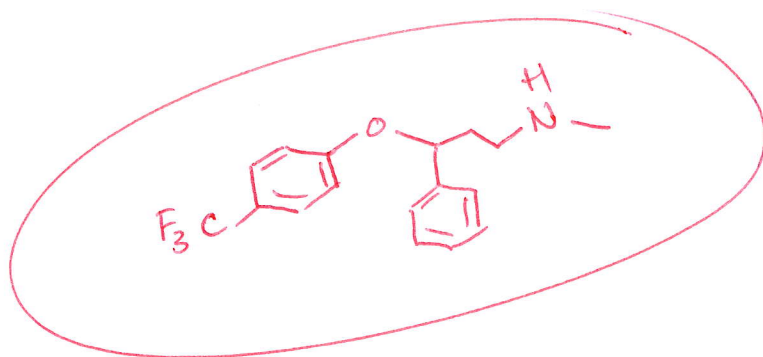
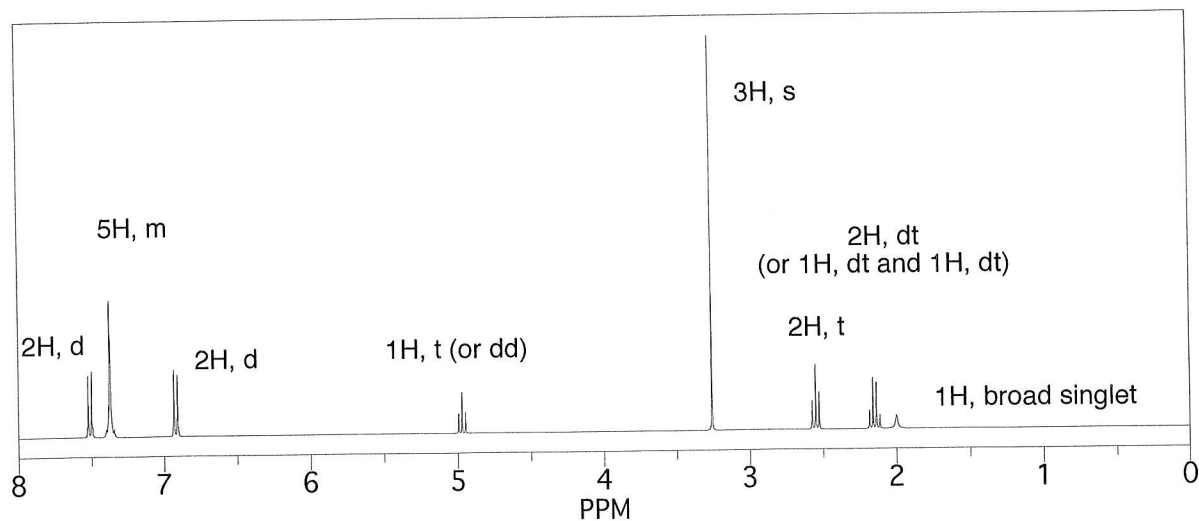
b. (10 points)



c. (10 points) Propose a synthesis of the following molecule using ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) as the source of carbon in the product.



7. NMR (20 points): The following is an NMR of the anti-depressant drug Prozac. The molecular formula is $C_{17}H_{18}F_3NO$. There are several structures that could be consistent with the NMR and molecular formula. To minimize the possibilities, I will tell you that Prozac contains a CF_3 group and that the broad singlet is from an NH. Show a structure that is consistent with this information. (bracketed splitting patterns are those that consider diastereotopicity)



many possible answers.

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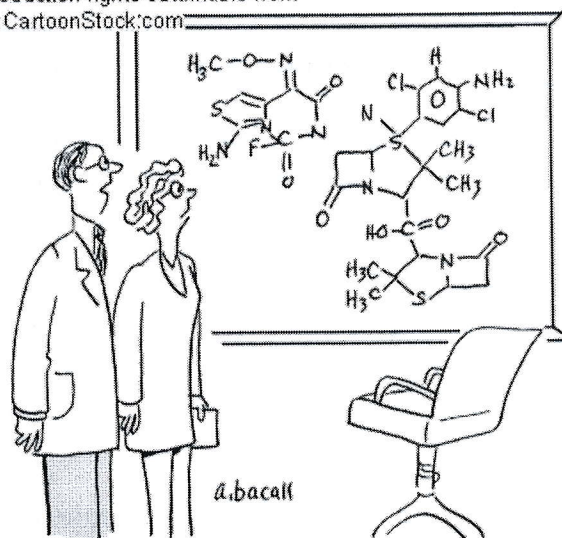
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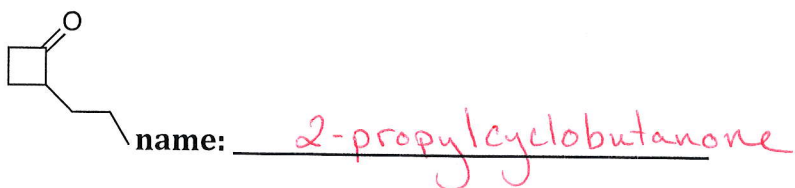
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"Let's agree to dispense with the rules of nomenclature and call it compound X."

1) IUPAC (6 points)

Give the IUPAC name of the following molecule



2) Stereochemistry (14 points)

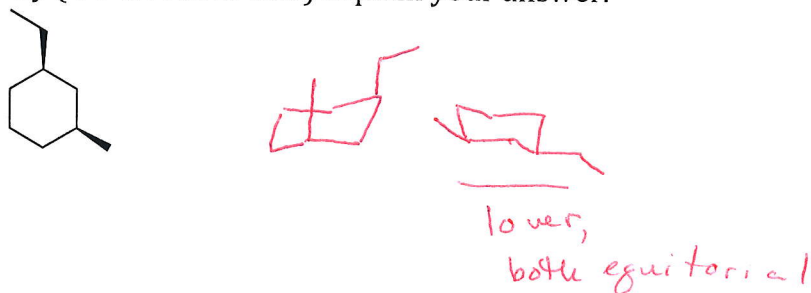
Circle and label (R or S) all of the stereocenters on the following molecule (8 points)

Is the molecule chiral or achiral, and if achiral would it classify as meso? (6 points)

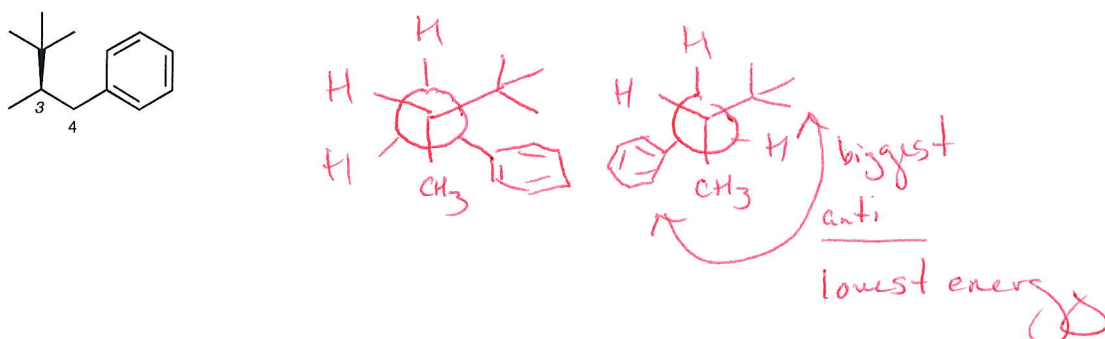


3) 3D Representations (20 points, 10 points each)

a. Draw both chair conformations of the following molecule and circle the lowest in energy. Briefly (4-5 words or less) explain your answer.

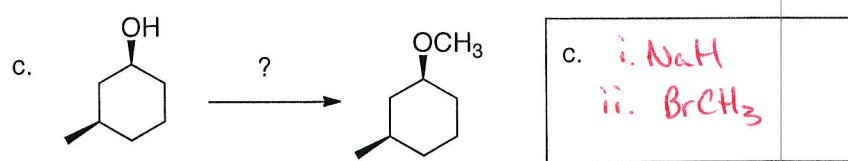
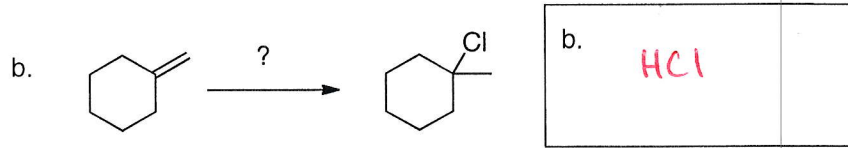
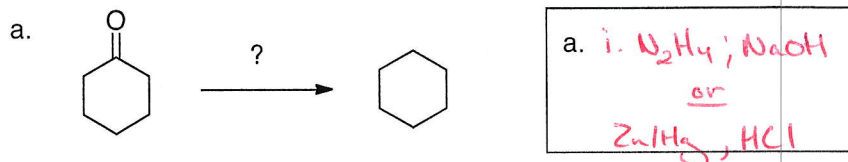


a. Draw the following molecule down the 3-4 bond in the lowest energy Newman conformation. Briefly (4-5 words or less) explain your answer.

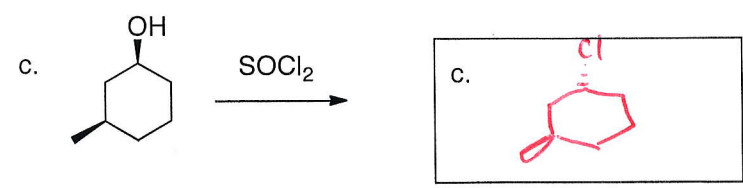
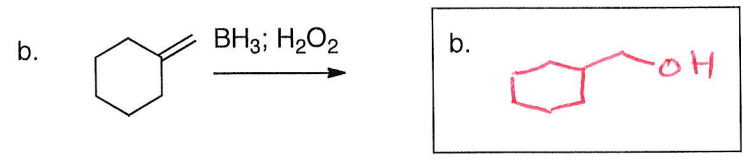
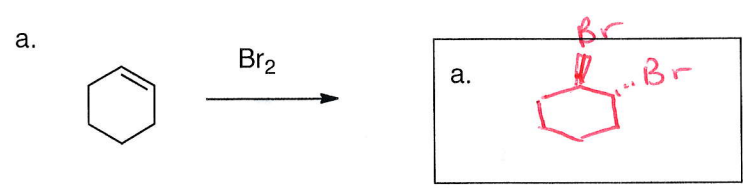


4) Reactions (40 points)

4a. Show the reagents necessary to carry out the following reaction (12 points, 4 points each)

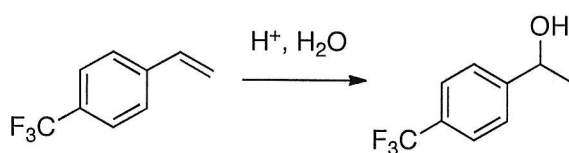
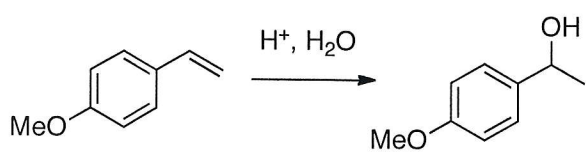


4b. Show the products of the following reactions (12 points, 4 points each)



4b. Predict which of the following reactions would work faster and briefly explain your answer. You must use structures to help explain your answers. (16 points, 8 points each)

a.



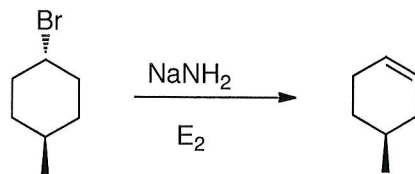
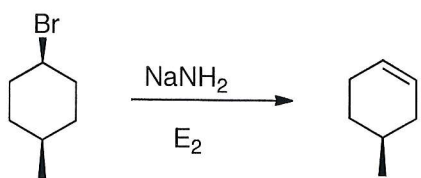
Faster

Reason:



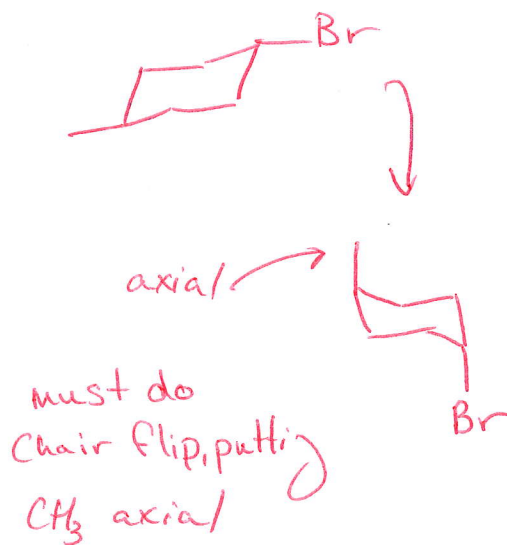
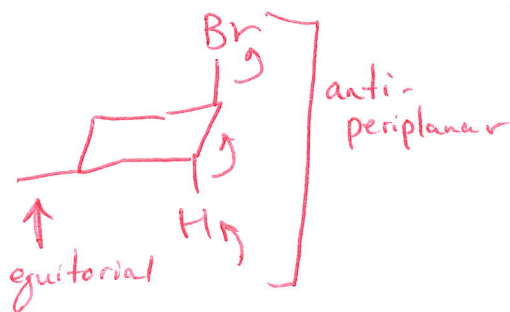
*Resonance stabilized.
Carbocation will form quicker*

b.



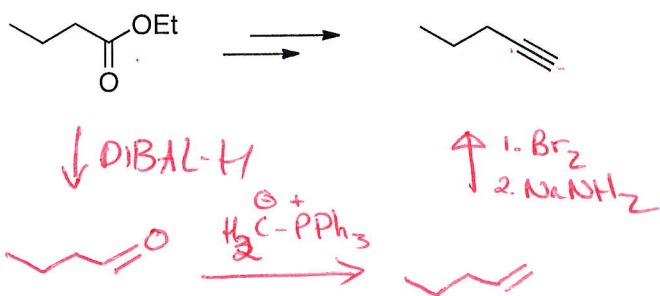
faster

Reason:

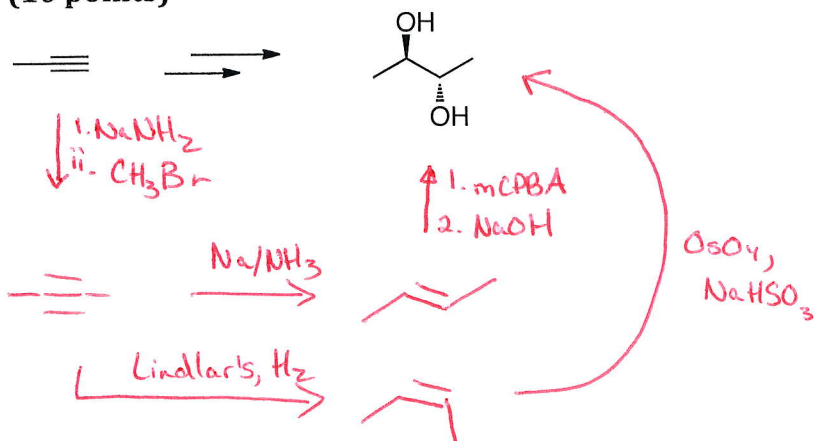


5. Synthesis (30 points)

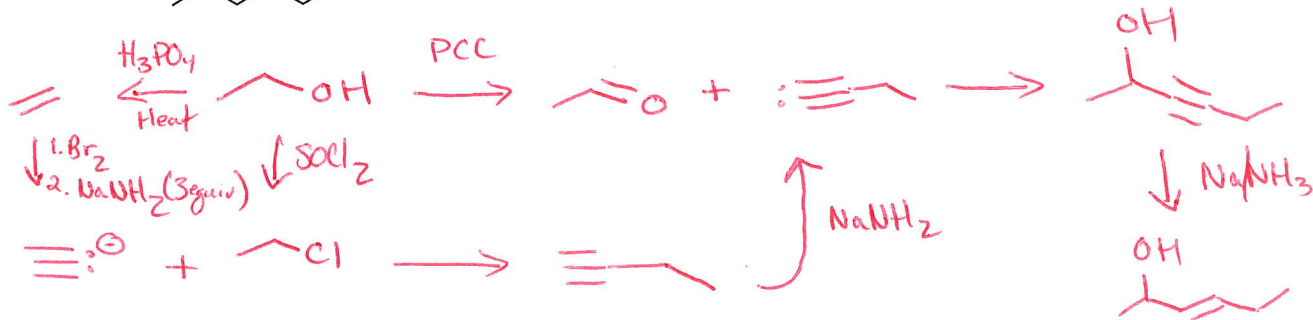
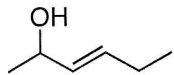
a. (10 points)



b. (10 points)

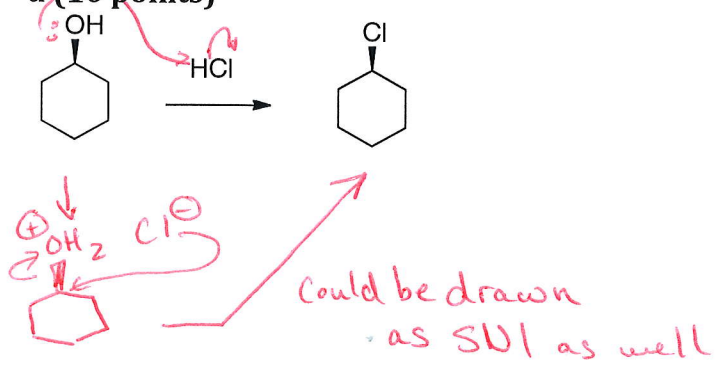


c. (10 points) Propose a synthesis of the following molecule using ethanol (CH₃CH₂OH) as the source of carbon in the product.

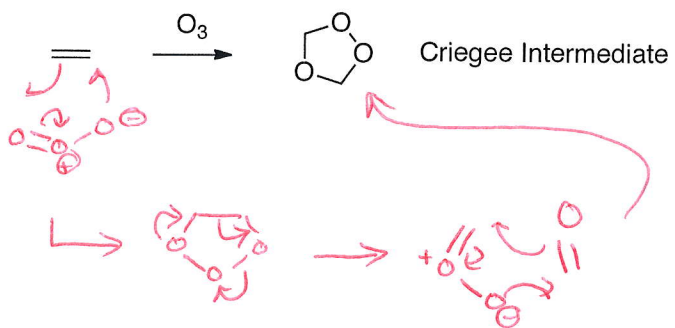


6. Mechanisms (40 points)

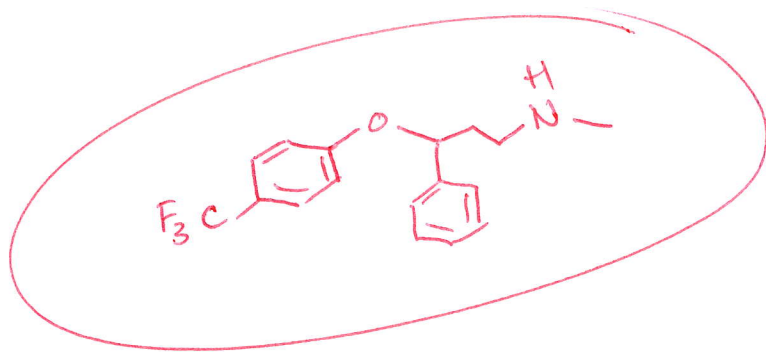
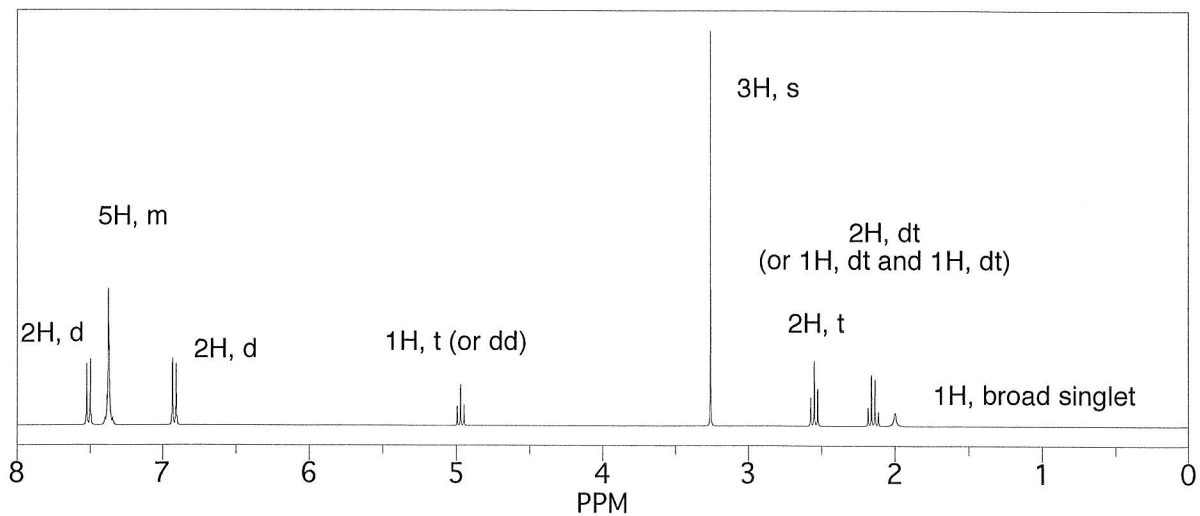
a (10 points)



b. (10 points)



7. NMR (20 points): The following is an NMR of the anti-depressant drug Prozac. The molecular formula is $C_{17}H_{18}F_3NO$. There are several structures that could be consistent with the NMR and molecular formula. To minimize the possibilities, I will tell you that Prozac contains a CF_3 group and that the broad singlet is from an NH. Show a structure that is consistent with this information. (bracketed splitting patterns are those that consider diastereotopicity)

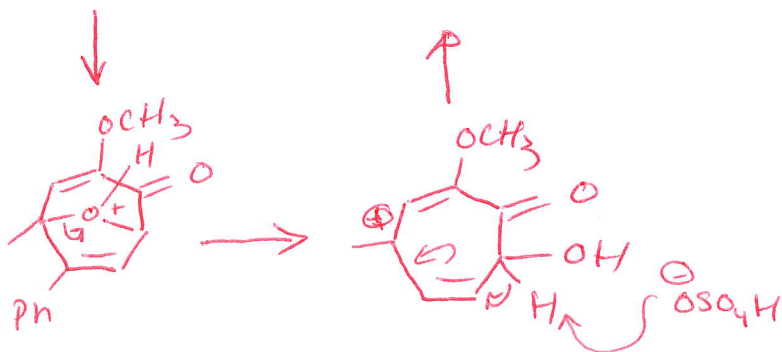
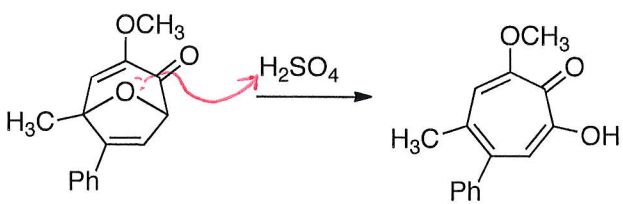


many possible answers.

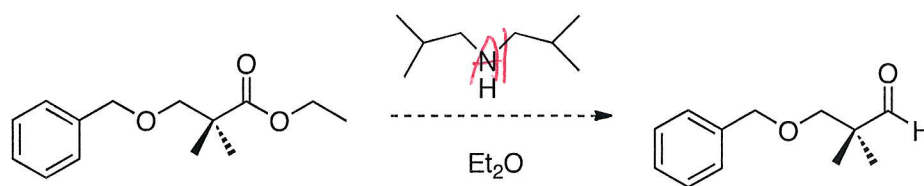
c. (10 points)



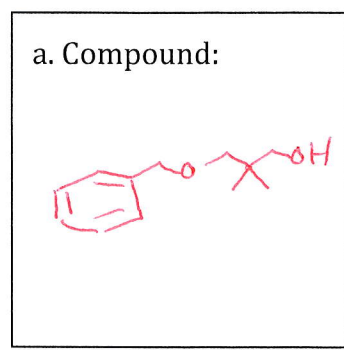
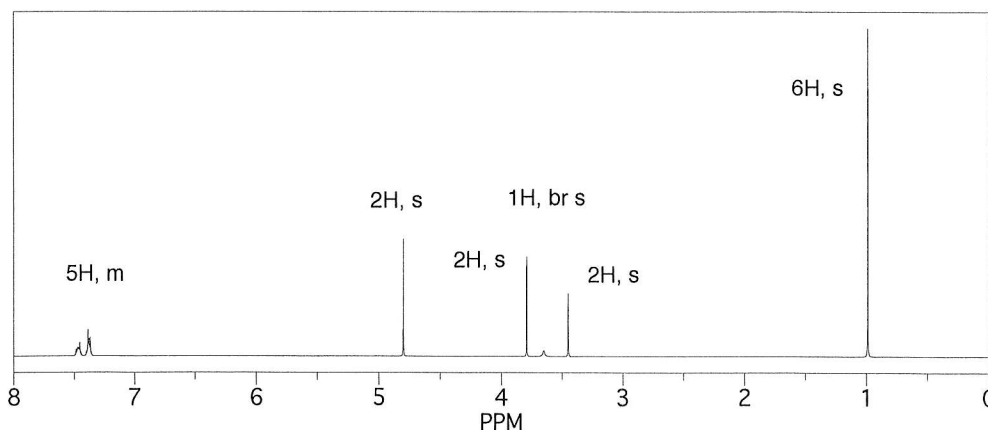
d. (10 points)



8. General Spectroscopy (30 points) Sally Scientist wanted to carry out the following DIBAL reduction:



The reaction called for -78°C temperature. Unfortunately, Sally didn't have any dry ice on her, but she found that ice water could be cooled to -10°C with sodium chloride. Upon working up the reaction, she obtained the following NMR. **a. (10 points)** What did Sally make?



b. **(10 points)** Briefly, how could Sally use BOTH mass spectroscopy and IR to confirm this?

IR: OH stretch @ ≈ 3300 (large; broad)

Mass Spec: should see mass consistent w/ product. May also see product mass - H_2O

c. **(10 points)** Using your knowledge of a DIBAL reaction, try to rationalize why Sally might have obtained this compound/ what went wrong?

DIBAL needs to be run @ low temp to prevent breakdown of intermediate

stable at lowtemp

If aldehyde forms, it will reduce rapidly to alcohol,

