

Name _____

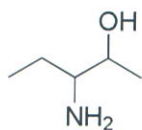
Exam 3
Chemistry 52
August 9, 2013
4-6 pm

Do not open or begin this exam until instructed. This exam consists of 7 pages plus the cover page and 1 scrap page. Before starting the exam, check to make sure that you have all of the pages. The exam has a total of 125 points and includes 14 questions. Only legible answers written on the exam will be considered for grading. All pertinent information needed for the exam is given. Notes, textbooks, and electronic communication devices are not permitted. This exam is administered under the Dartmouth College Honor Principle.

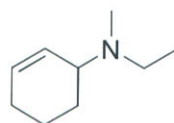
Use your time wisely.

Page Number	Value	Points Awarded
1	16	
2	19	
3	22	
4	22	
5	20	
6	10	
7	16	
Total	125	

1. (6 points, 3 each) Provide an IUPAC accepted name for the following compounds.

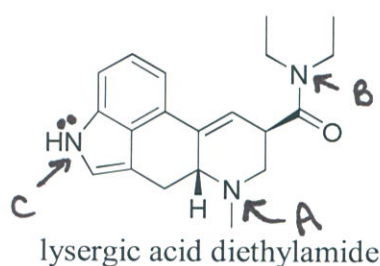


3-amino-2-pentanol
or 3-aminopentane-2-ol

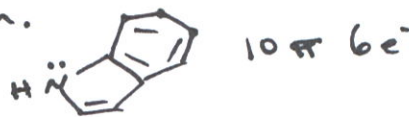


N-ethyl-N-methylcyclohex-2-enamine
or
N-ethyl-N-methyl-2-cyclohexenylamine

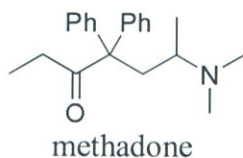
2. (4 points) Lysergic acid diethylamide (LSD), a potent hallucinogen, contains three nitrogen atoms. One of these three nitrogen atoms is significantly more basic than the other two. Identify the most basic nitrogen atom in LSD, and briefly explain your choice.



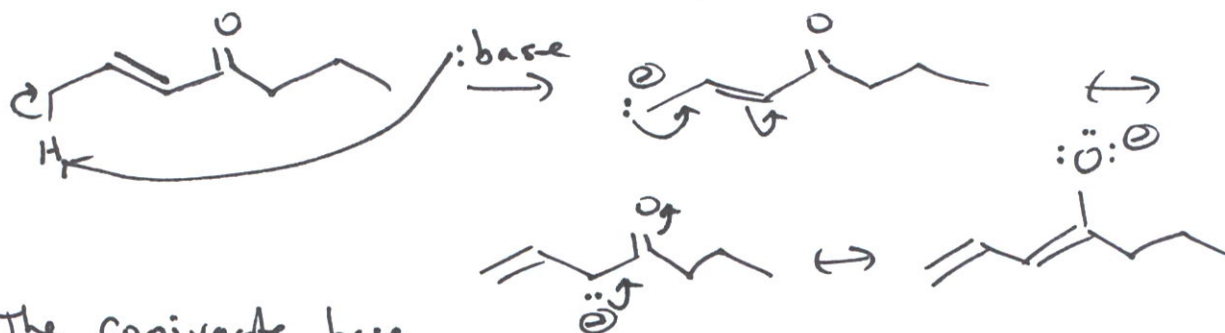
A is more basic than N_B or N_C . The lone pair on N_B is in resonance with the $C=O$, making it less basic. The lone pair on N_C is part of the aromatic ring system.



3. (3 points) Methadone is a powerful analgesic that is used to suppress withdrawal symptoms in the rehabilitation of heroin addicts. Identify the major product that is obtained when methadone is subjected to a Hofmann elimination (1. excess CH_3I 2. Ag_2O , H_2O 3. heat).

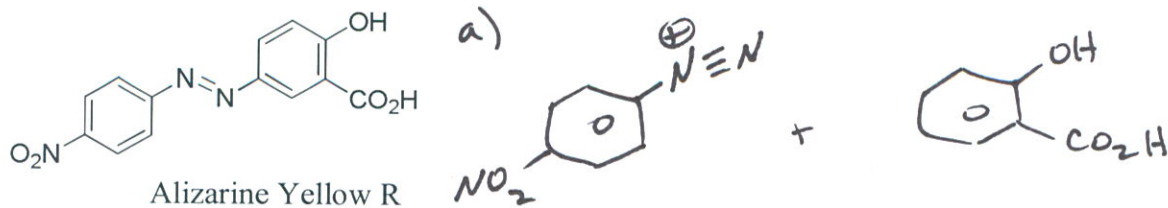


4. (3 points) When 2-hepten-4-one is treated with LDA, a gamma proton is removed. Show the resulting conjugate base and explain why the gamma proton is most acidic.



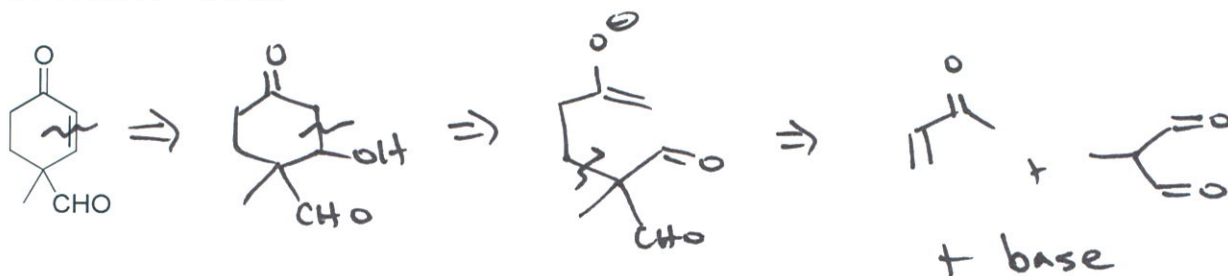
The conjugate base has the most resonance stabilization.

5. a. (4 points) Alizarine Yellow R is an azo dye that can be used as a pH indicator. It is yellow below pH 10 and red above pH 12. What reagents would be required to prepare the dye via an azo coupling? b. (2 points) What changes in the structure as the pH of a solution of the dye moves from below pH 10 to above pH 12?



b) The phenol is deprotonated \sim pH 10.

6. (5 points) What reagents would be required to prepare the following compound via a Robinson annulation?

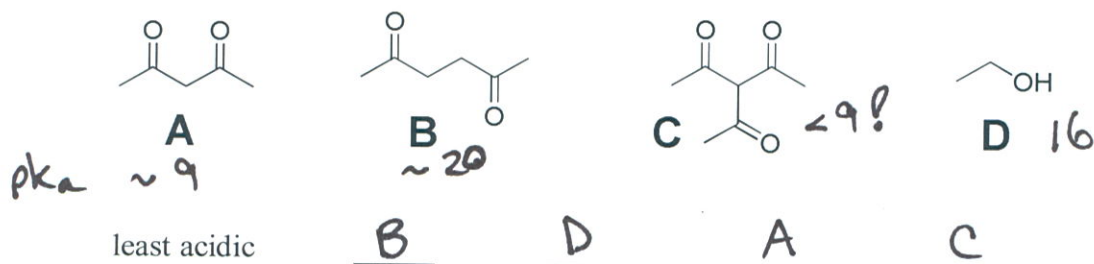


7. (4 points) Could 5-methylhex-4-en-3-one be synthesized in high yield via an aldol condensation? If yes, give the appropriate starting materials. If no, briefly explain why not.

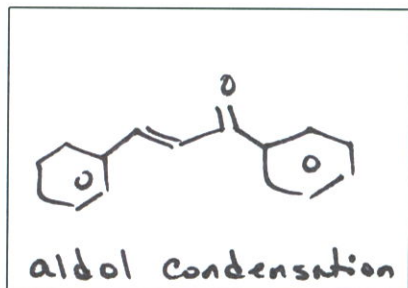
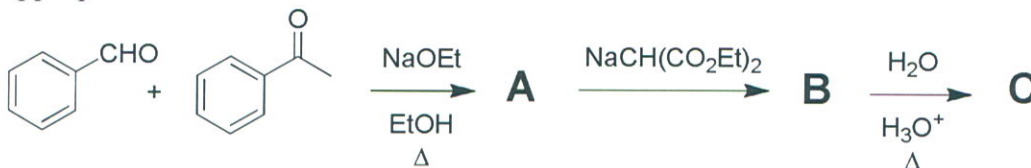


No, this would not work well. 1) Self-condensations will compete 2) 2-Butanone can form multiple enolates.

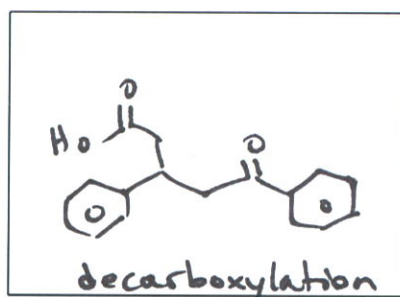
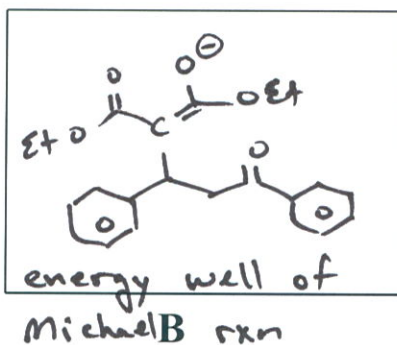
8. (4 points) Rank the following compounds in order of increasing acidity. (No partial credit will be awarded for this problem.)



9. (6 points, 2 each) Provide structures for compounds A-C. Place your final answers in the appropriate box.

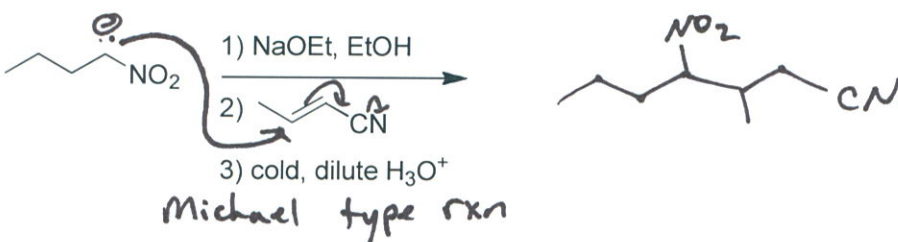
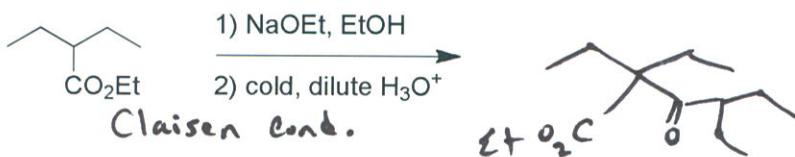
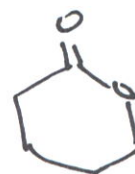
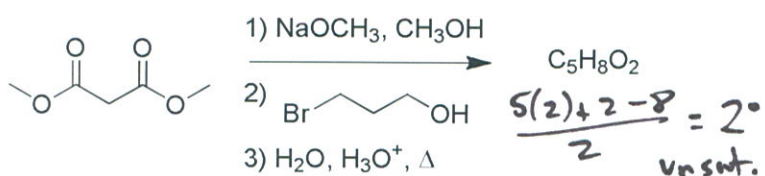
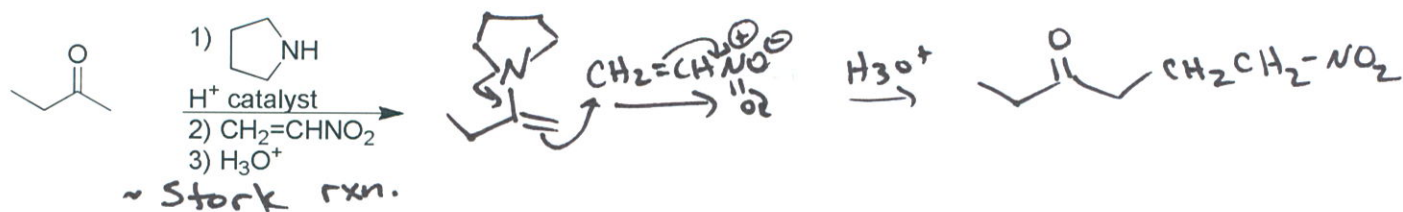


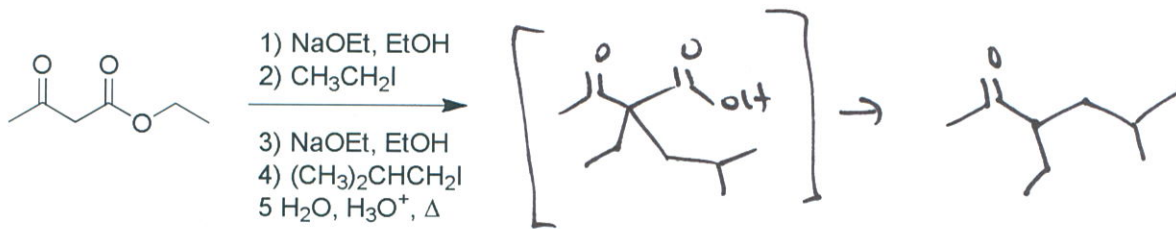
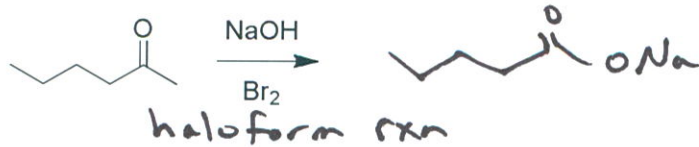
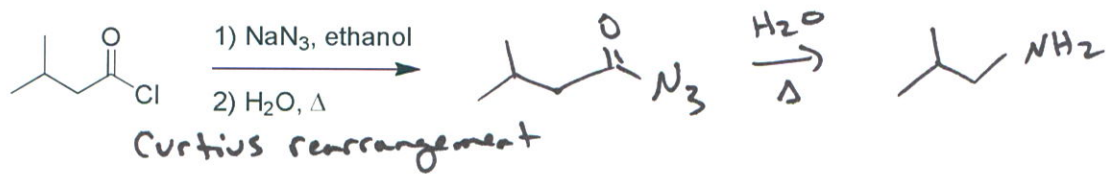
A



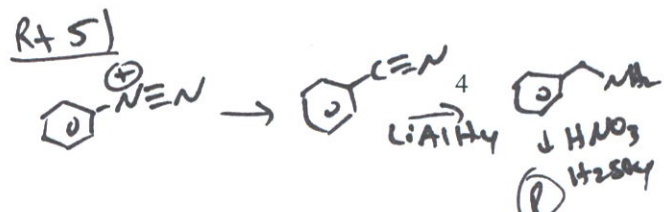
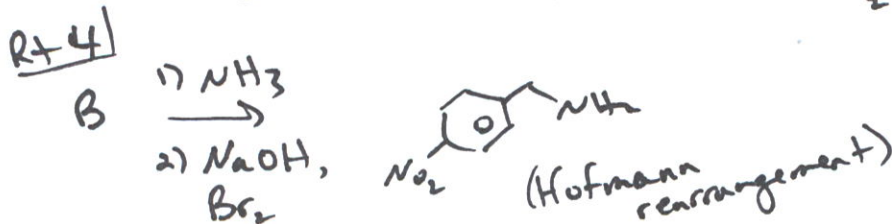
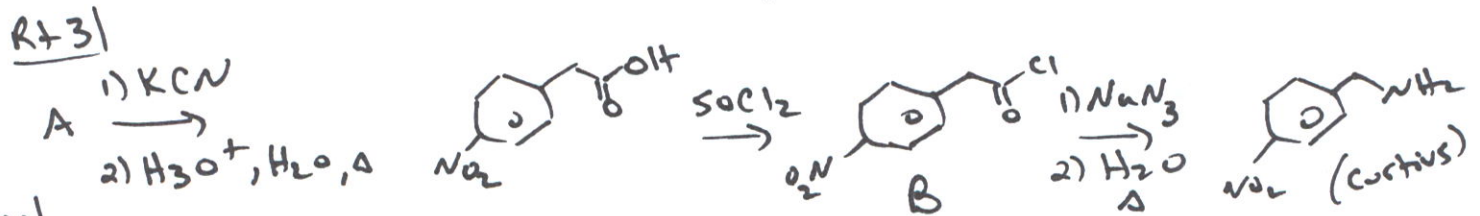
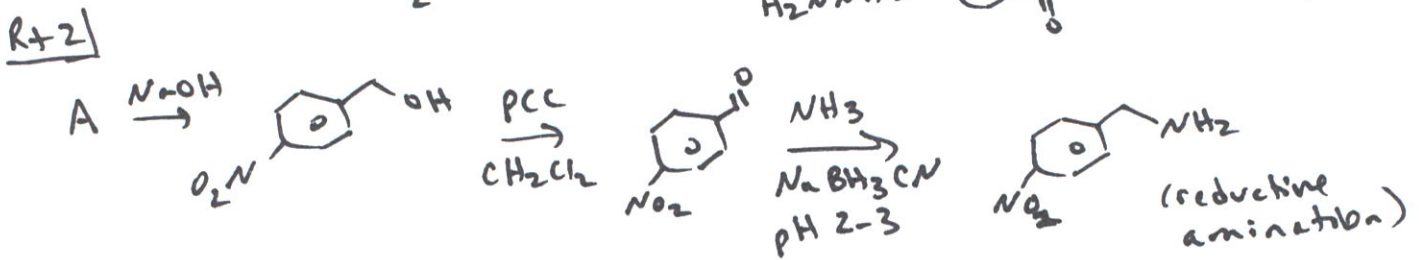
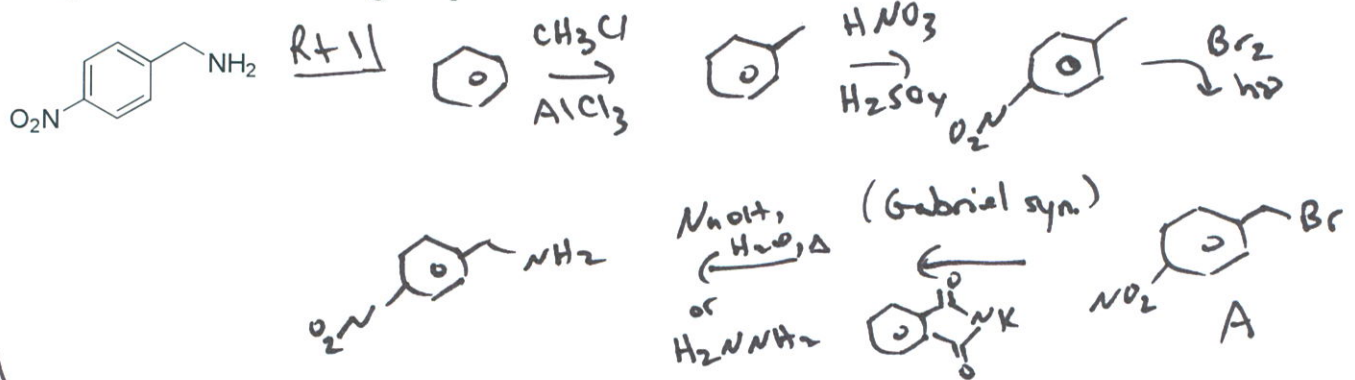
C

10. (28 points, 4 each) Provide the major organic products of the following reactions

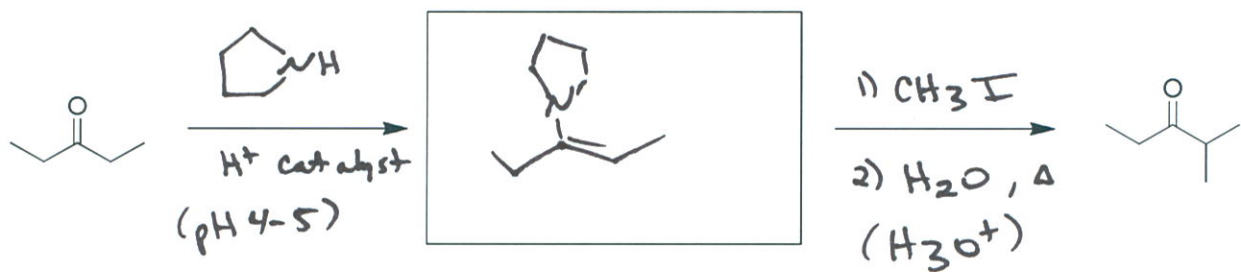
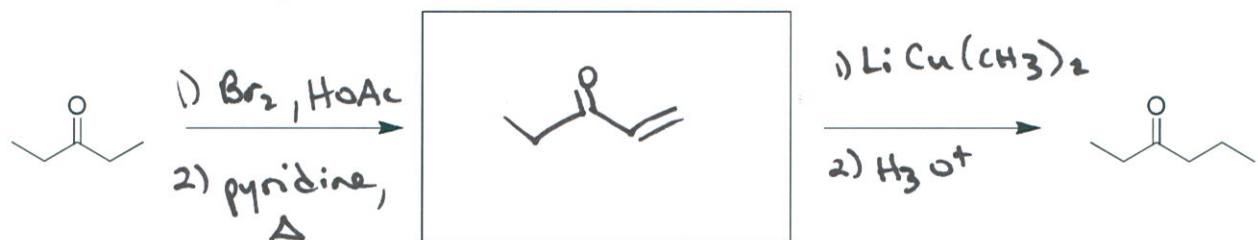
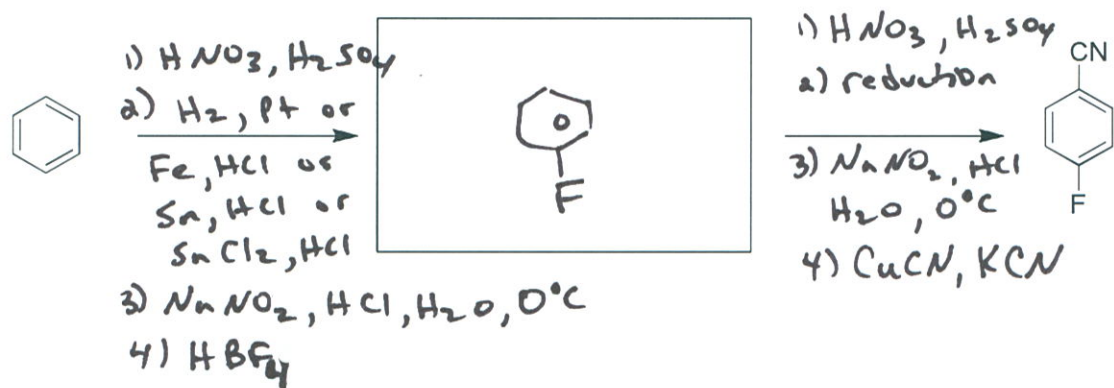
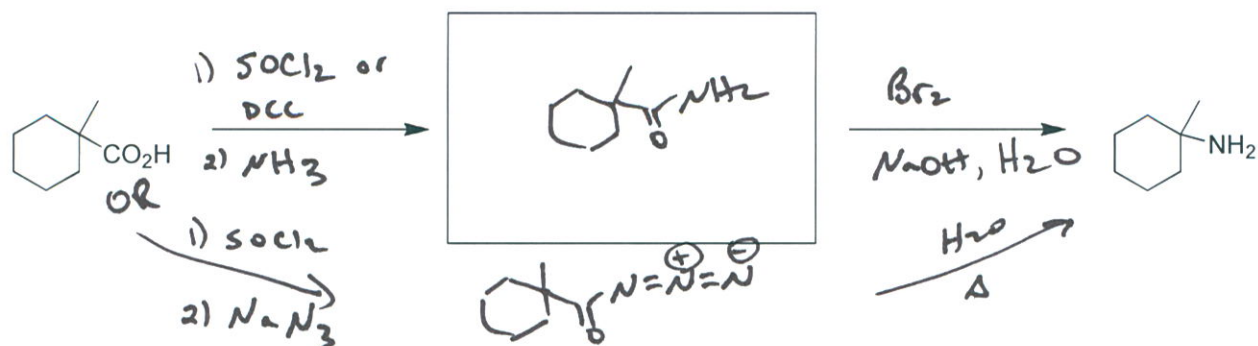




11. (10 points) Starting from benzene and any other reagents you need, propose an efficient synthesis of the following compound.



12. (20 points, 5 each) Complete the following short, multi-step syntheses by providing reagents over arrows and intermediate compounds in the boxes.



14. (16 points, 8 each) Using cyclopentanone as your starting material and any other reagents you need, prepare an efficient synthesis of two of the following three compounds. Clearly indicate which one you are omitting.

