CHEM 3331-100 Spring 2008

High = 102

Low = 15

Average = 68

Exam 3

Professor R. Hoenigman

I pledge to uphold the CU Honor Code:

Signature_____

Name (printed)_____

Last four digits of your student ID number_____

Recitation TA_____

Recitation number, day, and time_____

You have 1 hour and 30 minutes to complete this exam.
No model kits or calculators allowed.
Periodic table and scratch paper are attached.

DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.

Recitation Sections:

#	Day	Time	TA
122	Monday	5 pm	Ashley
121	Tuesday	8 am	Noel
131	Tuesday	12 pm	Jin
132	Tuesday	12 pm	Ashley
161	Thursday	8 am	Morin
171	Thursday	12 pm	Jin

SCORE:

Page 1 _____/11 **Page 3_____/21**

Page 2 _____/19 **Page 4_____/19**

Page 5_____/30

TOTAL_____/100

Extra Credit (5 pts)
How are reactions between aldehydes and nucleophiles fundamentally different than reactions between acyl chlorides and nucleophiles?
Concept Test on 4/16/08

A. Aldehydes are readily oxidized by nucleophiles to carboxylic acids.

B. Acyl chlorides have a leaving group, Cl^-, whereas aldehydes do not.

C. Aldehydes do not form tetrahedral intermediates with nucleophiles.

D. Acyl chlorides readily form enol tautomers.

1. (6 pts) One or more of the following names do not follow the IUPAC rules. Circle the incorrect name(s) and provide a correct IUPAC name.

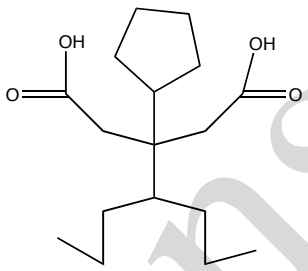
A. 2-(2-isopropoxy-2-oxoethyl)cyclopentanone

isopropyl 2-(2-oxocyclopentyl)acetate

B. 5-formyl-3-hydroxy-2-methylpentanoic acid

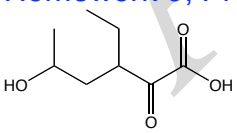
correct

C. Edward Scissorhands

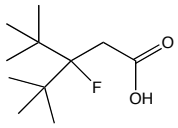


3-cyclopentyl-3-(1-propylbutyl)pentanedioic acid

2. (5 pts) Rank the following in terms of increasing acidity (1 = most acidic, 5 = least acidic)
Homework 9, Problem 1



1



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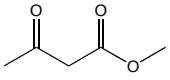

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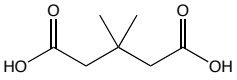

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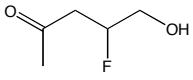
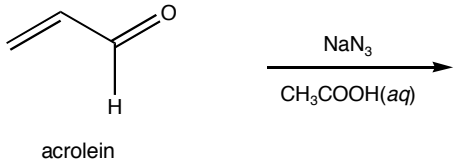
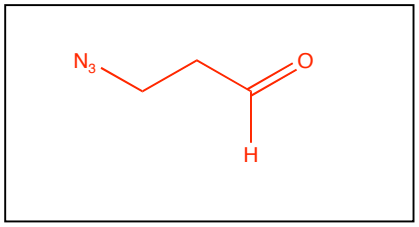


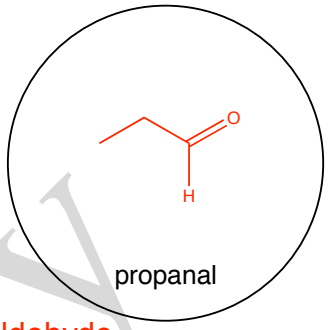
5

3. (9 pts) Acrolein reacts with sodium azide in aqueous acetic acid to form a compound ($C_3H_5N_3O$) in 71% yield. Propanal, when subjected to the same reaction conditions, is recovered unchanged. In the box below, suggest a structure for the product formed from acrolein. In the circle below, draw propanal. Give a brief explanation for the difference in reactivity between acrolein and propanal.



acrolein



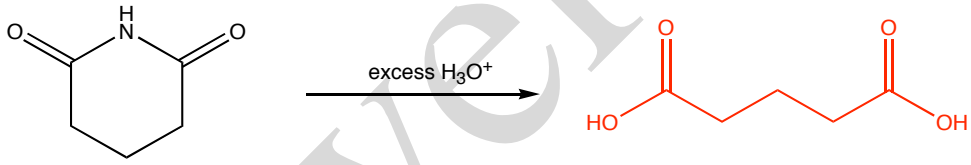


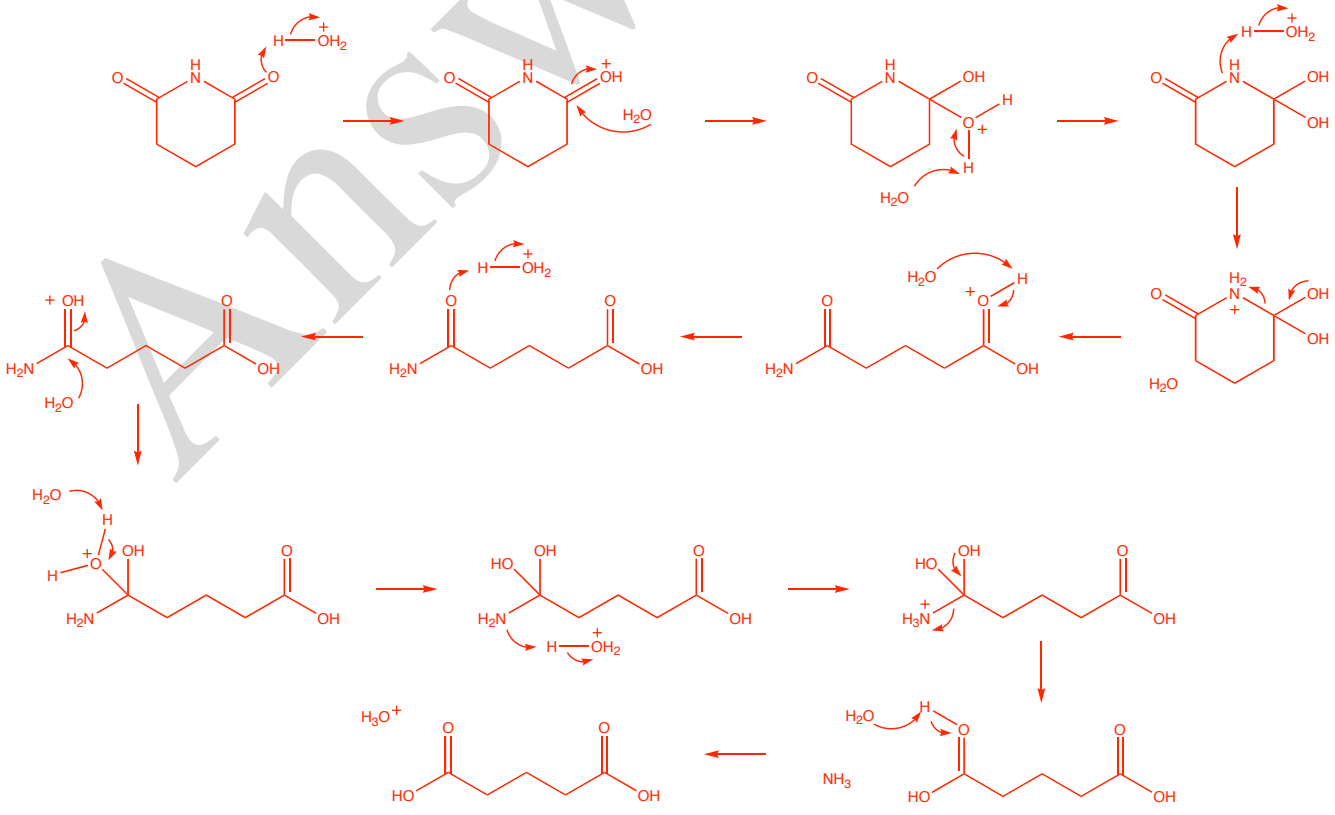
propanal

Book Problem 18.19

Weak nucleophiles, such as the azide ion, add to an α,β-unsaturated aldehyde by conjugate addition. The resulting β-substituted aldehyde still has a strong C-O double bond. Conversely, a weak nucleophile adds to an otherwise saturated aldehyde by addition at the carbonyl carbon to make a tetrahedral carbon. In the case of propanal (and most other aldehydes and ketones) the tetrahedral intermediate is less stable than the carbonyl compound and the equilibrium lies on the side of the aldehyde.

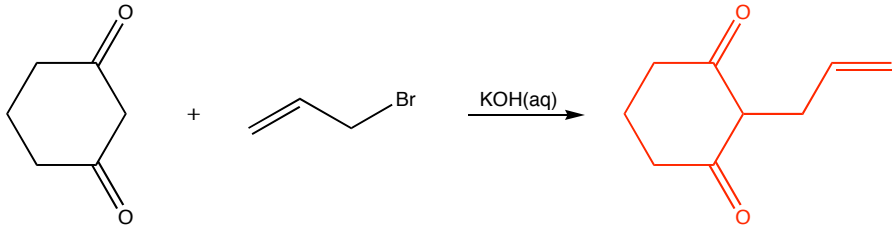
4. (10 pts) Fill in the product(s) of the following reaction and, using arrows to show the flow of electrons, propose a mechanism for the transformation.



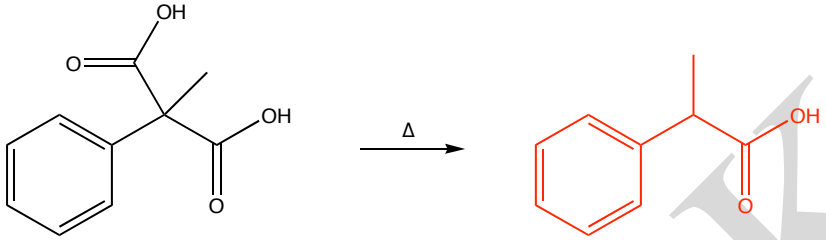


5. (21 pts) Draw the major organic product(s) of the following reactions. Write NR if no reaction occurs. (3 points each)

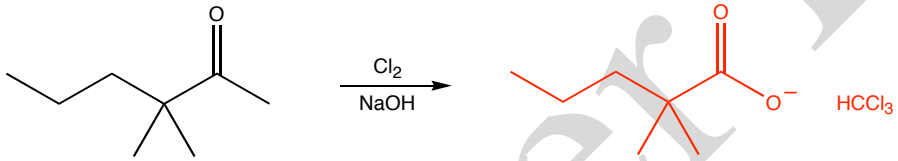
A. Book Problem 18.27h



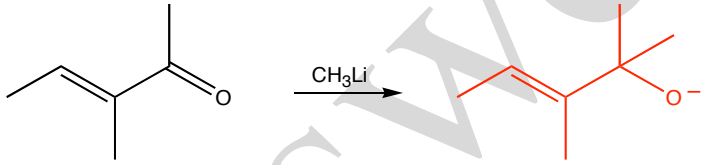
B. Book Problem 19.11c



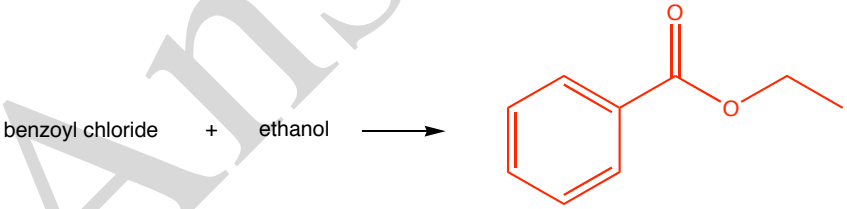
C.



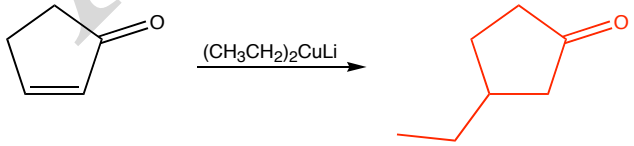
D.



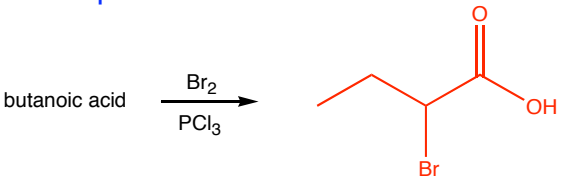
E. Book Problem 20.3c



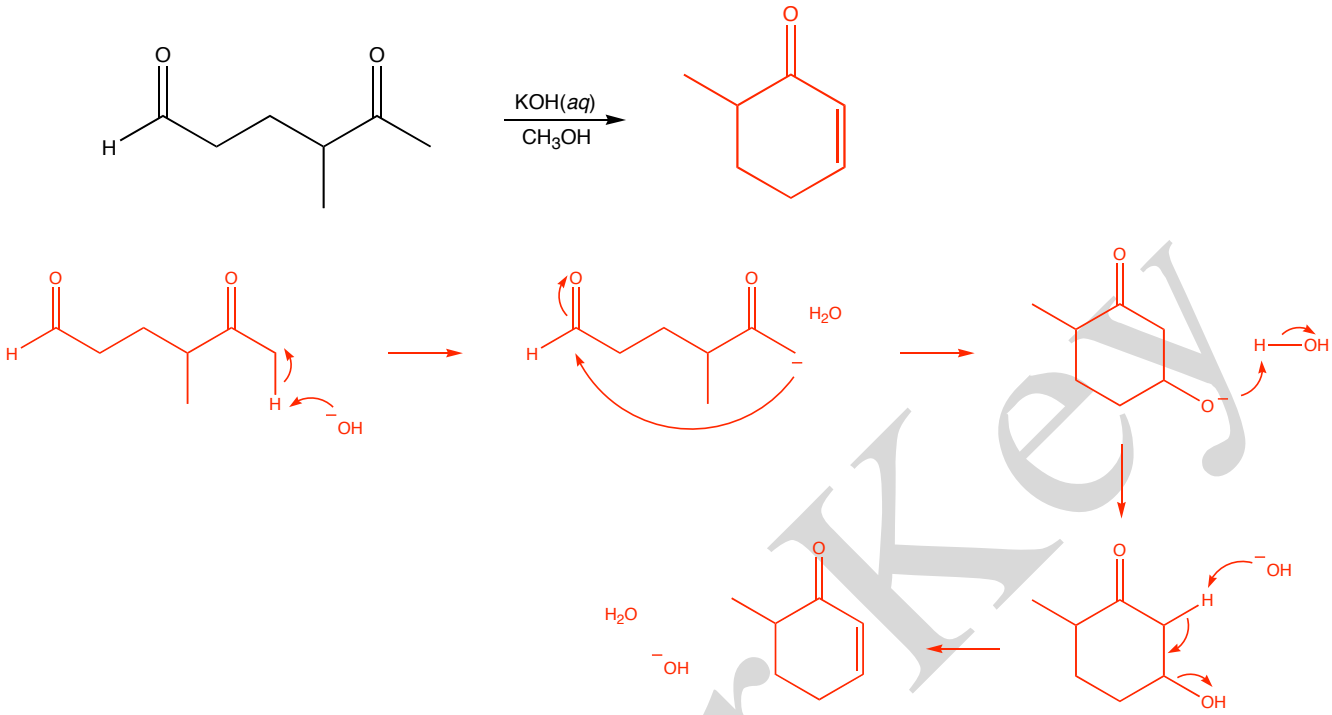
F.



G. Concept Test on 4/16/08

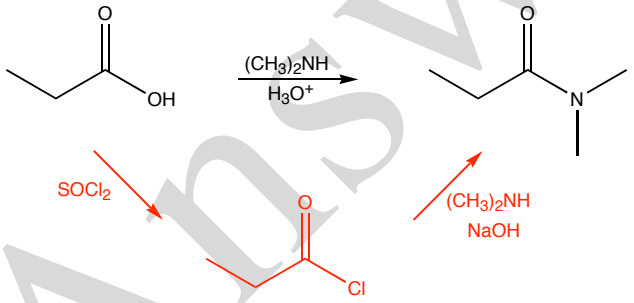


6. (10 pts) Fill in the product of the following reaction and, using arrows to show the flow of electrons, propose a mechanism for the transformation. Book Problem 18.41c



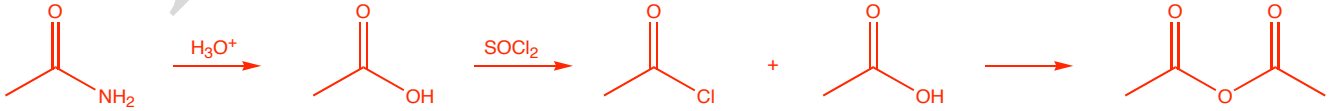
7. (9 pts) Some (or possibly all) of the reactions below will not produce the desired product. For each reaction that will not "work" propose a viable synthesis from the starting organic reactant to produce the desired product.

A.



B.

acetamide —pyridine→ acetic anhydride



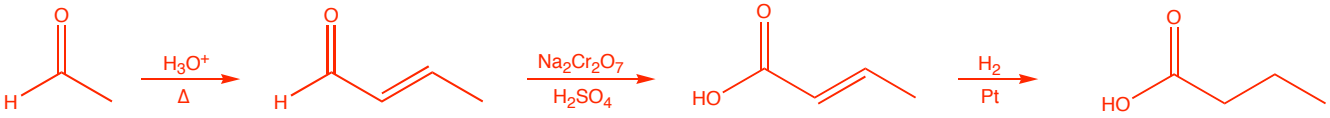
C.

isopropyl 3-methylpentanoate —1) NaOH, 2) H_3O^+→ isopropanol + 3-methylpentanoic acid

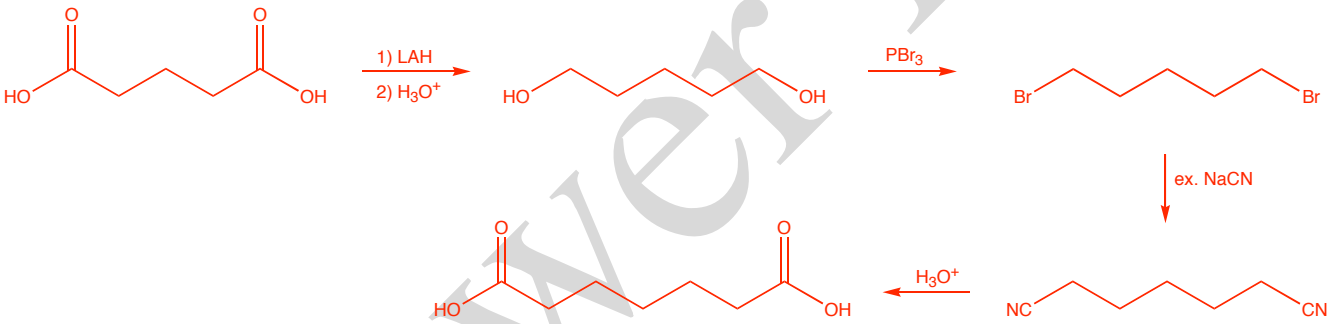
correct

8. (30 pts) Propose an efficient synthesis for the following transformations. You may use any reagents you like, but must use the given starting material. (10 points each)

A. butanoic acid *starting from* acetaldehyde
Book Problem 19.17f



B. heptanedioic acid *starting from* pentanedioic acid
Book Problem 19.24d



C. 4-bromo-2,2,5-trimethyl-3-hexanone *starting from* 3-methylbutanamide