Hour Exam #3
Chemistry 345
Professor Gellman
1 May 2015

Last Name Answer

First Name key

General Instructions:

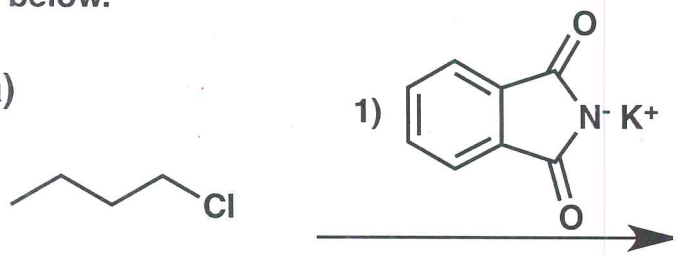
(i) Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit. Models are allowed.

(ii) Print your name on each page.

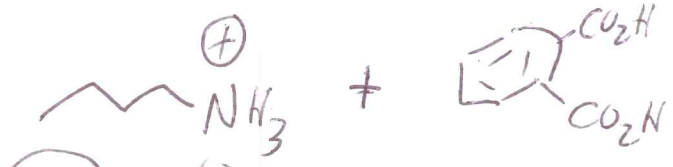
(iii) Please keep your paper covered and your eyes on your own work. No electronic devices may be used. Misconduct will lead to failure in the course.

1. (19 points) Show the ORGANIC product(s) expected from the reactions indicated below.

(a)

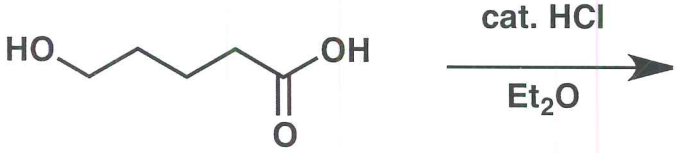


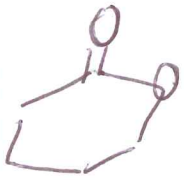
[NH_2 OK] [Not required]



+5 $Br^{\ominus}$

(b)

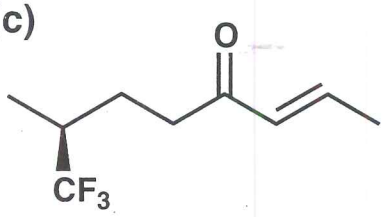




+6

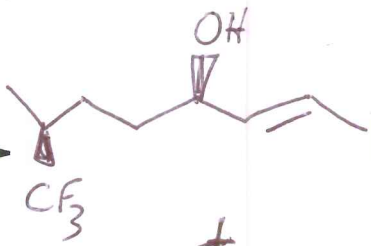
[HINT: The organic product has a strong IR signal at 1740 cm^{-1}, and no IR signal above 3000 cm^{-1}.]

(c)



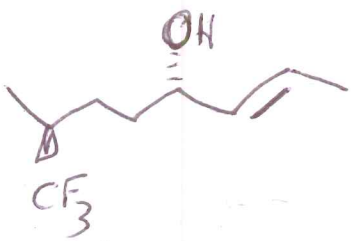
1) $LiAlH_4$, Et_2O

2) H_3O^+

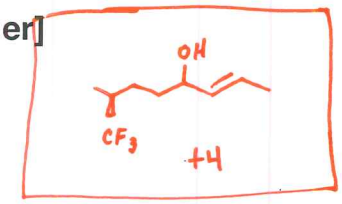


+5 for one;
+8 for both

+



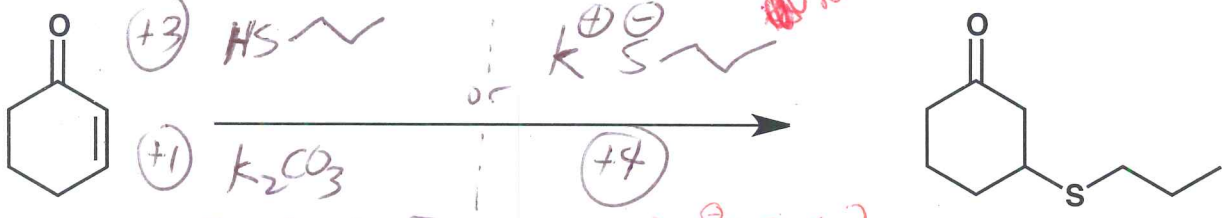
[single enantiomer]



Name _____

2. (29 points) Show the reagents and other organic molecules required to convert the starting material to the indicated product. Be sure to differentiate clearly between distinct steps, by using "1)", "2)", etc. over or under the arrow.

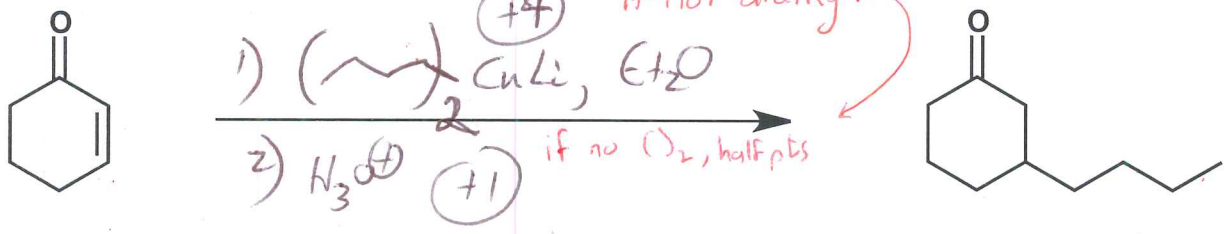
(a)



1). $^{\ominus}S$~
2). $H_3O^{\oplus}$
} +4/4

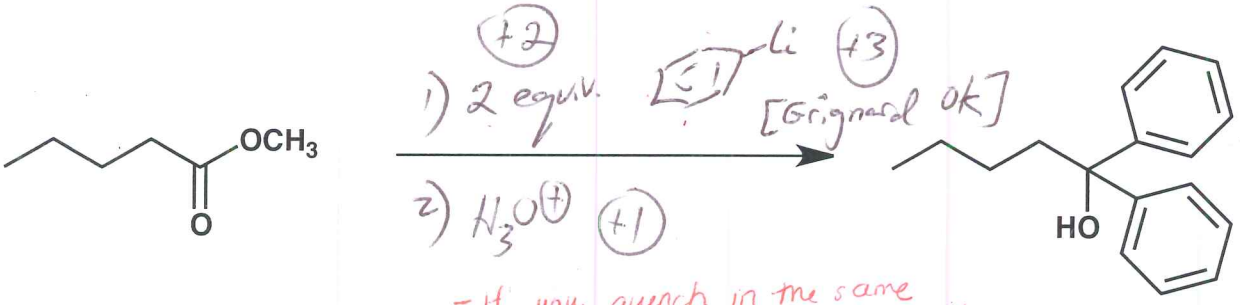
4

(b)



5

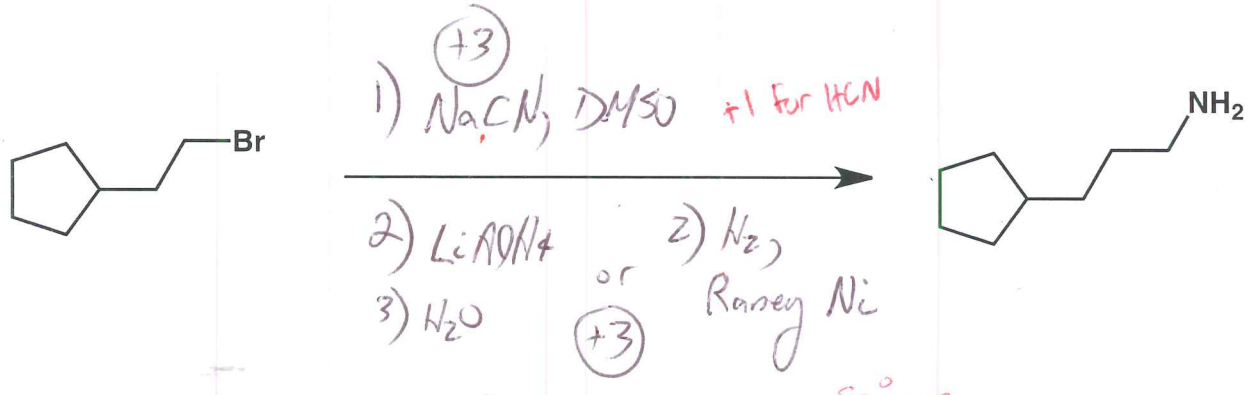
(c)



- If you quench in the same step max 4/6

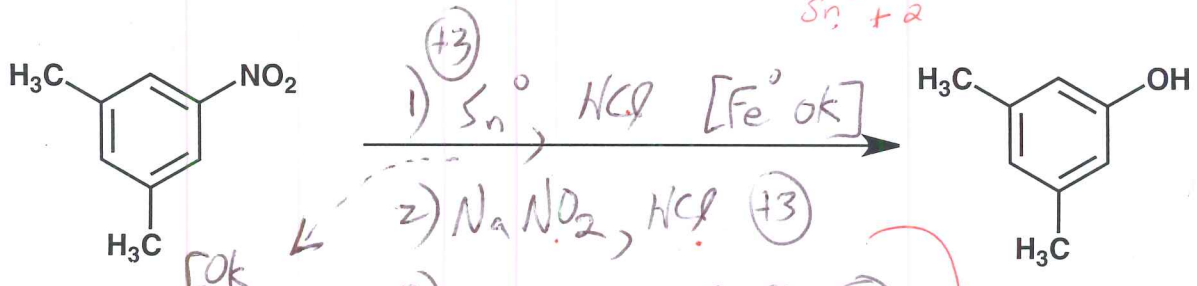
6

(d)



6

(e)

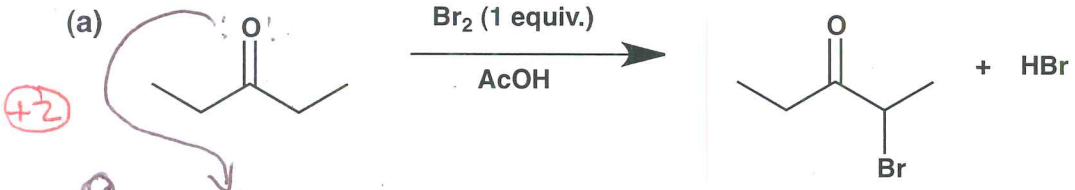


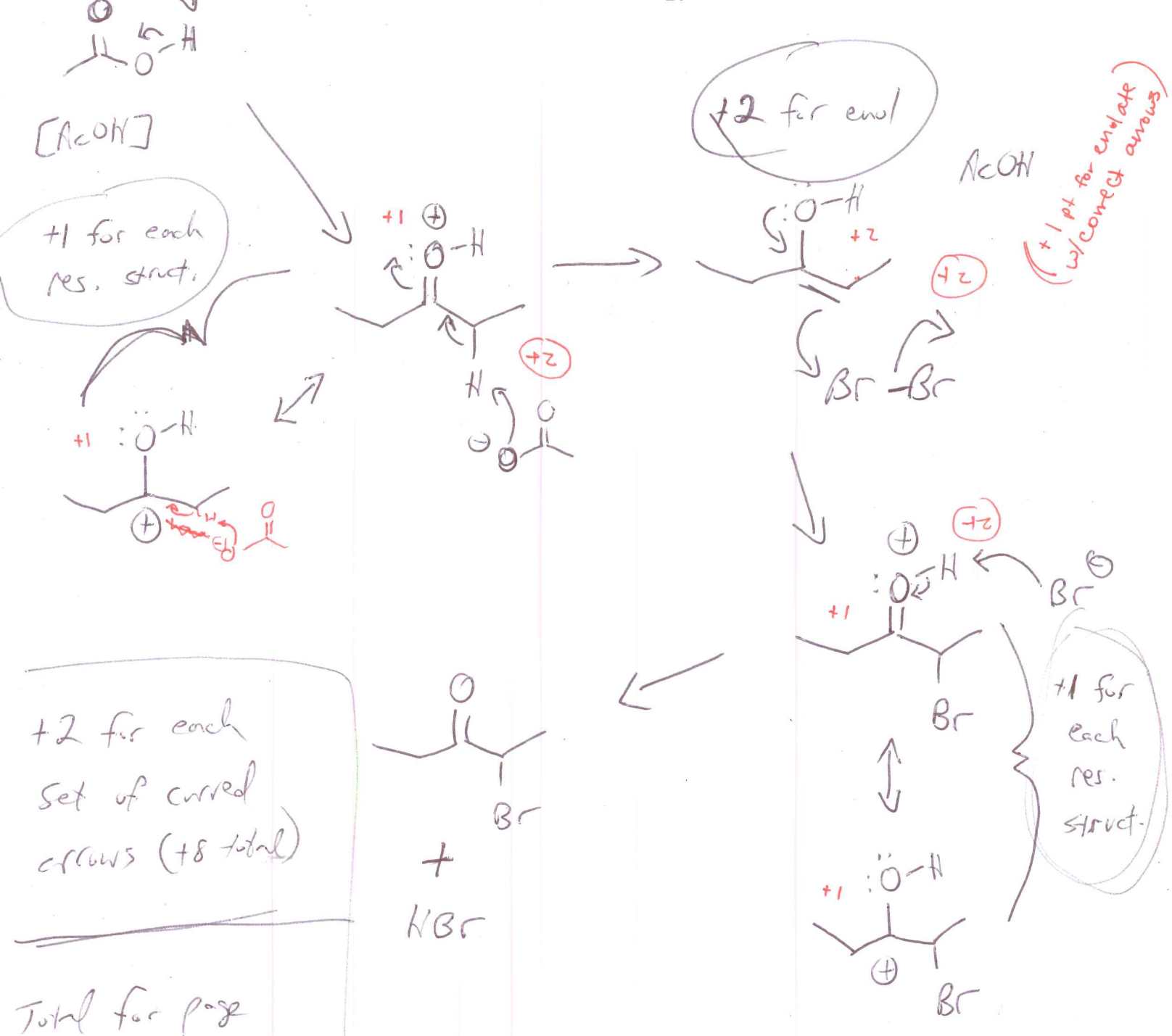
8

Name _____

3. (24 points) Provide a mechanism (curved arrows) for each reaction shown below. Draw all important resonance structures for intermediates.

(a)





Total for page = +14

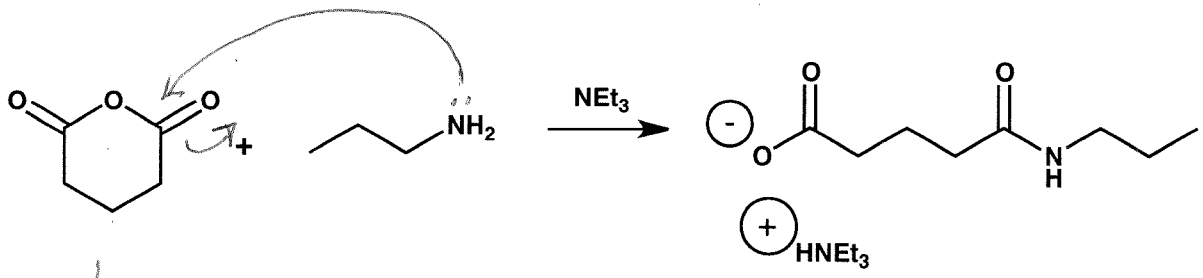
(cont. on next page)

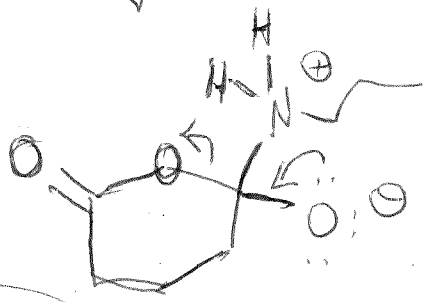
- missing arrows (-1)
- 1/2 pts./step for wrong acid/base

Name _____

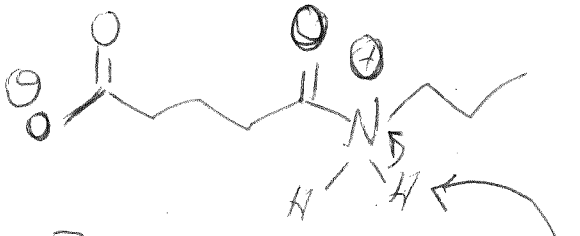
3. (cont.)

(b)

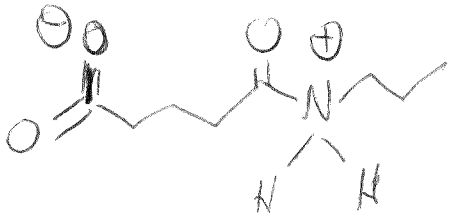




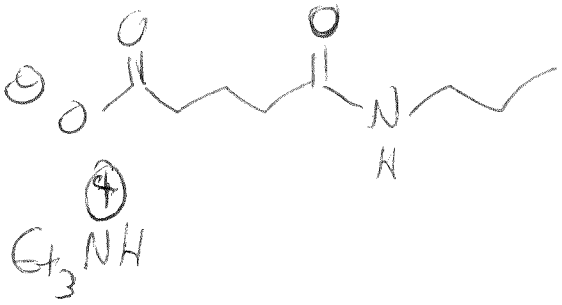
+2 for intermediate



+2 for intermediate



[carboxylate res. structure not required]

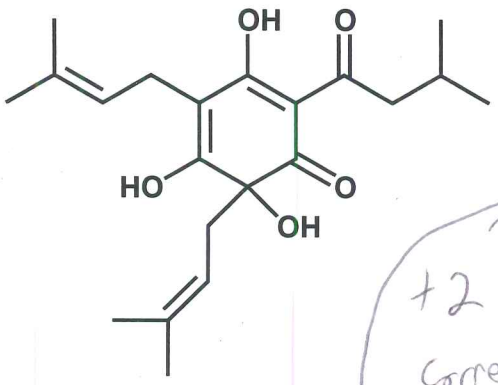


+2 for each set of curved arrows (+6 total)

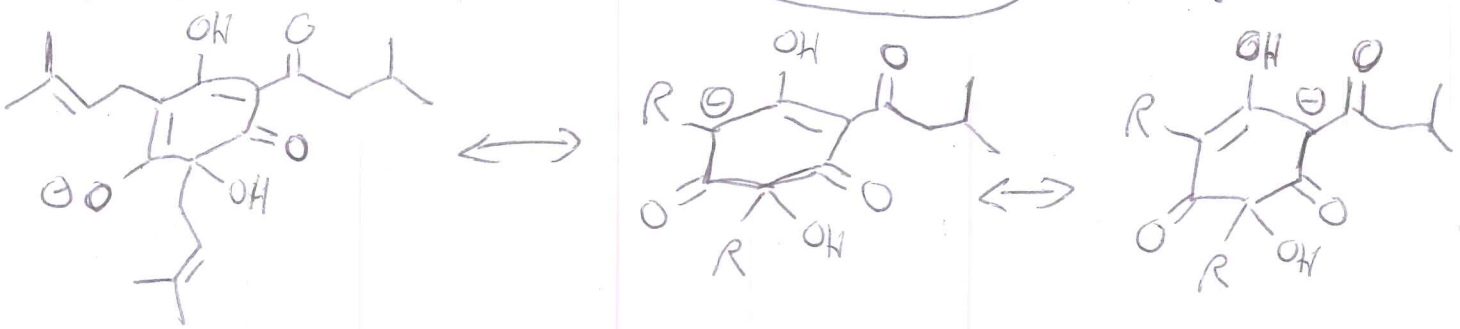
Total mechanism = +10

Name _____

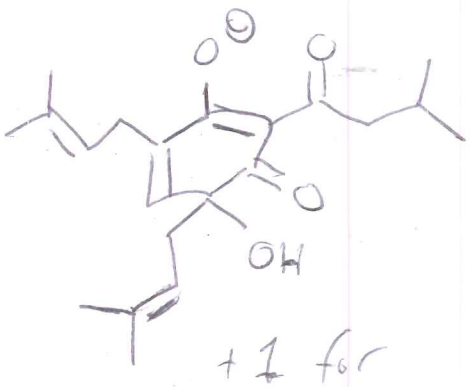
4. (10 points) The molecule shown below, humulone, contributes to the bitter taste of many beers. This molecule is released by the hops during the brewing process. This molecule is relatively acidic. Show the conjugate base that would be formed by removing the most acidic proton; draw all resonance structures of this basic form.



+2 for each correct res. structure



Note: If an answer involves alternative deprotonation:

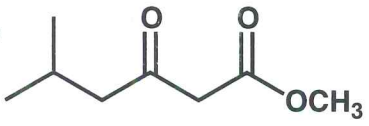


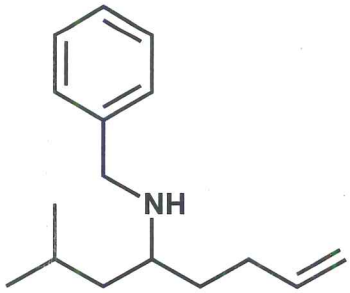
+2 for each additional correct res. structure (there are 3)

+1 for this structure

Name _____

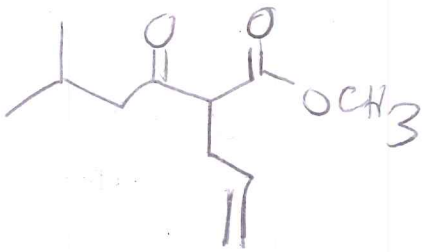
5. (18 points) Propose an efficient synthetic route from the indicated starting material to the target. You may use any other starting materials and reagents.

Starting material = 

Target = 

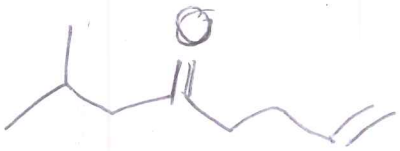
1) $CH_3O^{\ominus}Na^{\oplus}$, CH_3OH (+3)

2)  (+3)



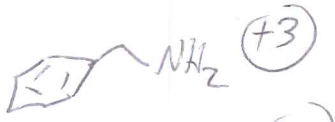
1) $NaOH$, H_2O (+2)

2) HCl, H_2O, Δ (+3)



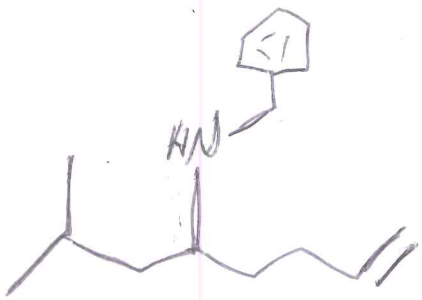
-1 w/out Δ

[Note: Acid/H_2O/Δ is sufficient]

 (+3)

$NaBH_3CN$ (+3)

$AcOH$ (+1)



Elimination of -OH w/ H_2SO_4 gets +1