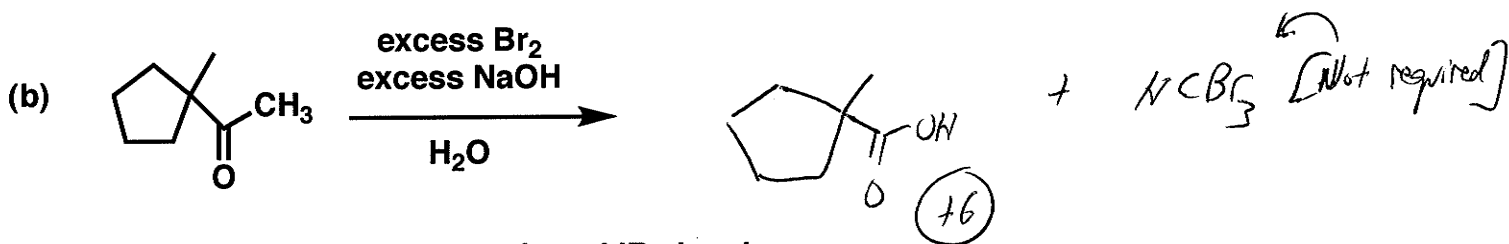
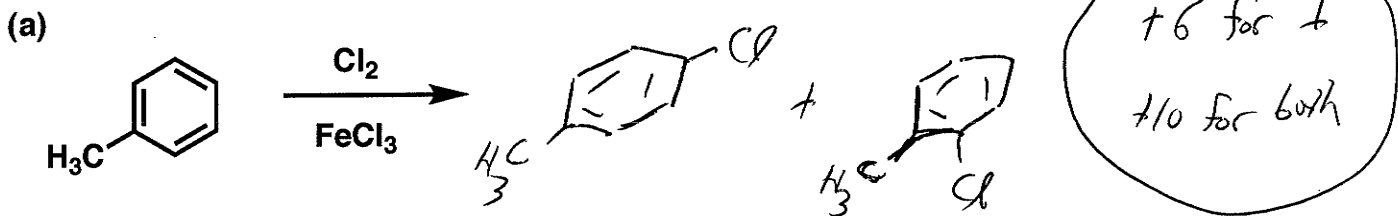


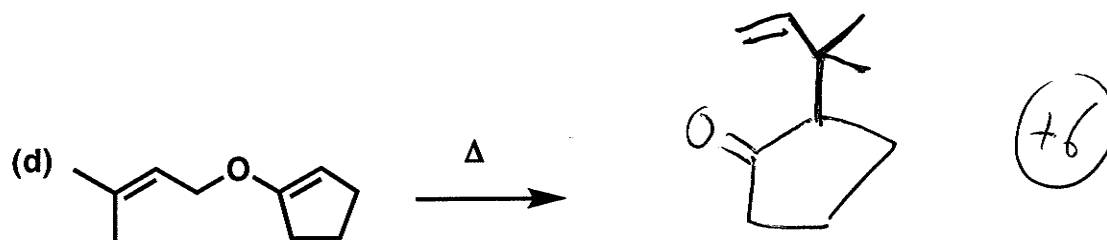
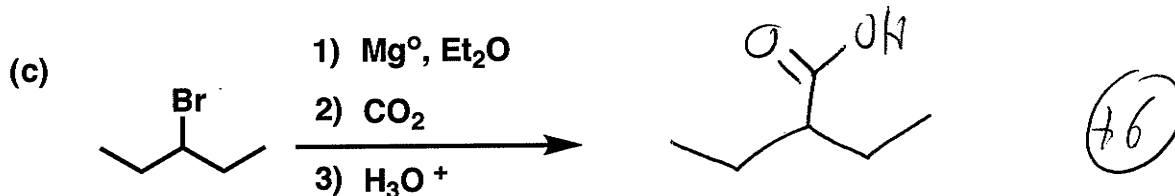
General Instructions:

- (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.
(ii) Print your name on each page.

1. (44 points) Show the major product or products expected from each reaction:

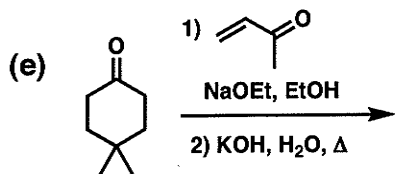


Hint: The product has a strong, broad IR signal at 3100 cm^{-1} , which is not seen in the starting material.



1. (cont.)

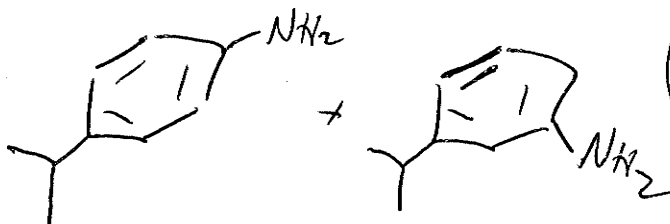
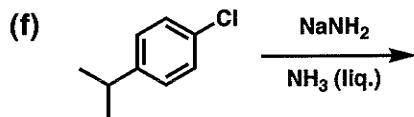
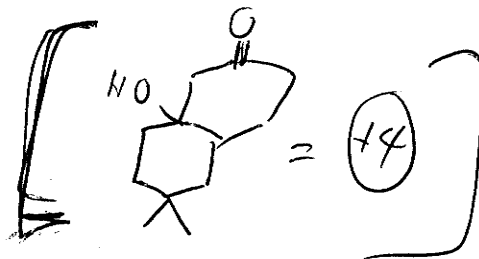
Name _____



Hint: The product has a strong IR signal at 1675 cm^{-1} , and no signal $\geq 3200\text{ cm}^{-1}$.



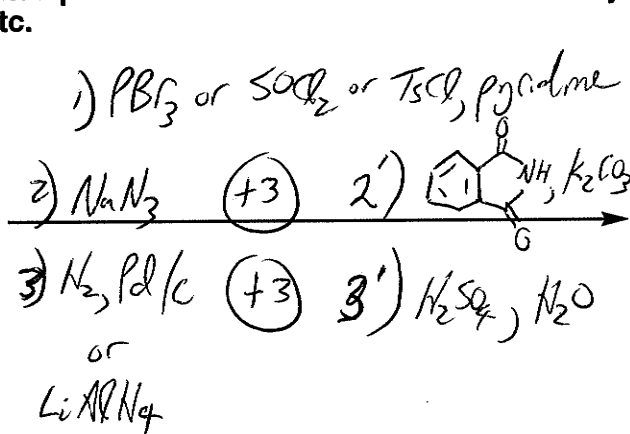
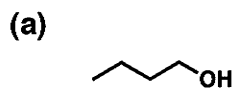
(+6)



+6 for 1
+10 for both

+6 if they draw the ~~ortho~~ product also

2. (47 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.

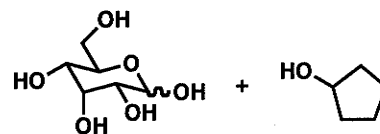
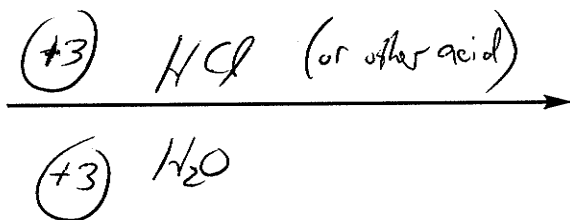
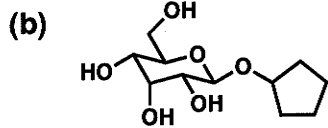


(+3)

1) PCC
 2) NH_3 , NaBH_3CN



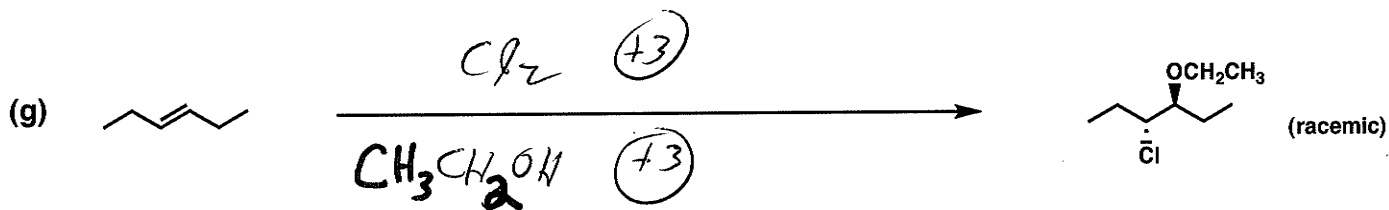
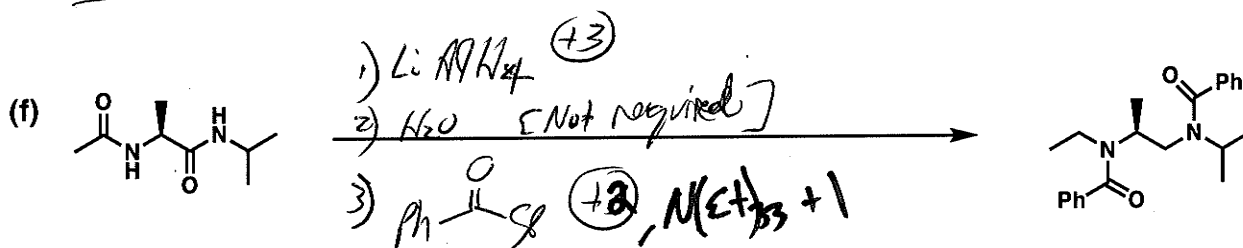
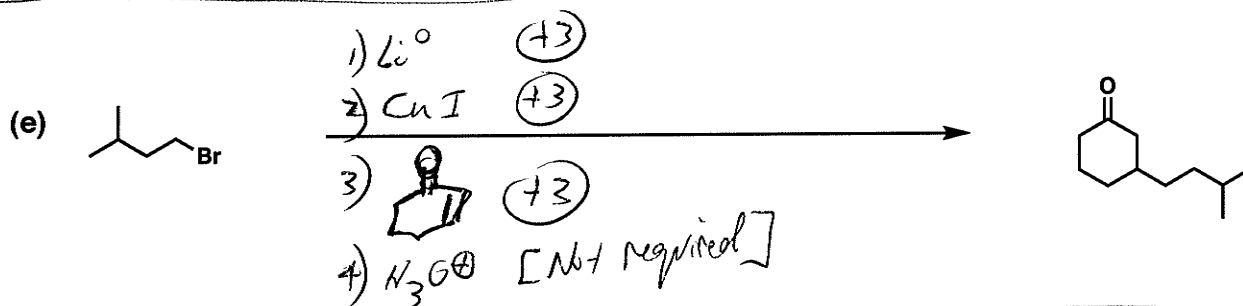
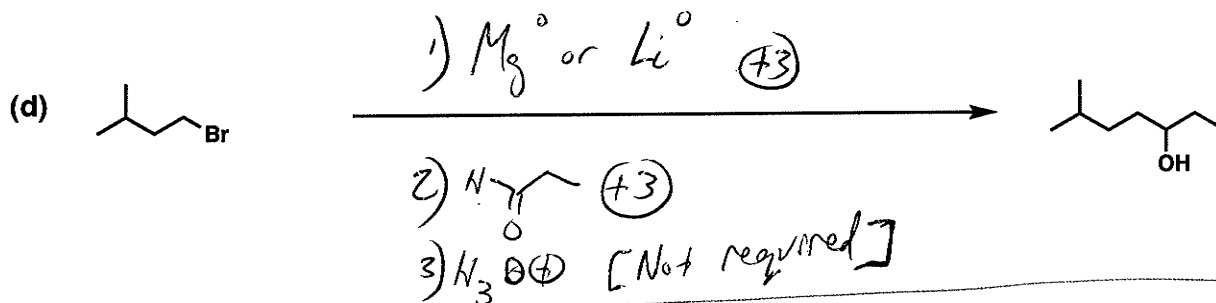
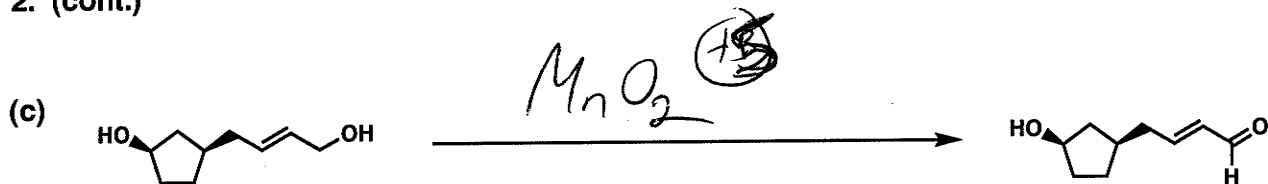
+9



(cont. on next page)

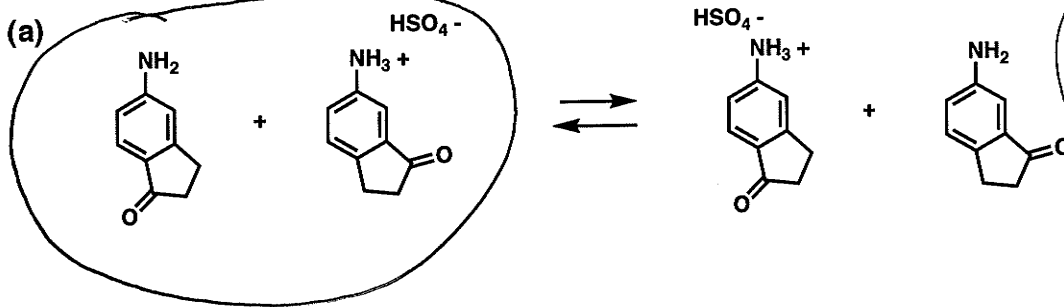
Name _____

2. (cont.)



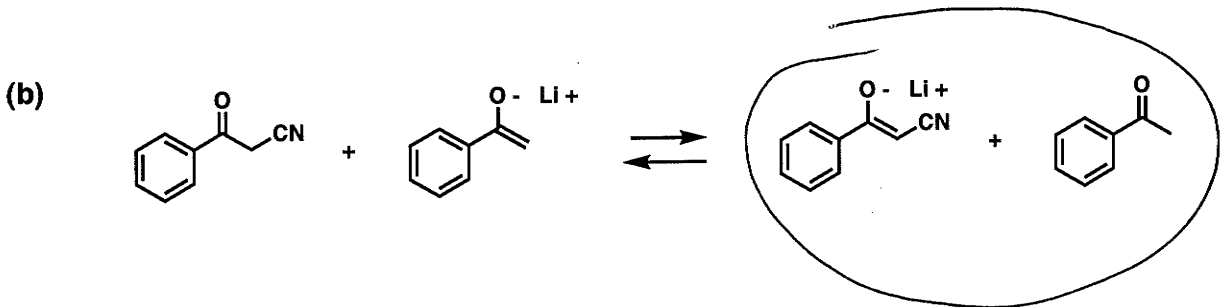
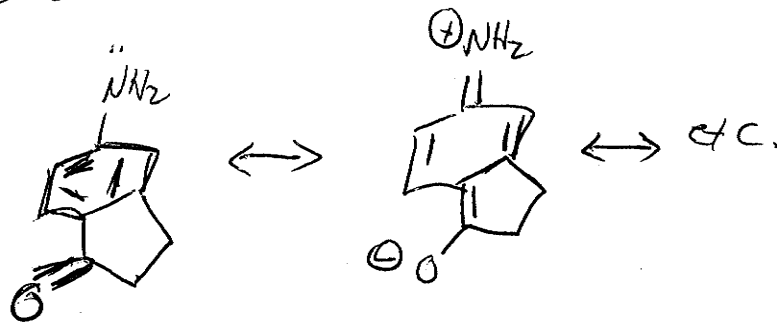
Name _____

3. (14 points) For each equilibrium shown below, circle the form (left side or right side) that you expect to be favored in each case. BRIEFLY explain your choice, using structures as necessary to bolster your explanation.

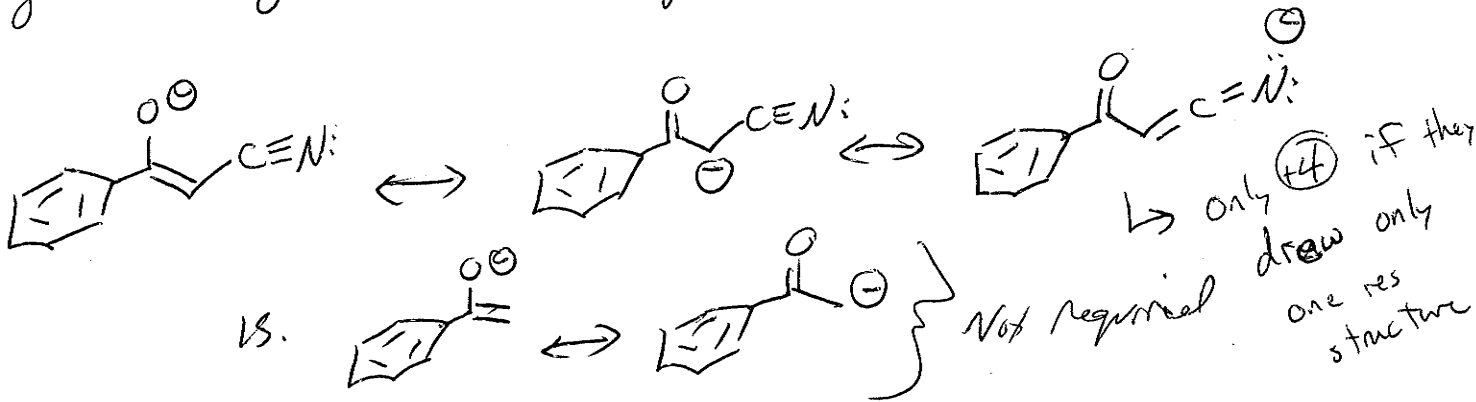


+1 for circle
+6 for explanation

[Weaker acid/weaker base preferred.] Indicated side has weaker base because of resonance - N lone pair delocalizes more fully:



Indicated side has weaker base - more ~~delocalized~~ delocalized negative charge than for simple enolate:



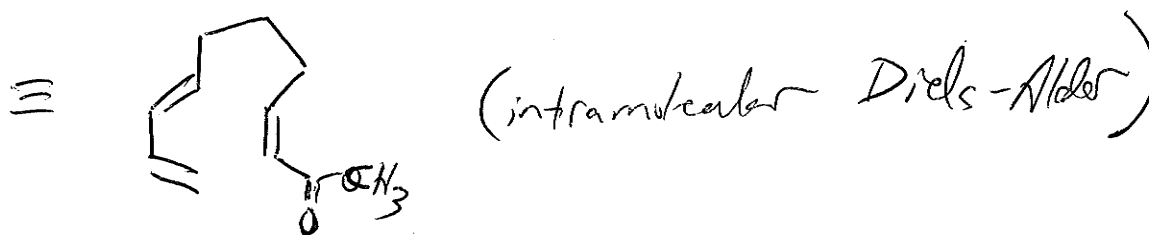
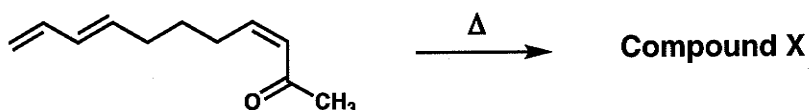
Name _____

4. (8 points) When the molecule shown below is heated, compound X is formed. Propose a structure for compound X based on the observations below.

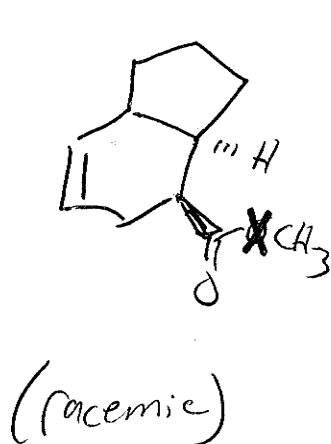
-- Compound X is an isomer of the starting material.

-- The ^1H NMR spectrum of the starting material has seven resonances (all multiplets) above 4.5 ppm, while NMR spectrum of compound X has only two resonances in this region of the NMR spectrum.

-- Compound X takes up only one equivalent of H_2 upon treatment with H_2 and Pd/C.



Compound X =

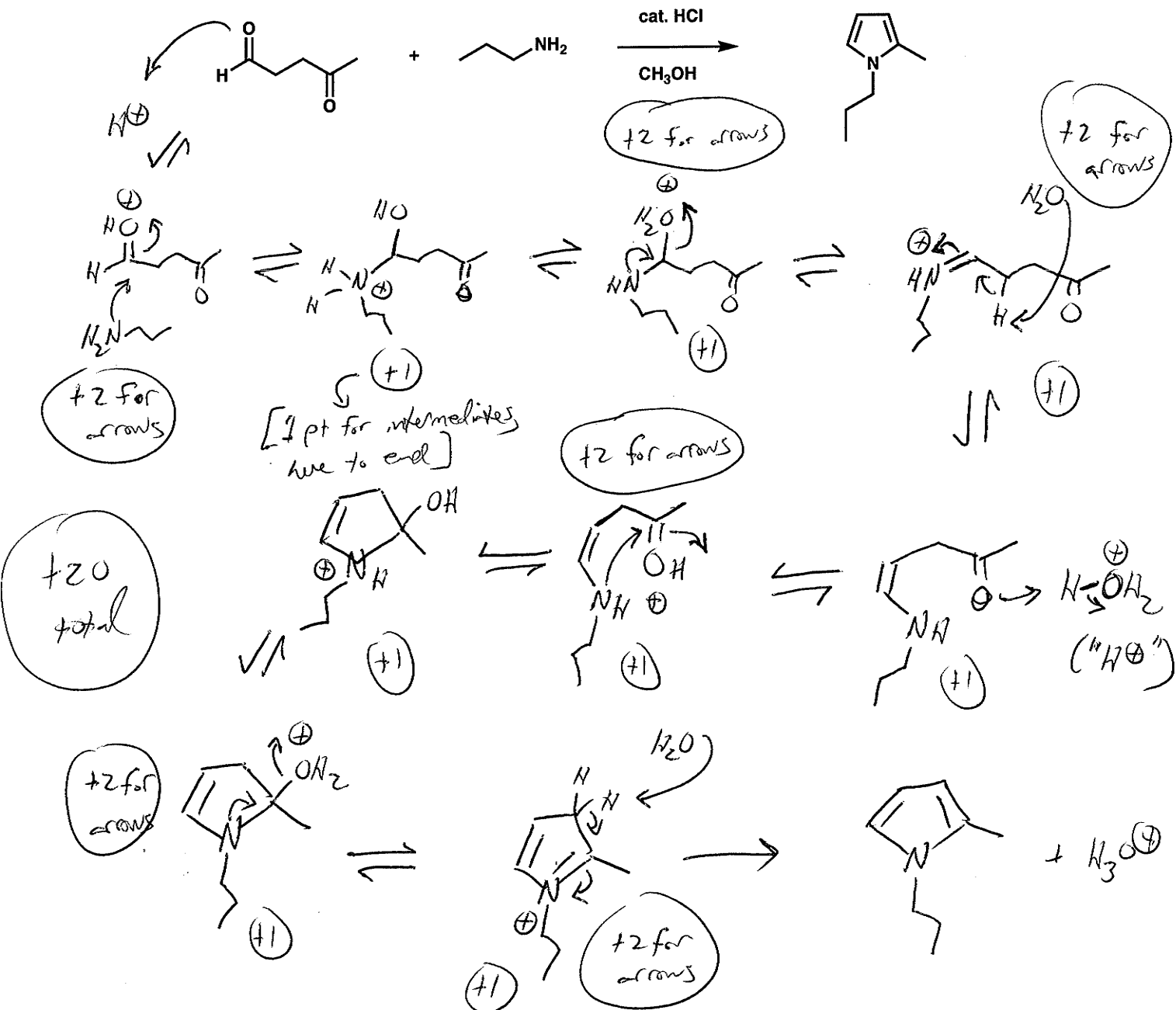


(+8)

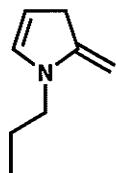
(+6 if
stereochem
incorrect or
incorrect)

5. (25 points)

(a) Draw a mechanism (curved arrows) for the reaction shown below.



(b) Give a brief rationale (one sentence) for the fact that the product indicated above is obtained in preference to the isomer shown below.

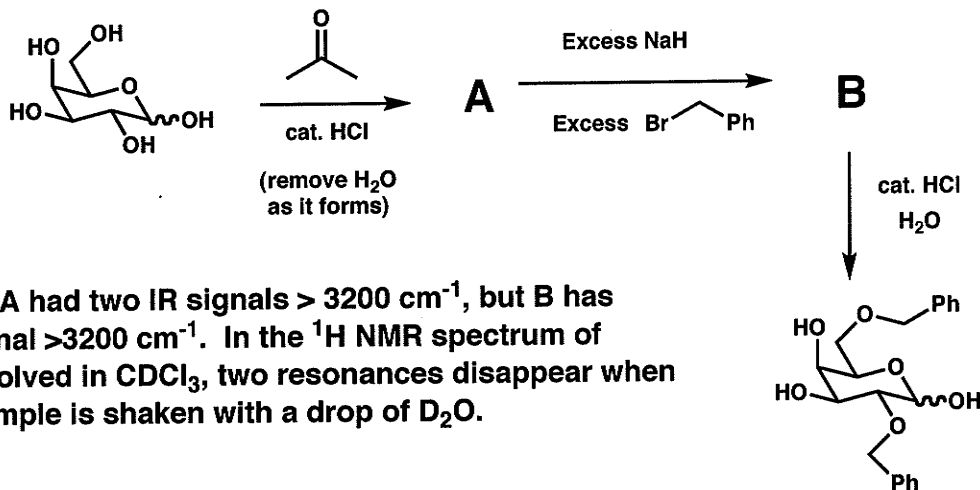


The observed product ~~is aromatic~~ has an aromatic ring, but this isomer is not aromatic.

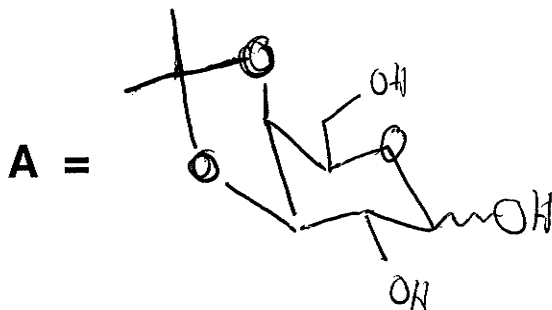
(+5)

Name _____

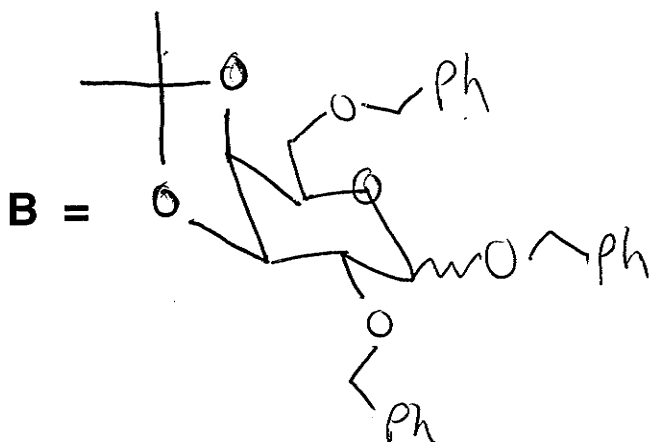
6. (14 points) Provide structures for molecules A and B, which are intermediates in the conversion of D-galactose (the starting material) to 2,6-dibenzyl-D-galactose (the final product).



Note: A had two IR signals $> 3200\text{ cm}^{-1}$, but B has no signal $> 3200\text{ cm}^{-1}$. In the ^1H NMR spectrum of A dissolved in CDCl_3 , two resonances disappear when the sample is shaken with a drop of D_2O .



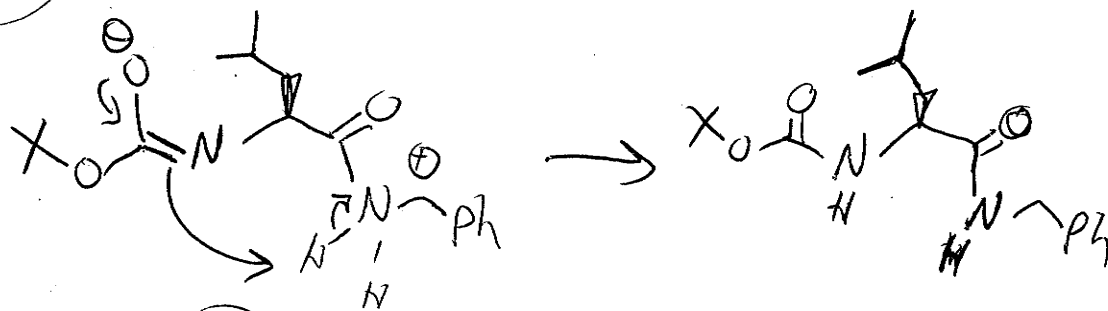
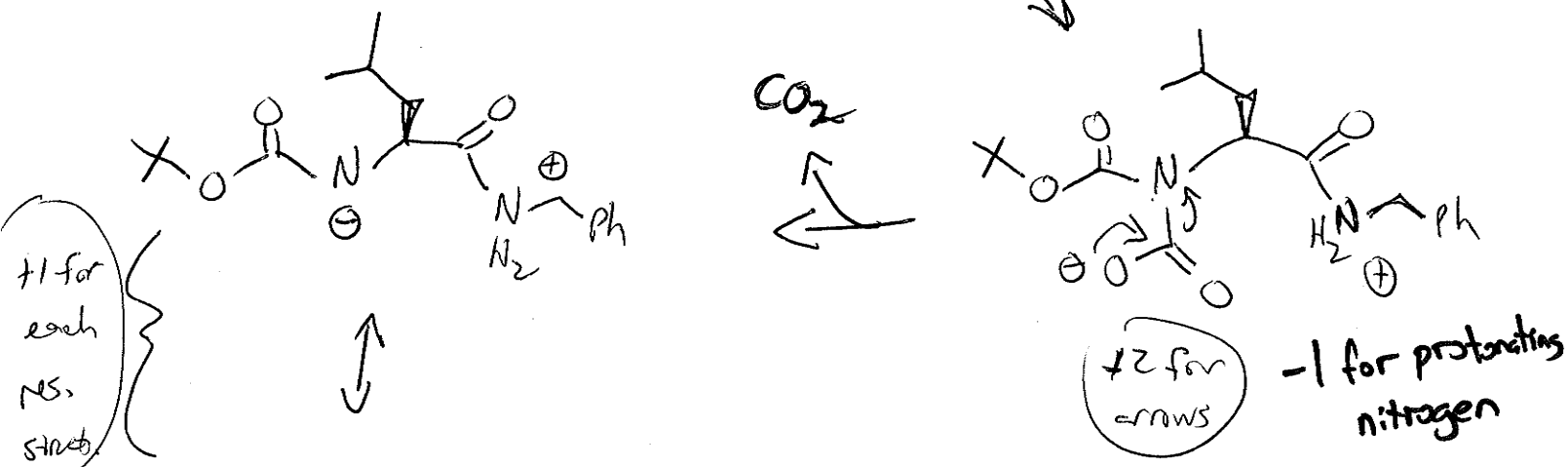
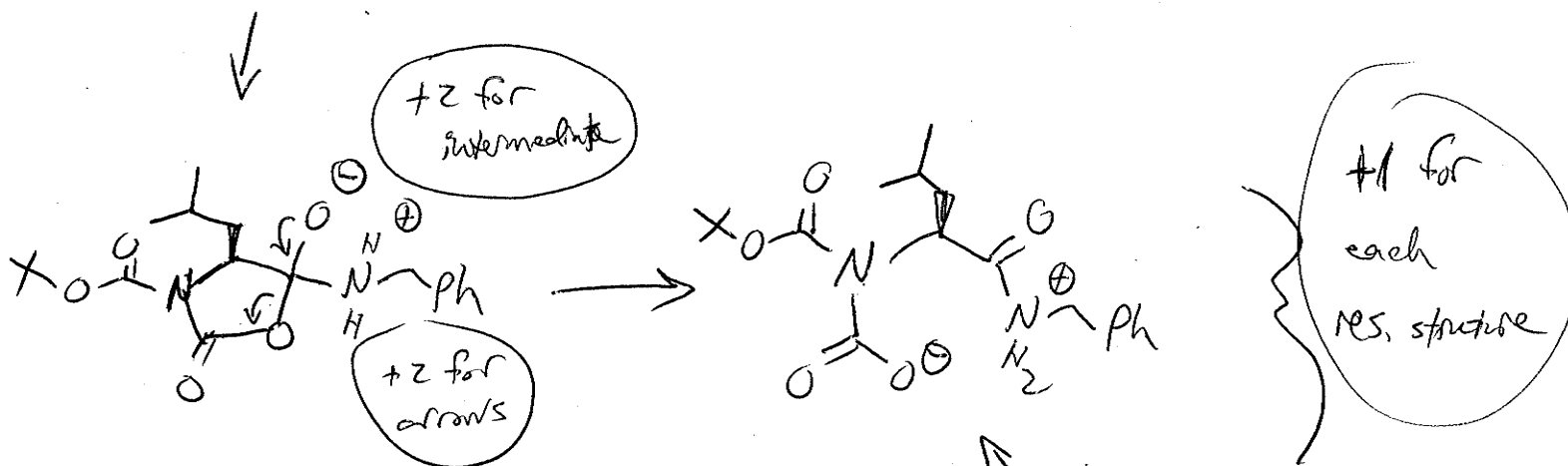
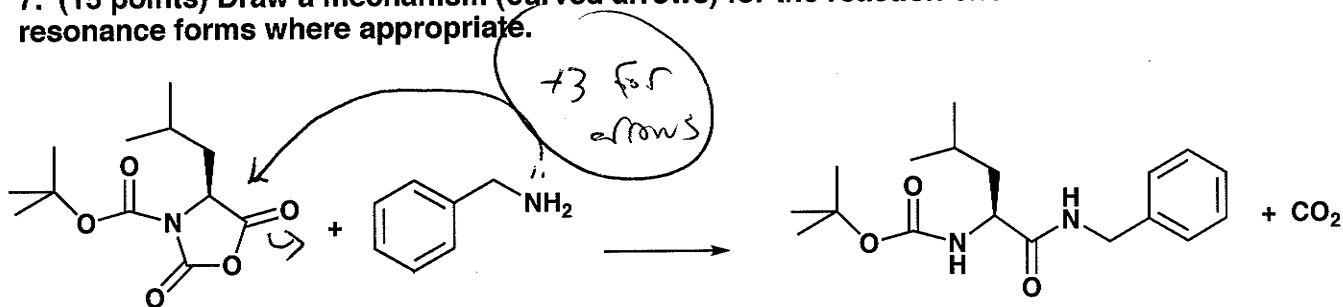
(+7)



(+7)

Name _____

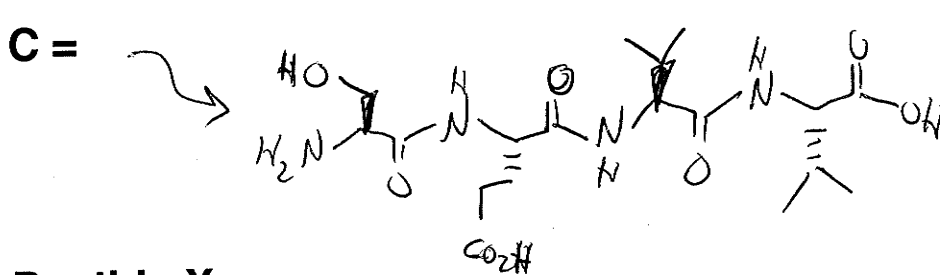
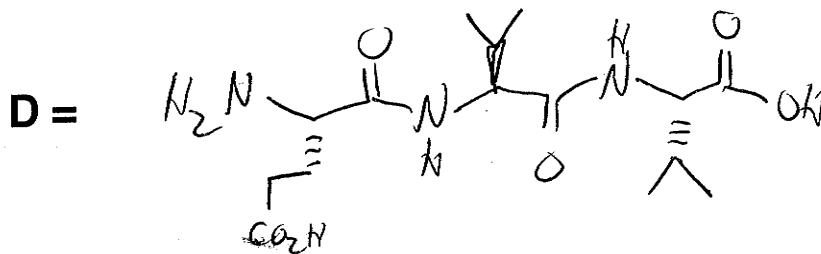
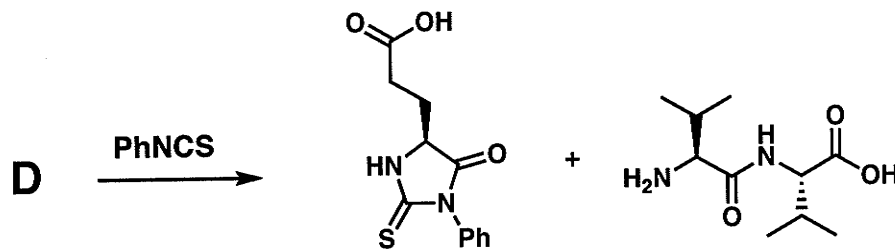
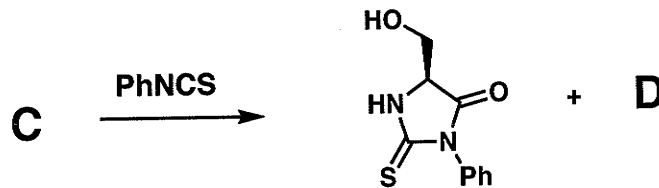
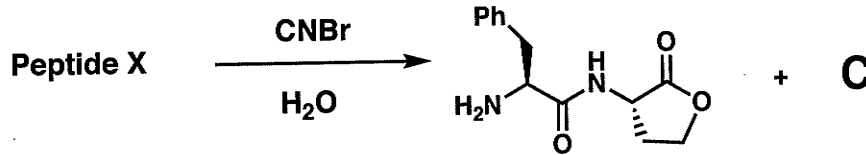
7. (15 points) Draw a mechanism (curved arrows) for the reaction shown below. Show resonance forms where appropriate.



+2 for arrows
[N⁺ transfer need not be intramolecular]

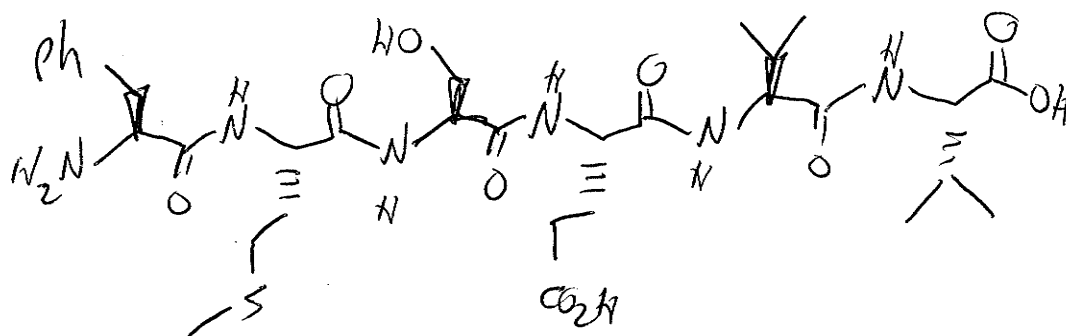
Name _____

8. (15 points) Peptide X is analyzed as indicated below. What are the structures of peptide X and the two unknown intermediates?



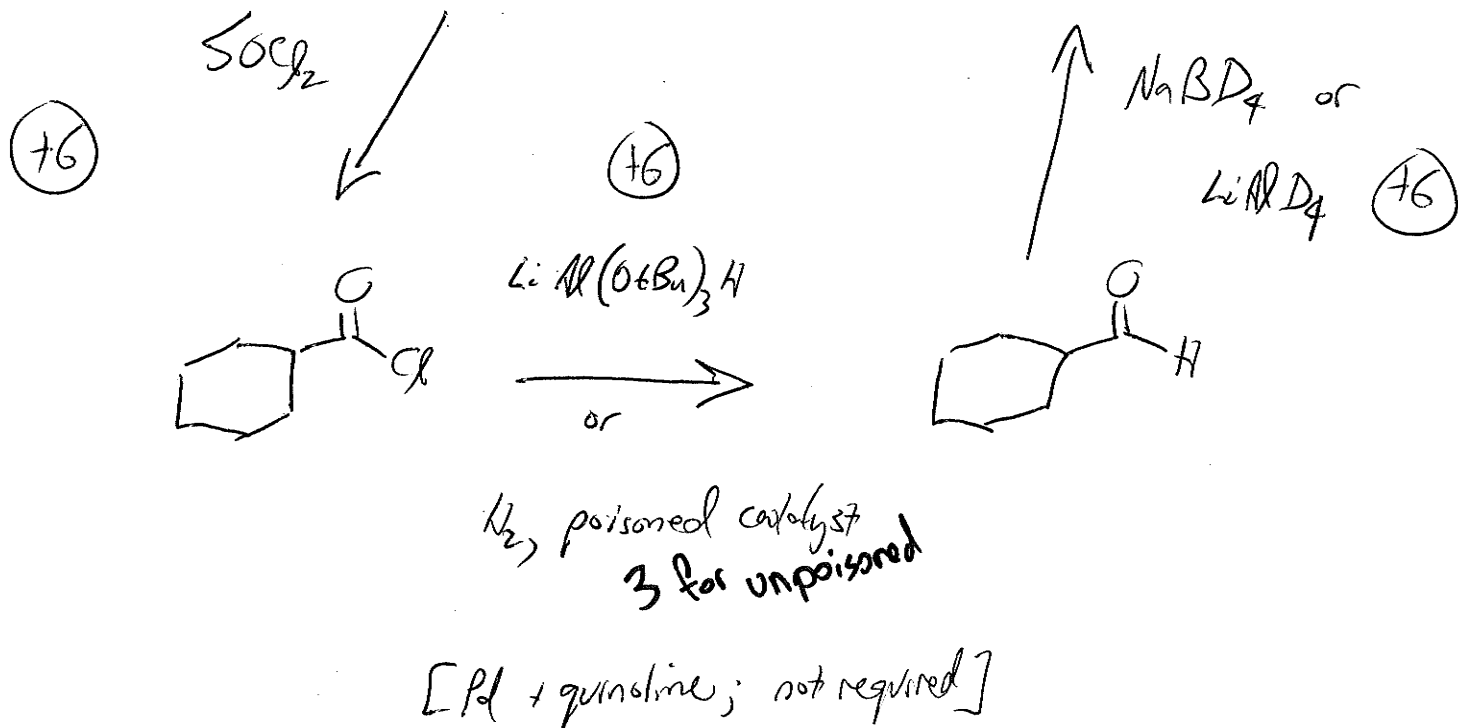
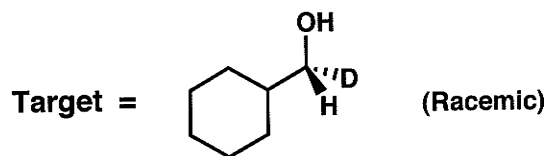
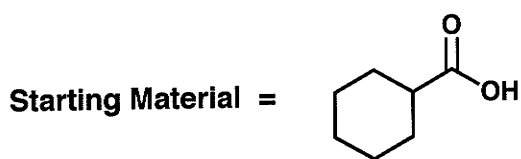
Peptide X =

+2 for no met.



Name _____

9. (18 points) Propose a synthesis of each target molecule shown below from the indicated starting material shown. You may use any other reagents.



Note: Order of D & H additions can be reversed.

