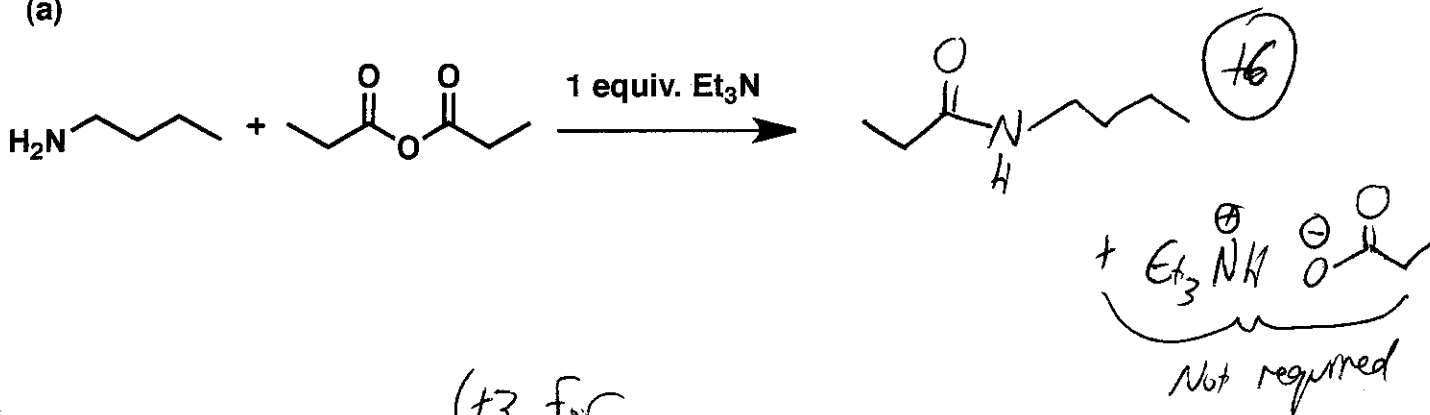


General Instructions:

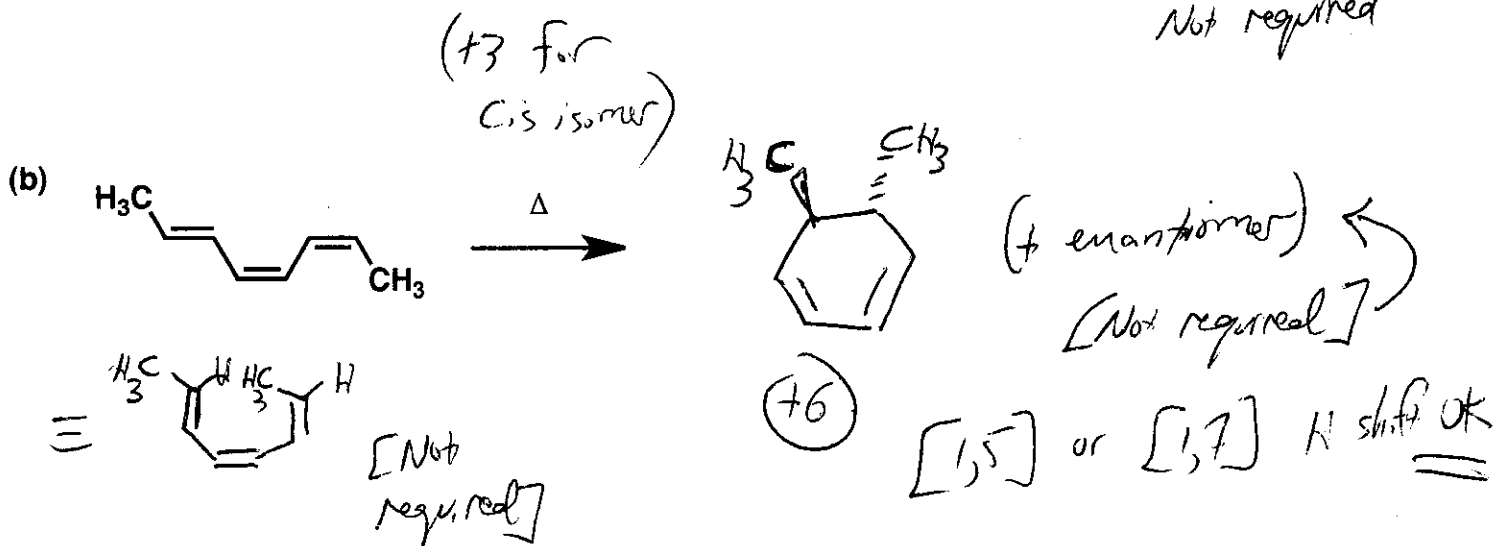
- Use scratch paper at back of exam to work out answers; final answers must be recorded at the proper place on the exam itself for credit.
- Print your name on each page.

1. (18 points) Show the major product or products expected from each reaction:

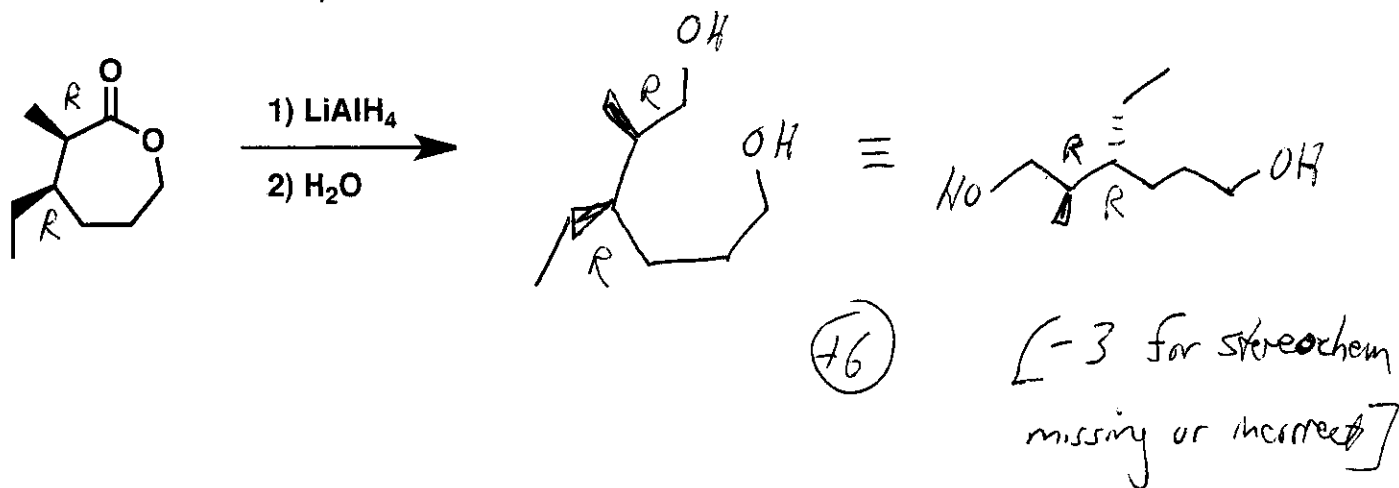
(a)



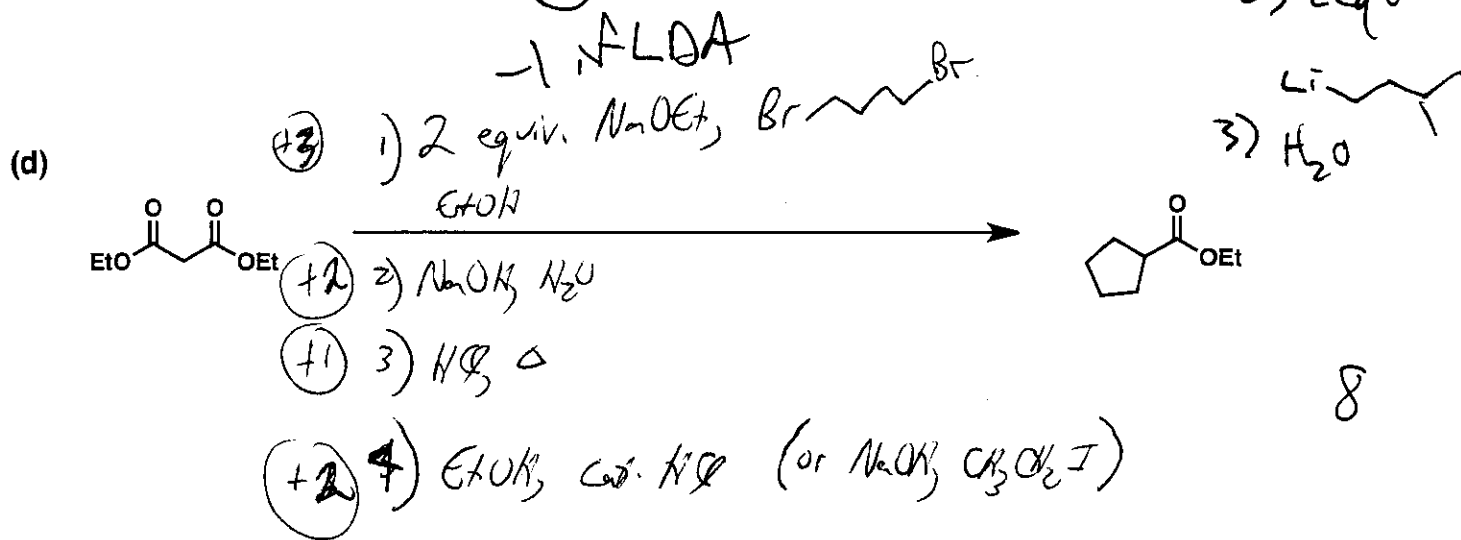
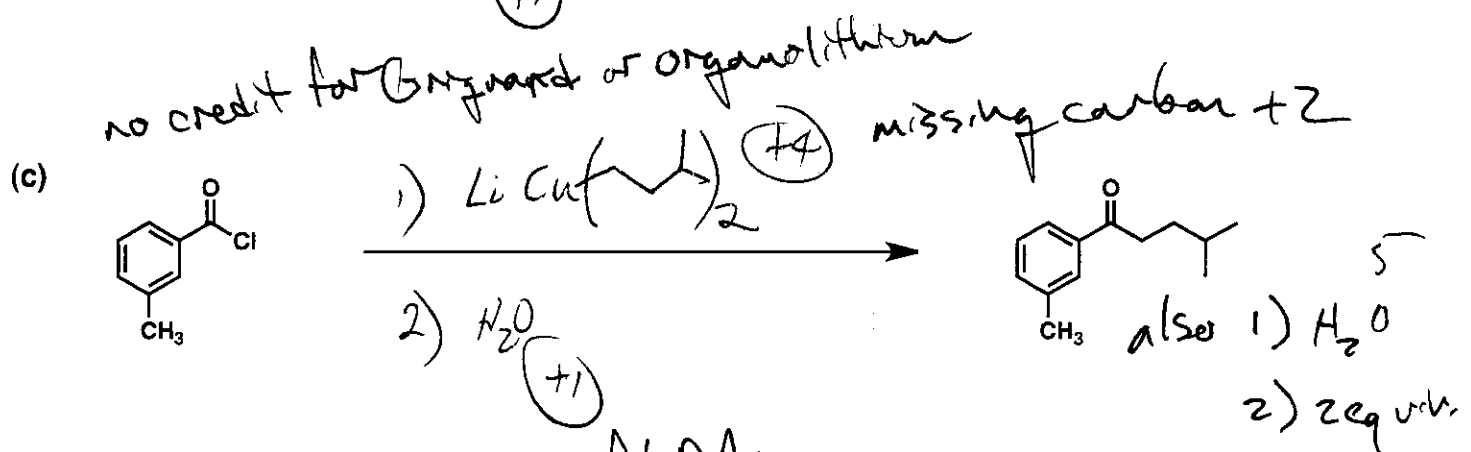
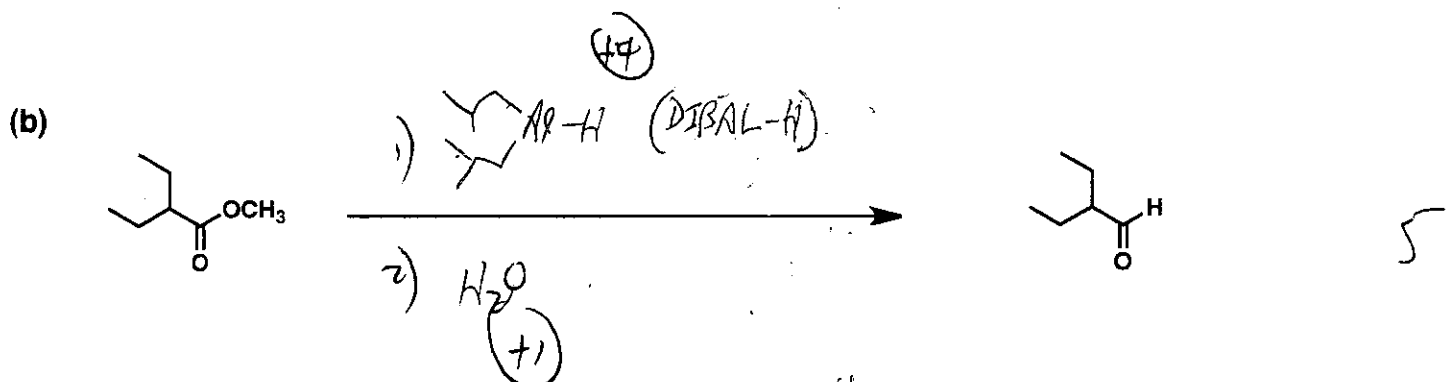
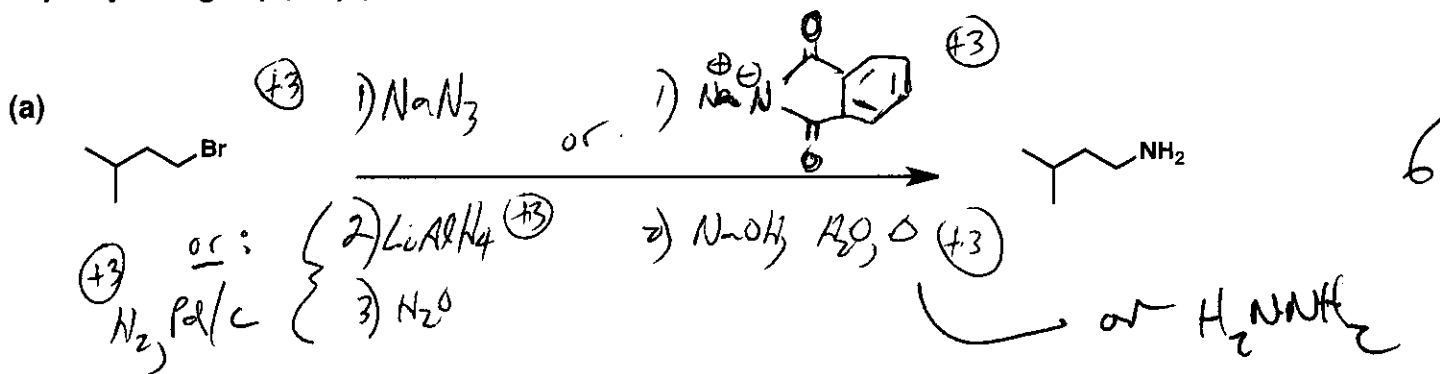
(b)



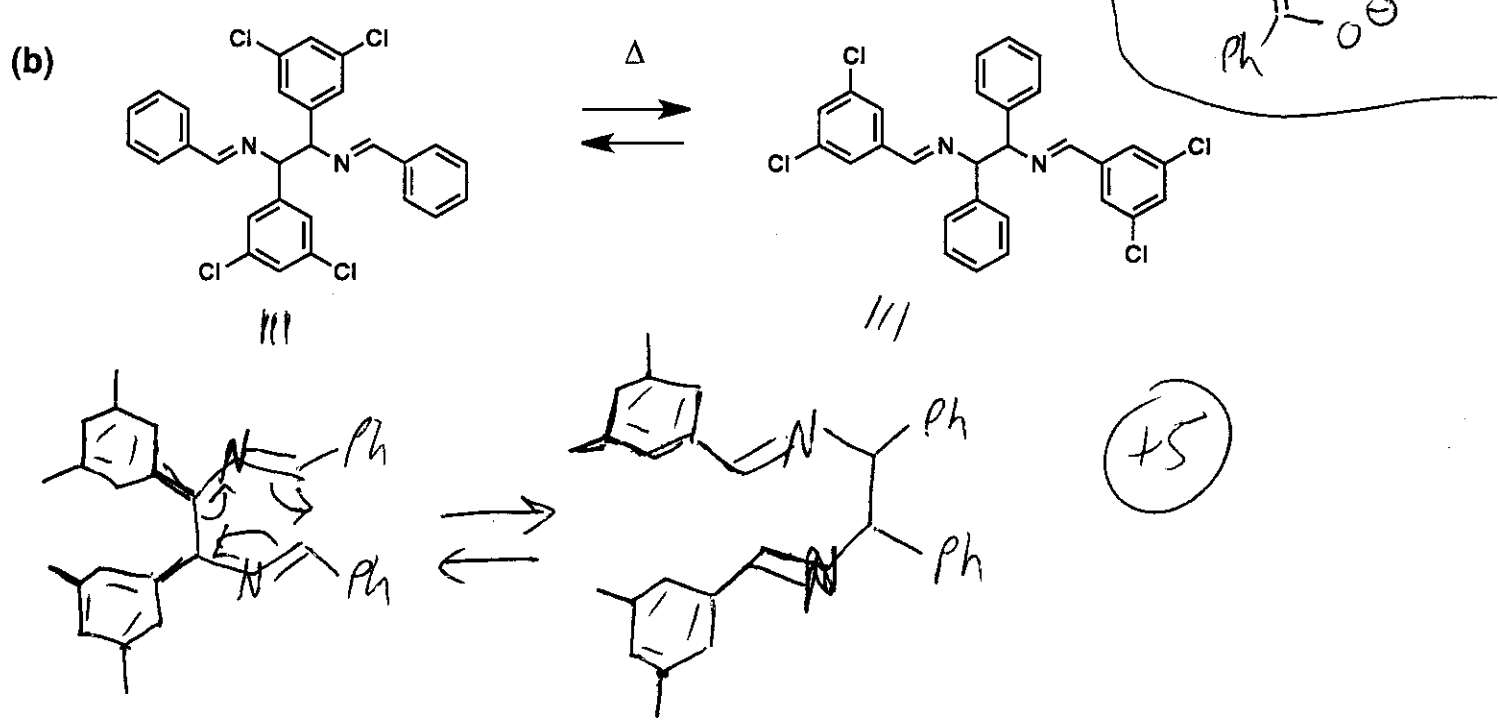
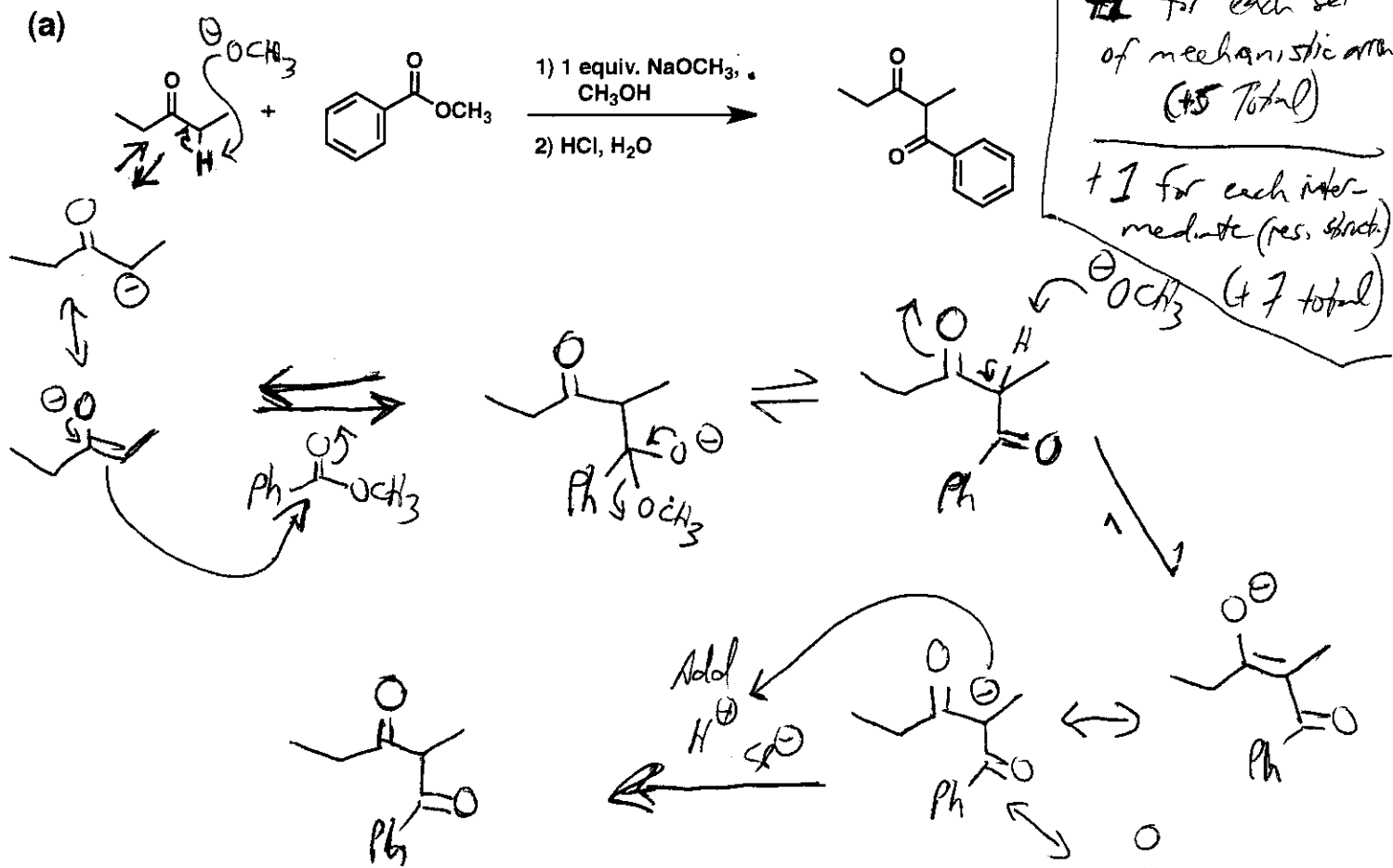
(c)



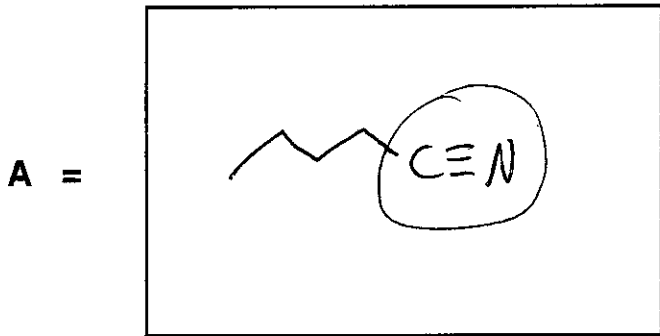
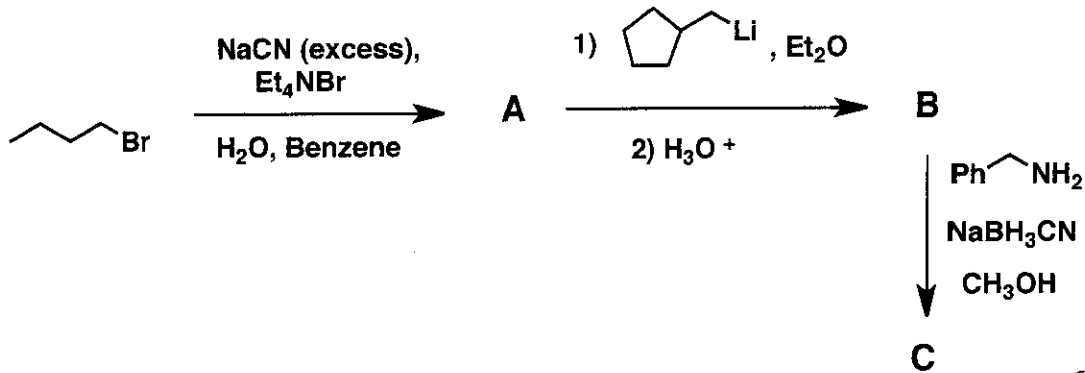
2. (24 points) Show the reagents and other organic molecules required to convert the starting material to the indicated product. Be sure to differentiate clearly between distinct steps by using "1)", "2)", etc.



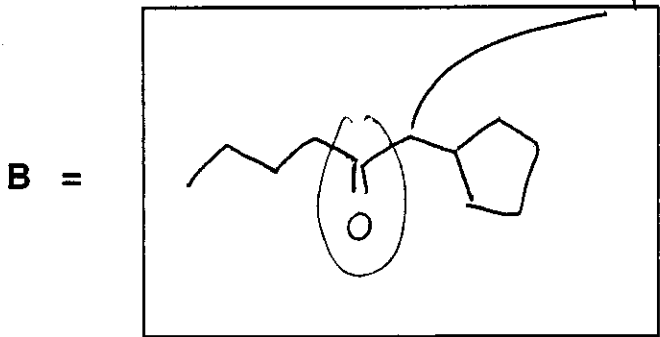
3. (17 points) Draw out a mechanism ("curved arrows") for each reaction shown below. Be sure to show all important resonance structures in intermediates.



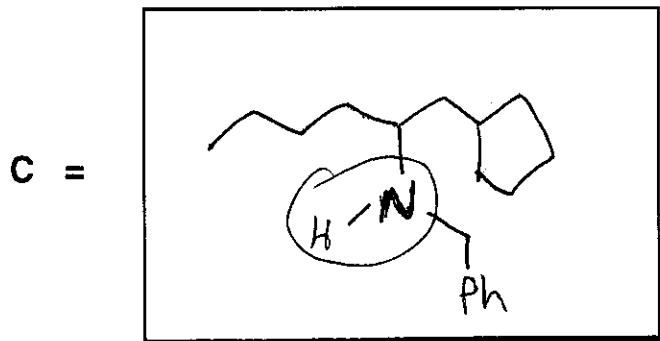
4. (21 points) Consider the reaction sequence below. Give the structures of compounds A, B and C in the appropriate boxes.



Strong IR signal at 2240 cm^{-1}



Strong IR signal at 1725 cm^{-1}



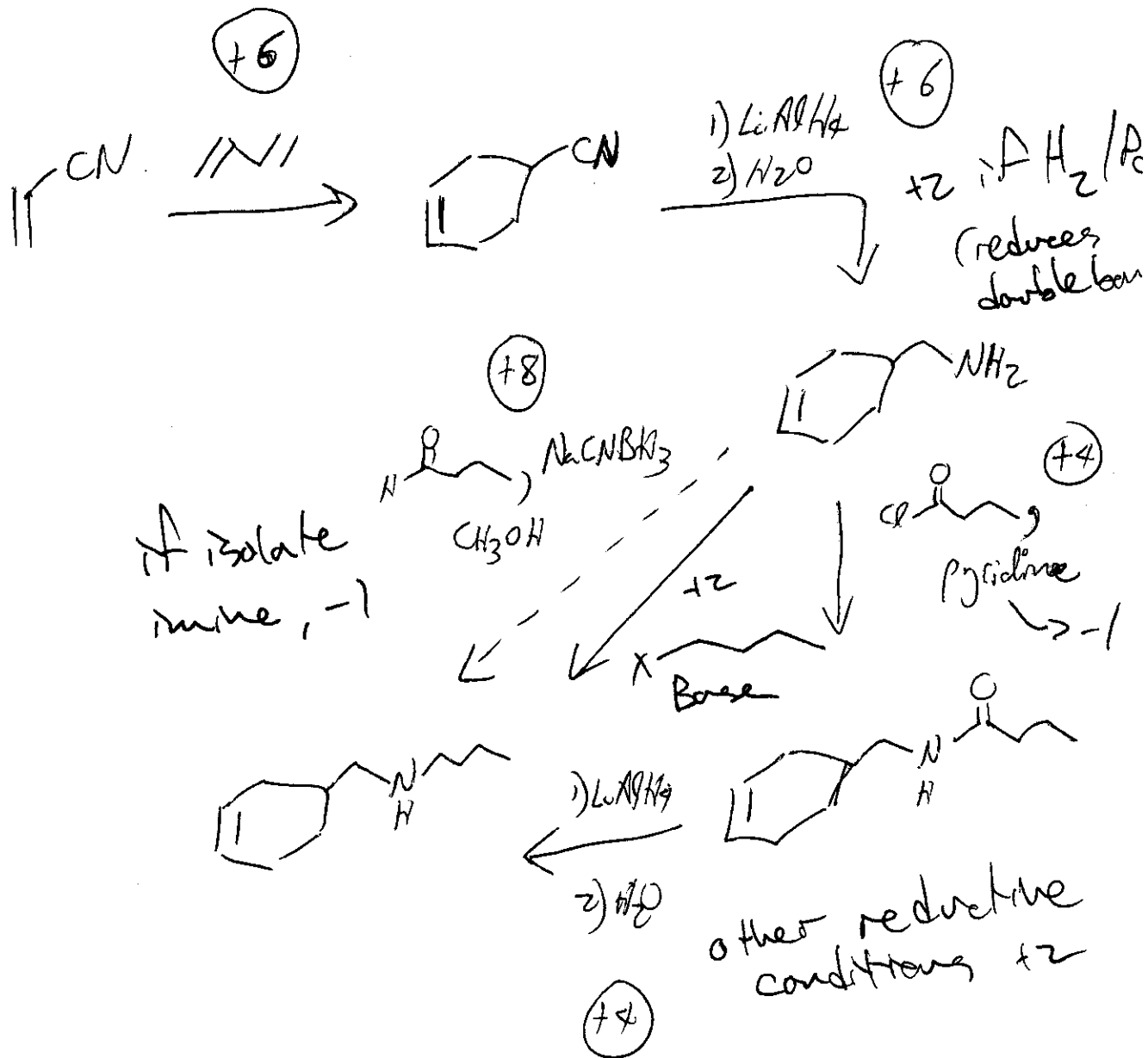
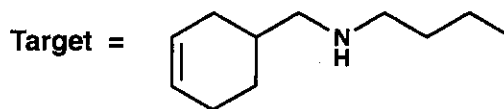
Moderate IR signal at 3350 cm^{-1}

+6 for each correct structure
+1 for each correct circle.

In each case, circle the functional group that gives rise to the indicated IR signal.

if missing carbon, +3

5. (20 points) Propose an efficient synthetic route from starting material to target. You may use any other starting materials containing 4 or fewer carbons.



[Note: Alternative routes from C=CC#N]