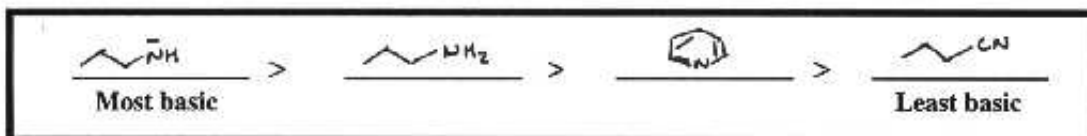


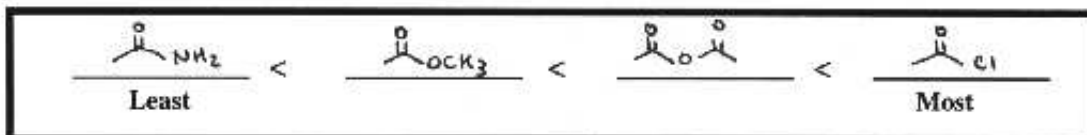
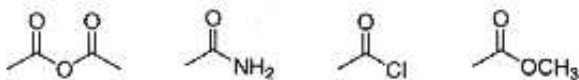
Question 1 (12 points)

Name key

- a. (4 pts) Rank the following compounds in order of decreasing basicity of the nitrogen atom. (NO PARTIAL CREDIT)



- b. (4 pts) Rank the following molecules in order of increasing electrophilicity at carbonyl carbon (C=O). (NO PARTIAL CREDIT)



- c. (4 pts) Explain why the boiling point of propylamine is higher than butane, but lower than propanol.

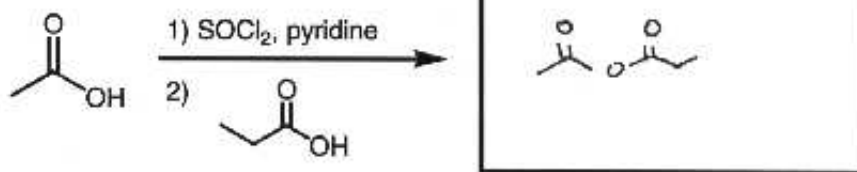
Propylamine has hydrogen bonding, which is not as strong as in propanol.

Question 2 (16 points)

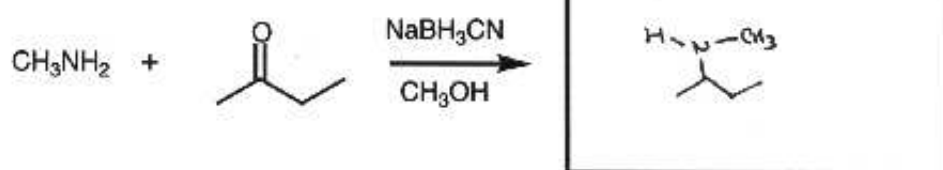
Name key

Give the complete structure of the major organic product(s) for the following reactions. Put your answer in the box provided. Be sure to indicate stereochemistry where appropriate. Write N. R., if no reaction occurs.

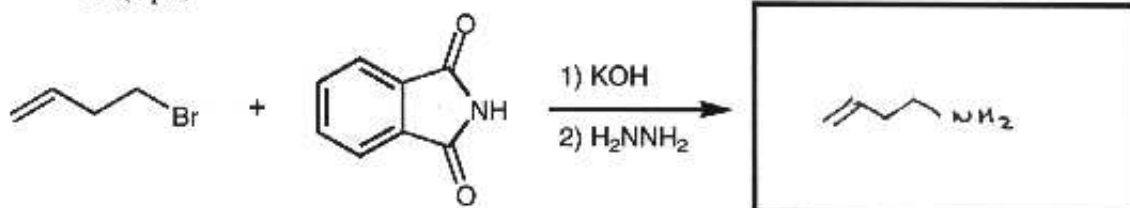
a. (4 pts)



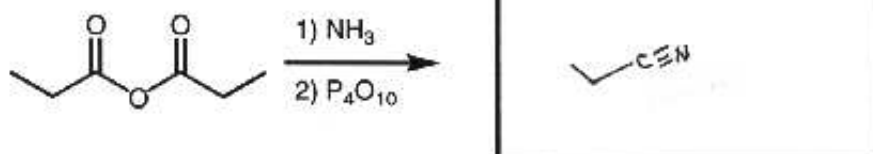
b. (4 pts)



c. (4 pts)



d. (4 pts)

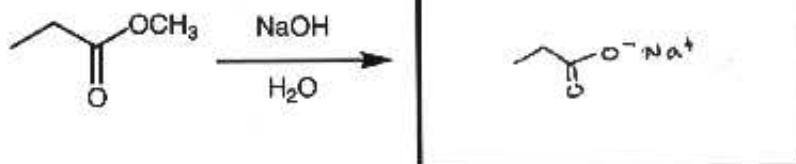


Question 3 (15 points)

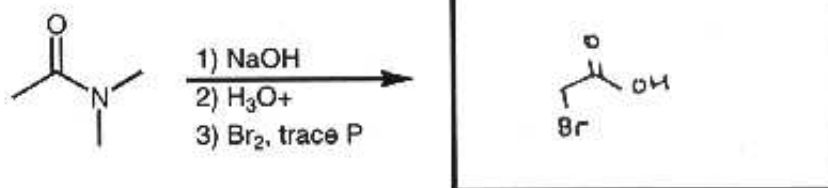
Name key

Give the complete structure of the major organic product(s) for the following reactions. Put your answer in the box provided. Be sure to indicate stereochemistry where appropriate. Write N. R., if no reaction occurs.

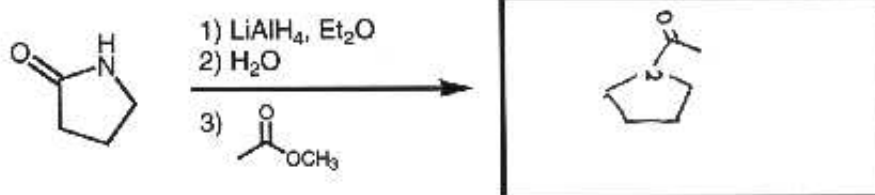
a. (3 pts)



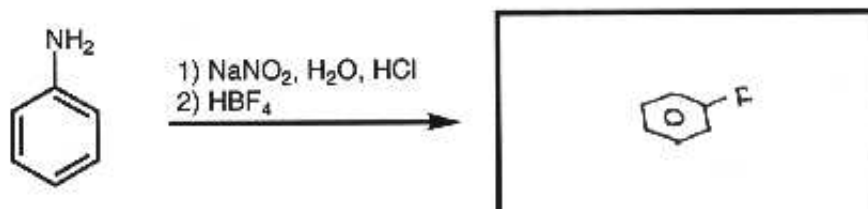
b. (4 pts)



c. (4 pts)



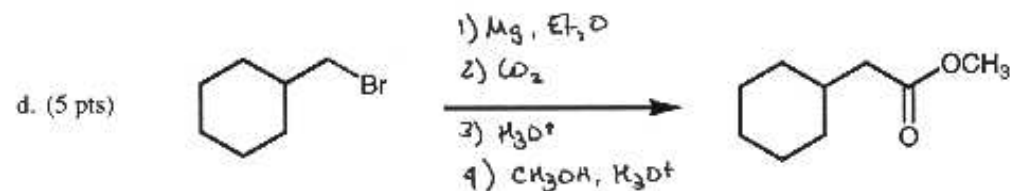
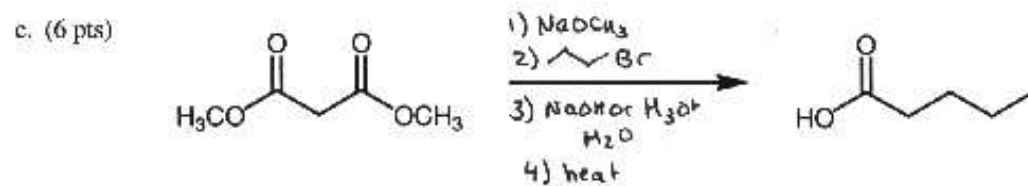
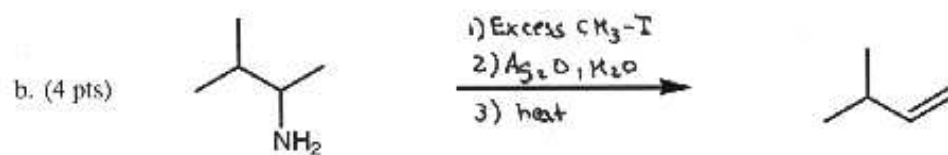
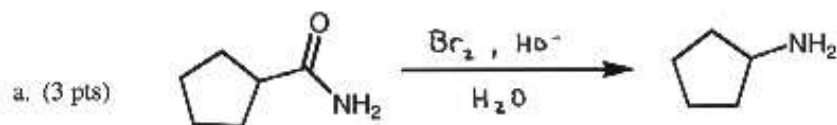
d. (4 pts)



Question 4 (18 points)

Name key

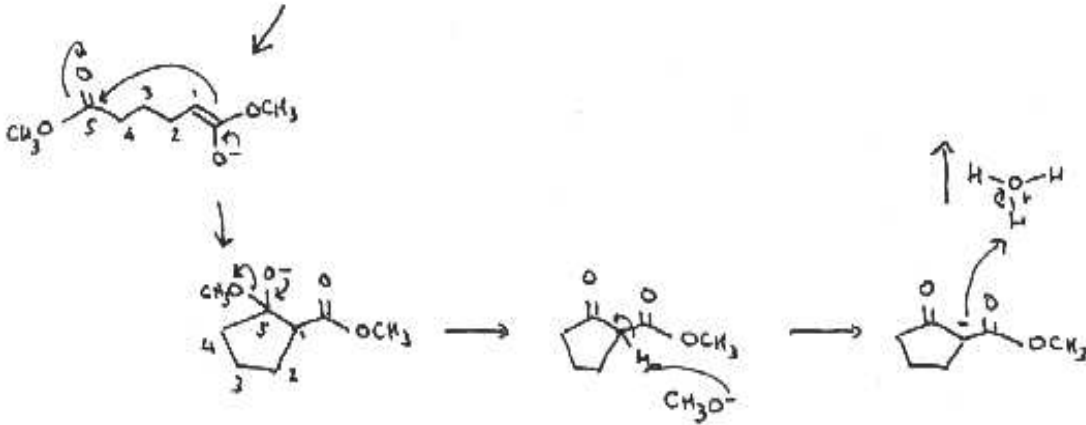
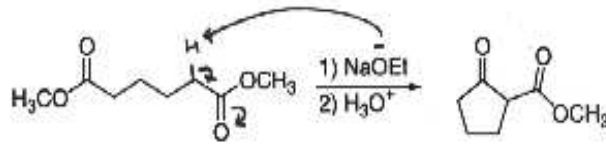
Provide the missing reagents for the following transformation. The reagents should be listed with numbers in order of use if more than one synthetic step is necessary.



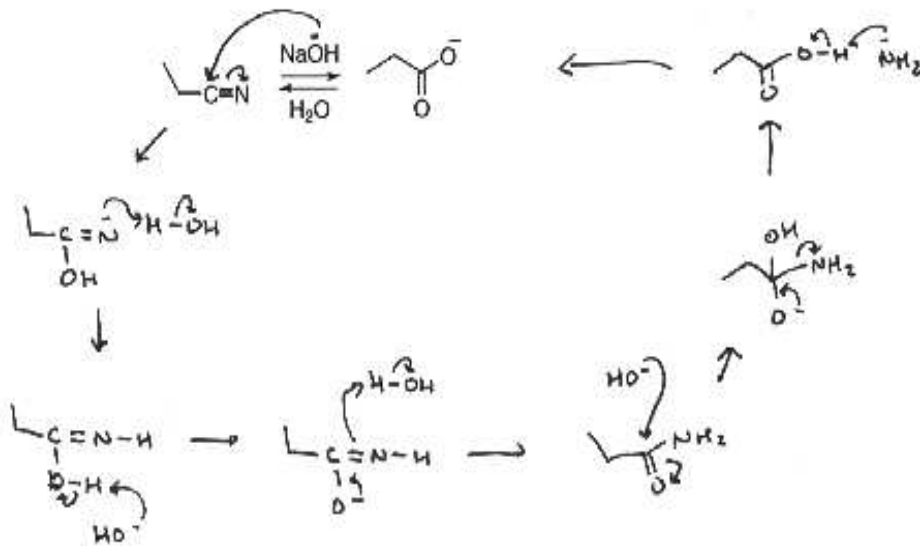
Question 5 (25 points)

Name key

a. (10 pts) Using the correct curved arrow formalism, draw the best mechanism for the following reaction.



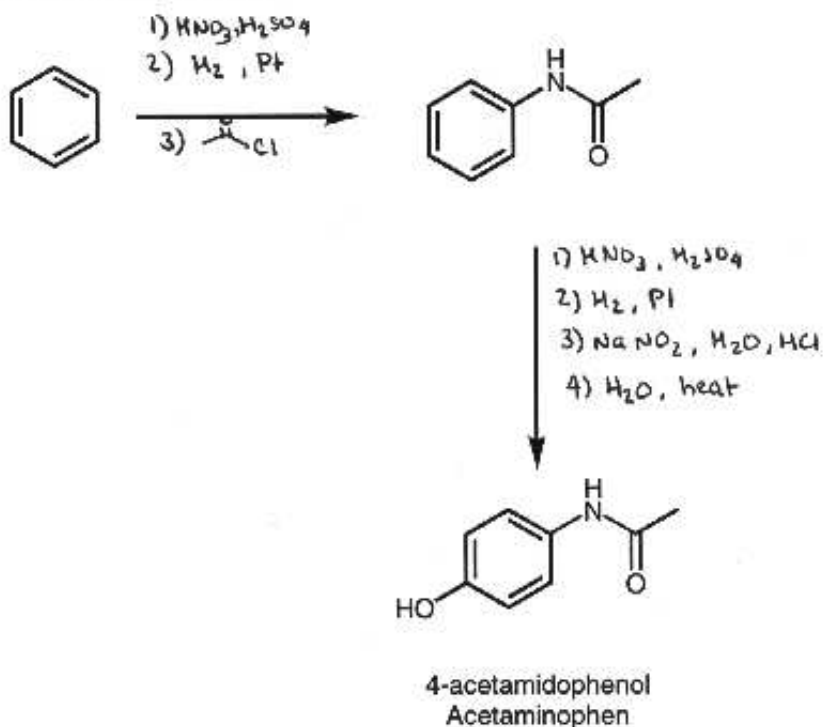
b. (15 pts) Using the correct curved arrow formalism, draw the best mechanism for the following reaction.



Question 6 (14 points)

Name key

Acetaminophen (4-acetamidophenol) is the active ingredient in Tylenol. Propose a synthesis of 4-acetamidophenol from benzene. The reagents should be listed with numbers in order of use if more than one synthetic step is necessary.



Extra Credit (12 points)

Name key

Provide a rational and efficient synthesis of the following molecule starting from bromobenzene and any other organic and/or inorganic reagents.

