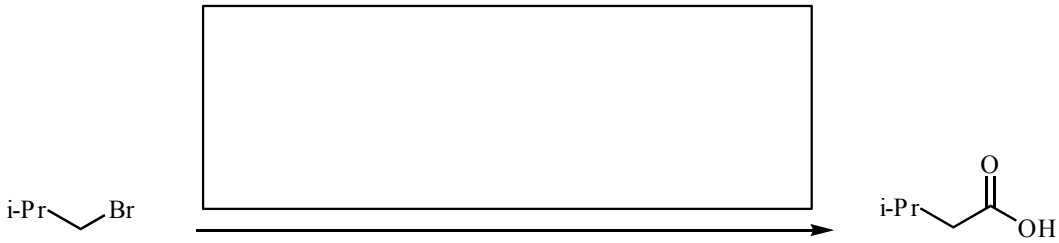
1. (4 points each, 8 points total) In the boxes, please provide the reagents for the illustrated transformations. More than one step may be required.

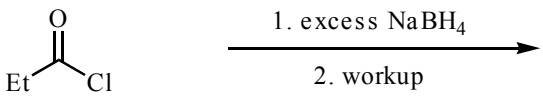
a)



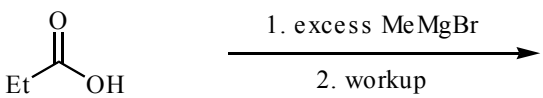
b)

2. (2 points each, 8 points total) Please provide the products of the following reactions. If no reaction is expected, write "NR".

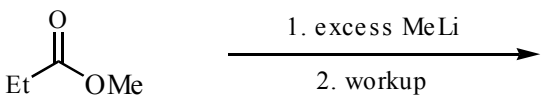
a)



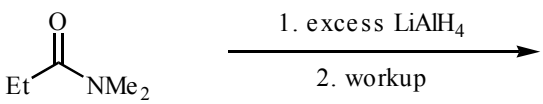
b)



c)

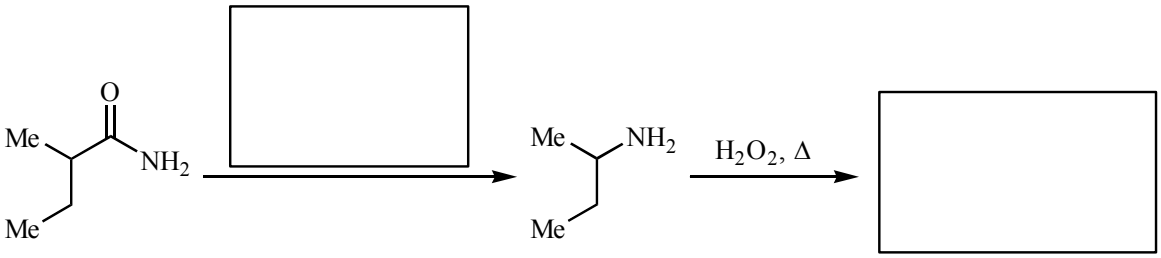


d)

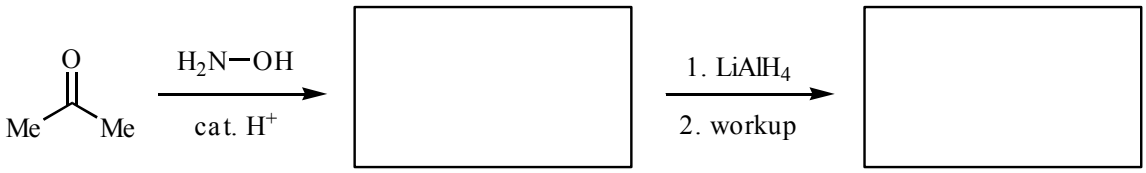


3. (2 points each, 16 points total) Please provide the requested products or reagents. If no reaction is expected, write "NR".

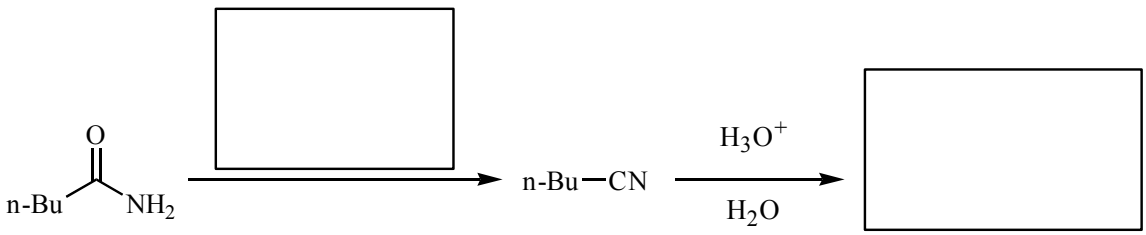
a)



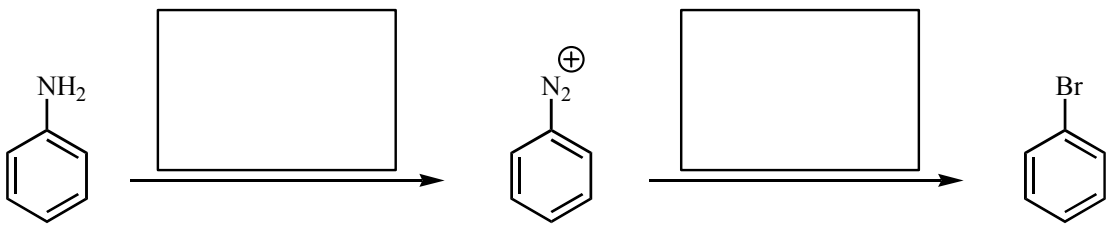
b)



c)



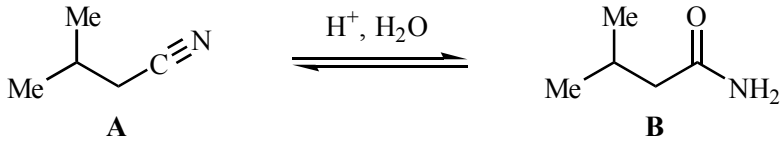
d)



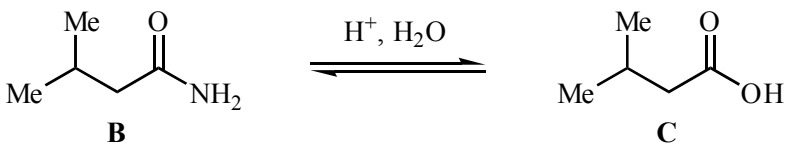
Name_____

4. (12 points) The hydrolysis of a nitrile (**A**) to a carboxylic acid (**C**) involves initial formation of a primary amide (**B**). Provide a detailed mechanism for each the following transformations.

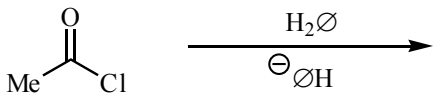
a)



b)



5. (12 points) Consider the labeling experiment outlined below:



stop the reaction at 50% conversion and examine the recovered acyl chloride for incorporation of ∅

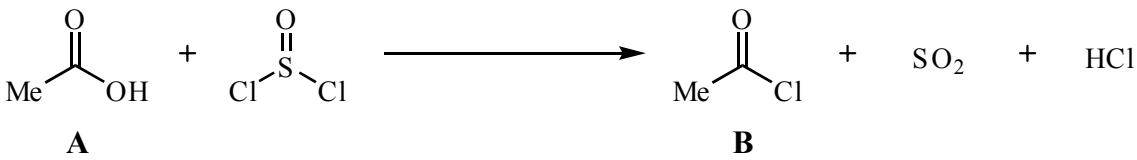
∅ = isotopically labeled oxygen (^{18}O)

a) Please provide the mechanism for the hydrolysis reaction shown above, including the pathway for incorporation of ∅ into the acyl chloride.

b) What level of ∅ incorporation ("high" or "low") you would expect to observe in the recovered acyl chloride? Explain briefly.

c) Based on your answer to part **b**, do you think the results of this labeling study definitively prove the mechanism of this reaction? Explain briefly.

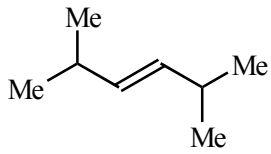
6. (11 points) Provide a detailed mechanism for the illustrated conversion of acetic acid (**A**) to acetyl chloride (**B**).

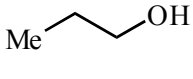


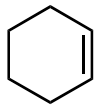
A **B**

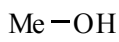
7. (11 points each, 22 points total) Please provide syntheses for **only two of the three** indicated compounds. All of the carbon atoms should be derived from the allowed starting materials. You may use any common reagents.

Allowed Starting Materials:

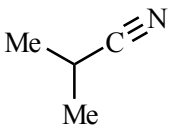


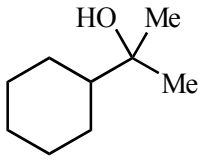


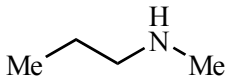




Pick Two:



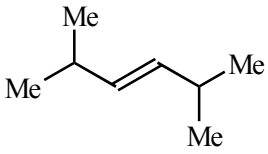


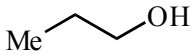


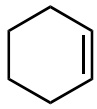
Synthesis #1:

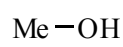
7. (continued)

Allowed Starting Materials:

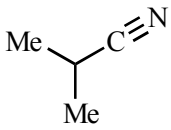


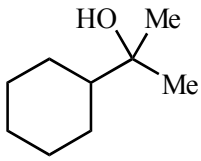


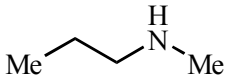




Pick Two:

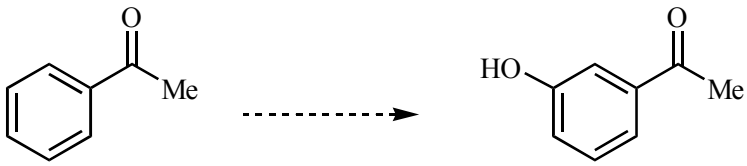






Synthesis #2:

8. (11 points) Provide a synthesis that will *selectively* convert **A** to **B**. Show all of the key intermediates and furnish all of the important reagents. This is not a one-step process.



A **B**