

Hour Exam #3
November 12, 2003

Printed Name _____ Signature _____

MIT ID # _____ Recitation TA _____

General Instructions:

- **This is a closed book exam.** No books, notes, or calculators allowed. You are allowed to use molecular models.
- Make sure that your exam has **11 pages** (including cover, a blank page for extra work, and a periodic table).
- Write your name on each page.
- Write answers in the spaces provided. If you run out of room, use the blank page and **indicate this for your grader.**
- Show all of your work if you wish to receive partial credit.
- Read the instructions **carefully**, and budget your time.

• **GOOD LUCK!!**

1 _____ / 8 _____

2 _____ / 8 _____

3 _____ / 16 _____

4 _____ / 12 _____

5 _____ / 12 _____

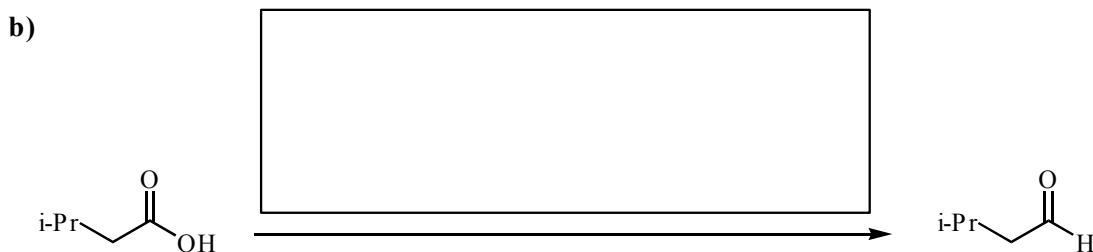
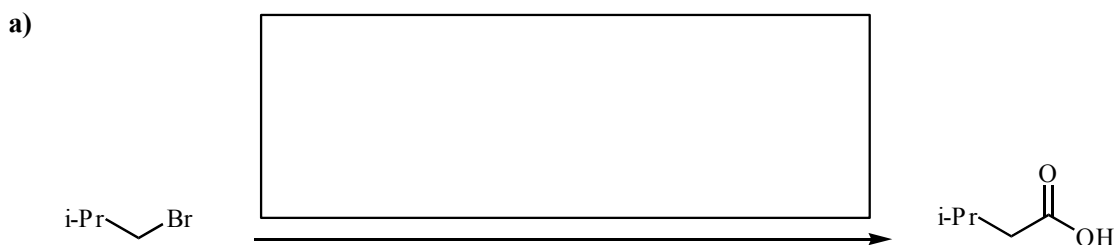
6 _____ / 11 _____

7 _____ / 22 _____

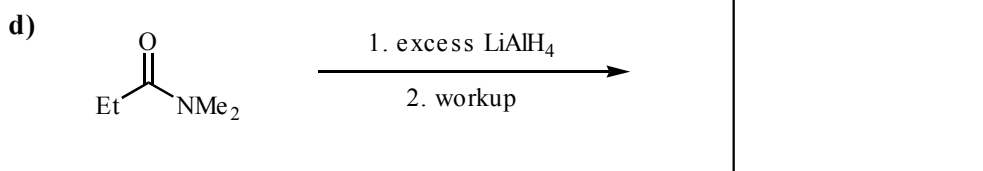
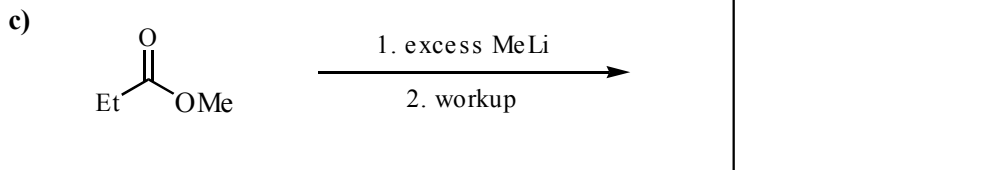
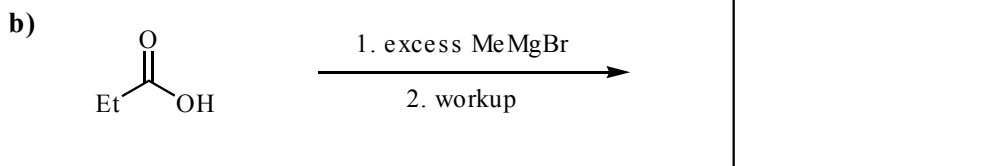
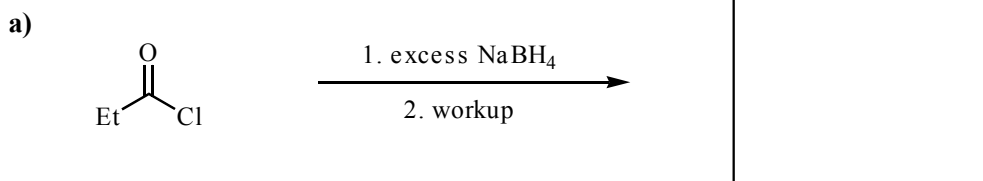
8 _____ / 11 _____

Total _____
(out of 100 points)

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.



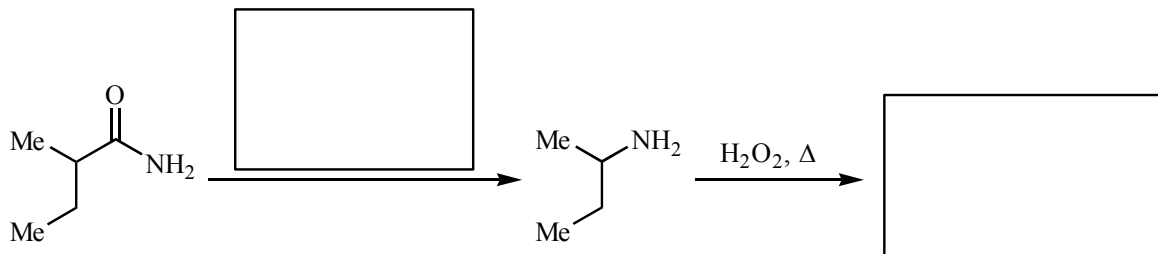
2. (2 points each, 8 points total) Please provide the products of the following reactions. If no reaction is expected, write "NR".



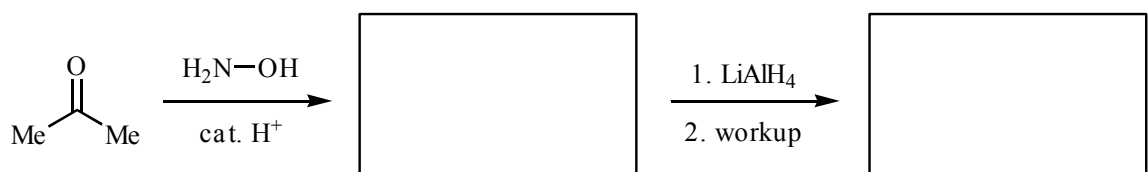
Name _____

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

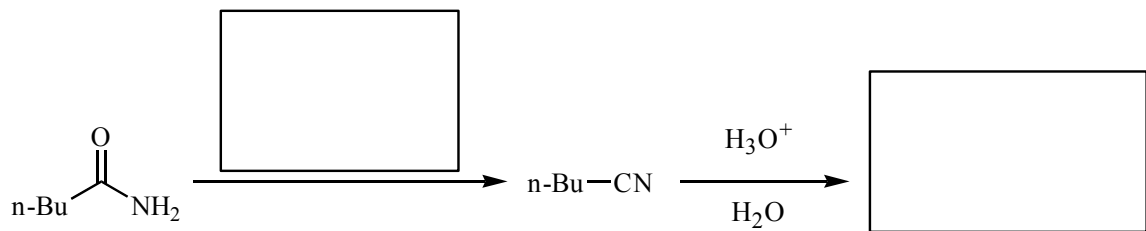
a)



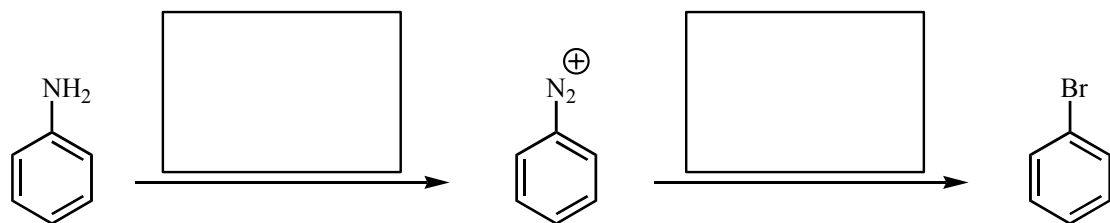
b)



c)



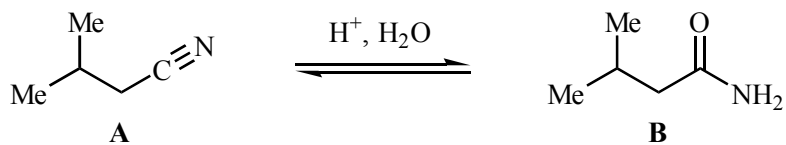
d)



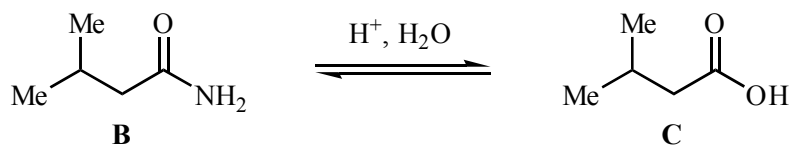
Name _____

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)

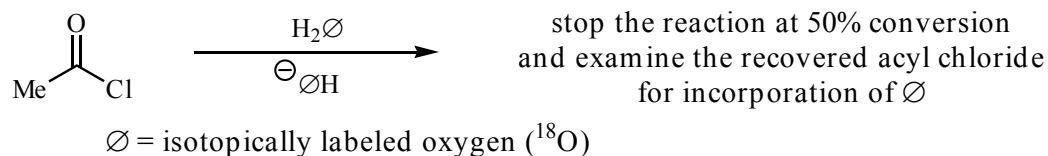


b)



Name _____

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



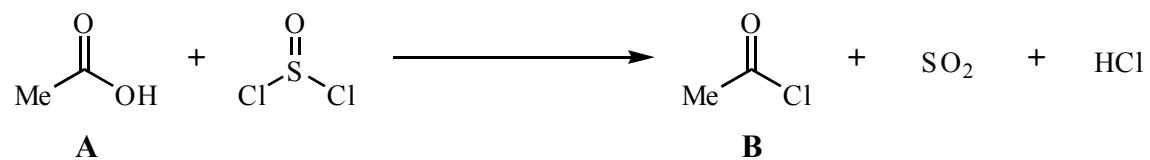
a) Please provide the mechanism for the hydrolysis reaction shown above, including the pathway for incorporation of O^{18} into the acyl chloride.

b) What level of O^{18} 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.

Name _____

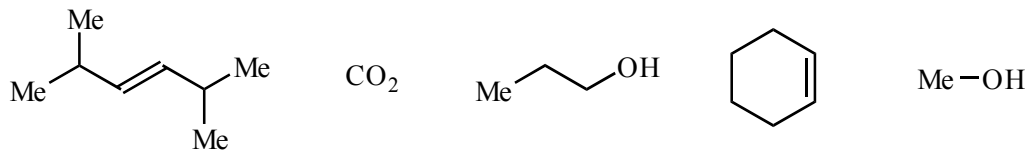
6. (11 points) Provide a detailed mechanism for the illustrated conversion of acetic acid (A) to acetyl chloride (B).



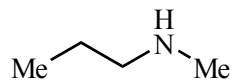
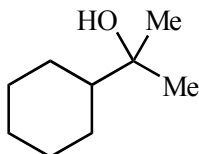
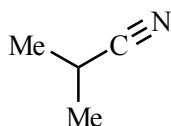
Name _____

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:

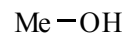
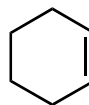
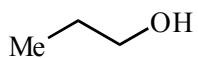
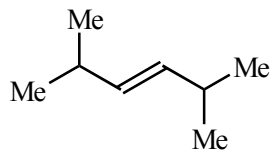


Synthesis #1:

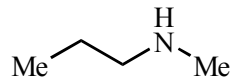
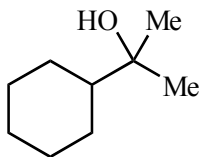
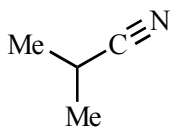
Name _____

7. (continued)

Allowed Starting Materials:



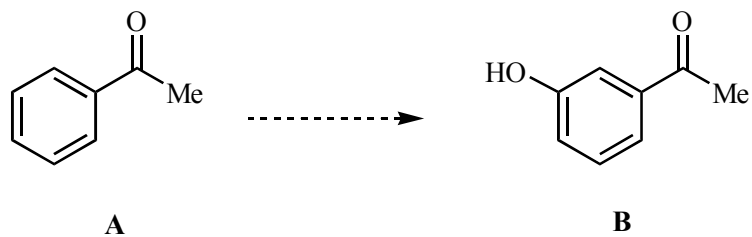
Pick Two:



Synthesis #2:

Name _____

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.



Name _____