# Chemistry 1315
# Exam 3- Topic 3A-KEY

**Name**_____

1. **NO CELL PHONE—NO CALCULATOR.**
2. Show your Buzz Card when you turn in your completed exam.
3. This is a closed book exam. Give or take no assistance from other students.

**I promise to uphold Georgia Tech's Honor Code**

**Signature:**_____

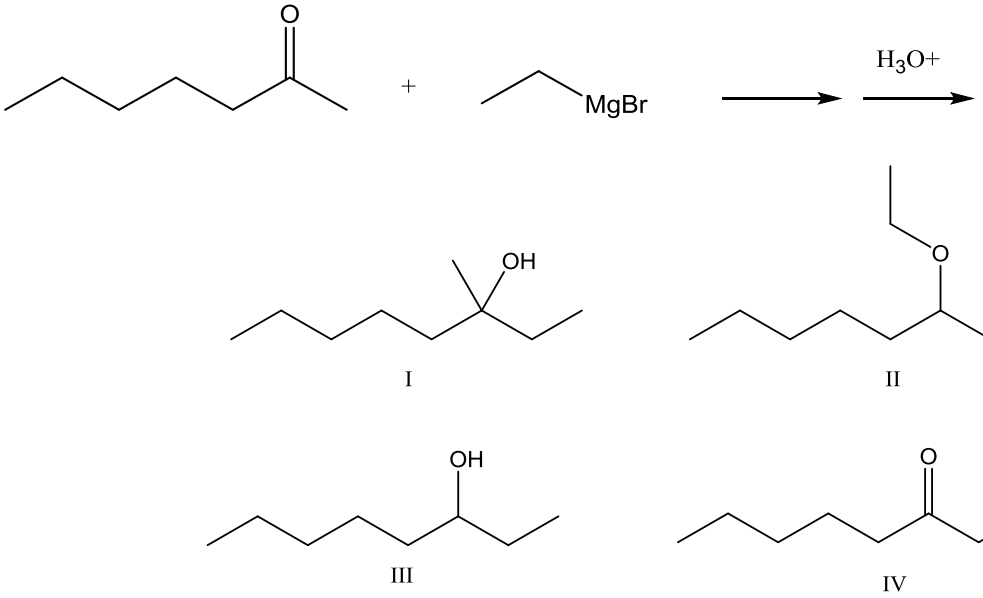
There are 5 sections on 10 pages. Read each questions carefully. **Write all answers and draw all structures clearly**. Take particular care to use solid-wedge lines and dashed lines in the structure to show the stereochemistry when appropriate.

A blank page for scratch work and pKa table are provided as a supplementary package.

## I- Questions

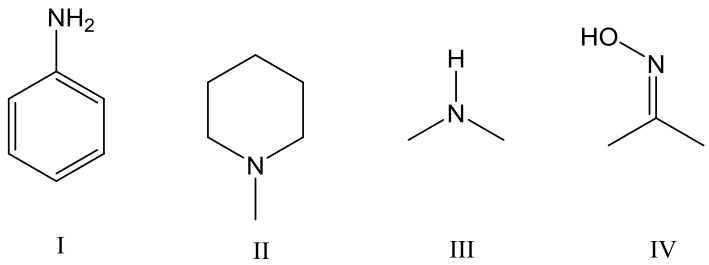
**Multiple Choice (2pts each)**

1- The product of the following Grignard reaction is?



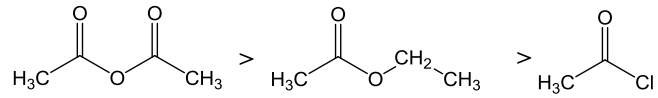

**A. I**
B. II
C. III
D. IV

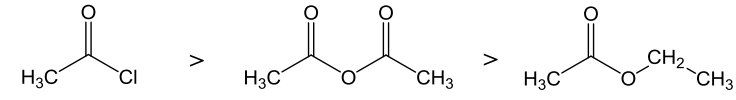
2- Which of the following is a tertiary amine?

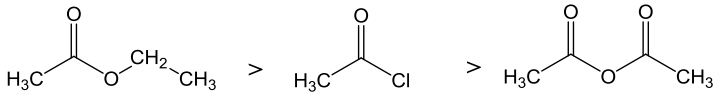


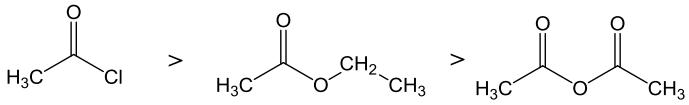

A. I
**B. II**
C. III
D. IV
E. II and IV

3- The order from the most reactive to the least reactive with propylamine is :

a. 

b. 

c. 

d. 

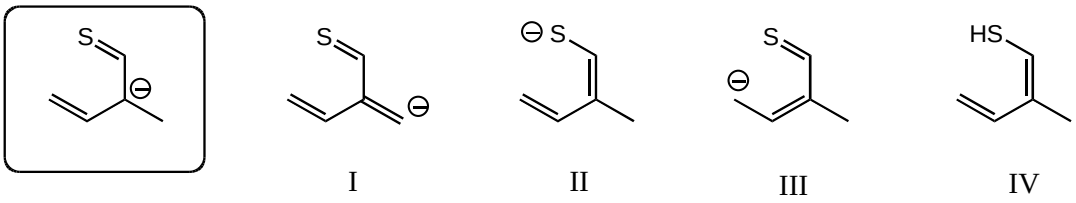
4- A carboxylic acid derivative will undergo a nucleophilic acyl substitution reaction provided that the:

A. substituent attached to the acyl group in the reactant is a very strong base.
B. incoming nucleophile and the substituent attached to the acyl group in the reactant have similar basicities.
**C. incoming nucleophile is not a much weaker base than the substituent attached to the acyl group in the reactant.**
D. incoming nucleophile is not a much larger base than the substituent attached to the acyl group in the reactant.
E. incoming nucleophile is not a much stronger base than the substituent attached to the acyl group in the reactant.

5- Which of the following reagent can be used to oxidize $1^{o}$ alcohols to carboxylic acids?

A. $MnO_2$
**B. $K_2Cr_2O_7/H_3O^+$**
C. PCC
D. $H_2O_2$

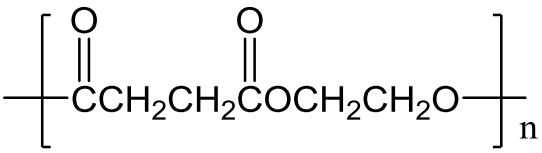
6- Which of the following species is/are ***not*** a resonance form(s) of the anionic species in the box?

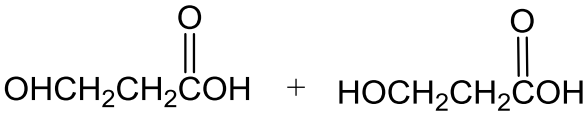


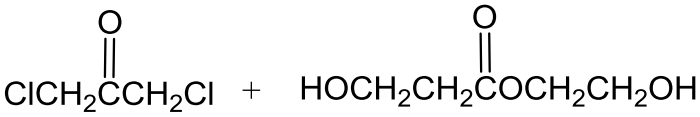

I II III IV

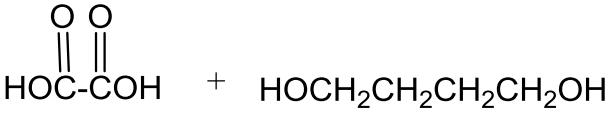
A. I
B. II and III
C. III and IV
**D. I and IV**

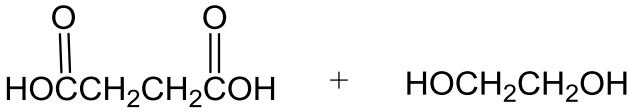
7- What monomers are needed to produce this polymer?




a- 


b- 

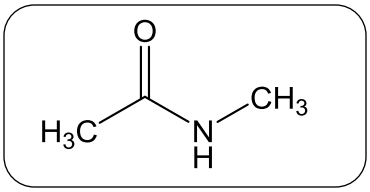

c- 

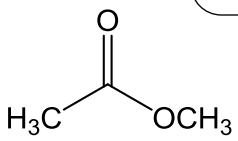

d- 

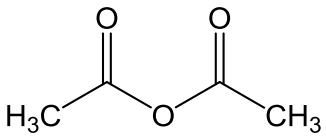

8- Which of the following is the correct order of decreasing reactivity with nucleophiles (most reactive>less reactive)

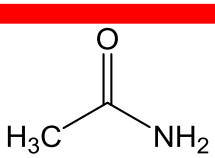
A. Acyl anhydride> acyl chloride> amide > ester
B. Ester>acyl anhydride>acyl chloride> amide
C. Acyl chloride> ester> acyl anhydride>amide
**D. Acyl chloride>acyl anhydride>ester>amide**

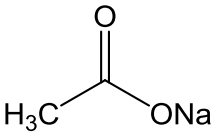
9- Which reaction will produce N-methyl-acetamide (shown below)?



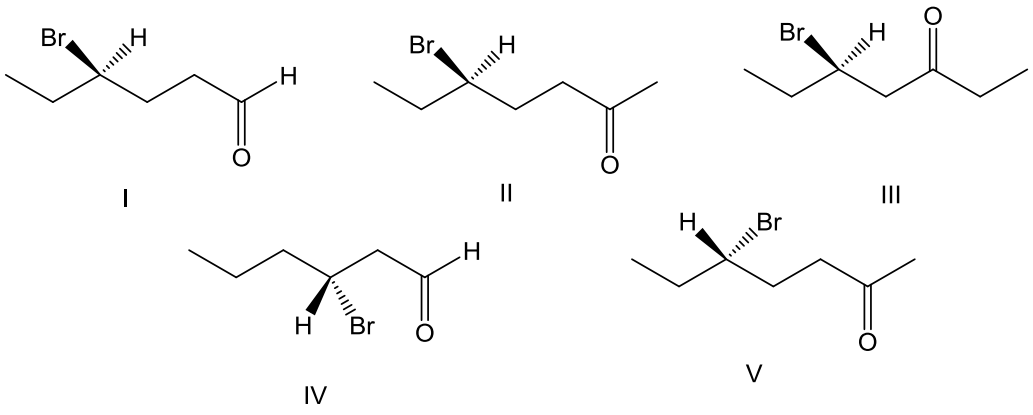
a-  $NH_3$

b-  $CH_3NH_2$

c-  $CH_3OH$

d-  $CH_3NH_2$

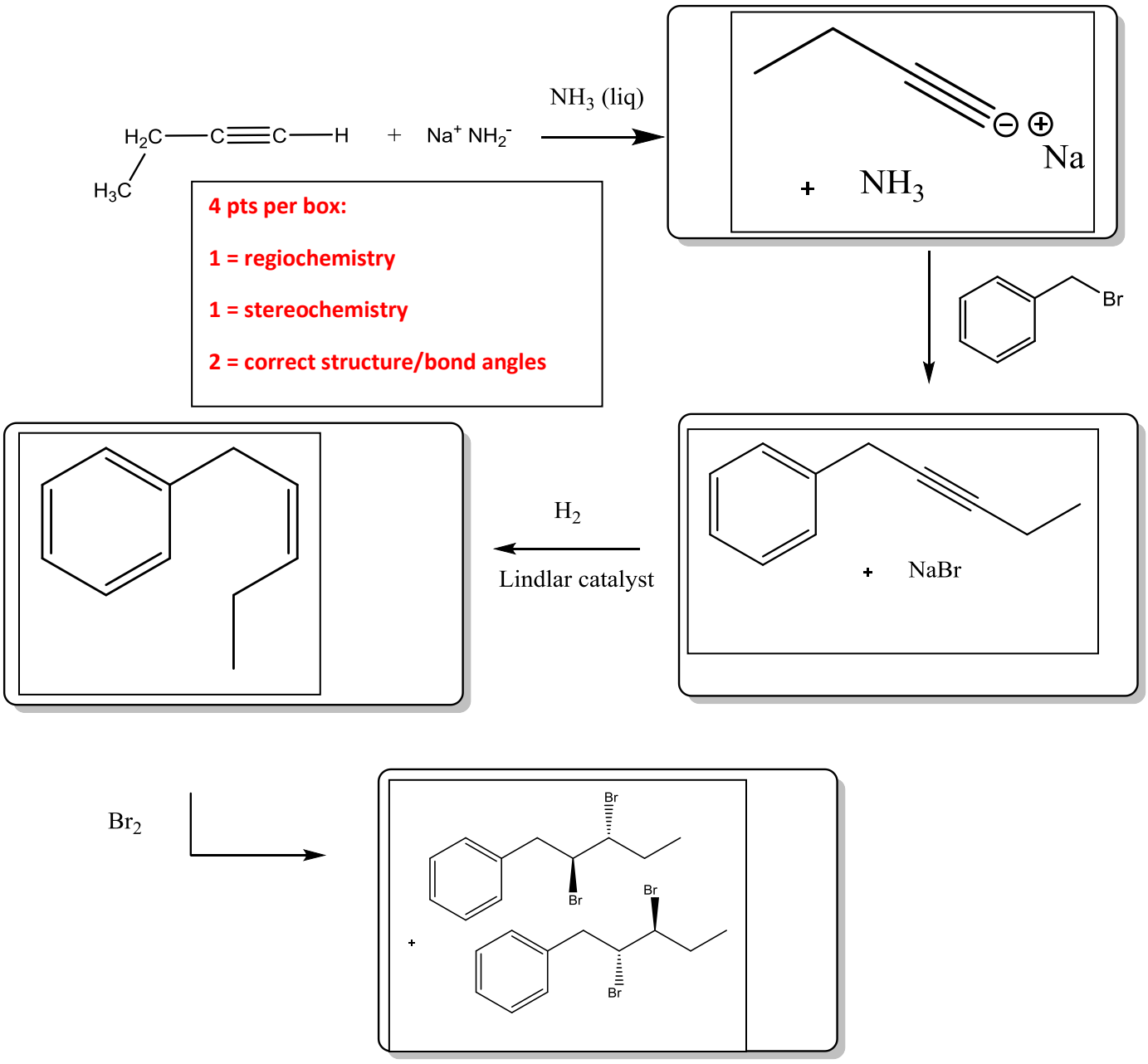
10- What is the correct structure for (S)-5-bromo-2-heptanone?




A. I
B. II
C. III
D. IV
**E. V**

## II- Reactions

(1) Complete the following reaction steps. Equations must be individually balanced. Be careful to consider regiochemistry and stereochemistry when appropriate.




**4 pts per box:**

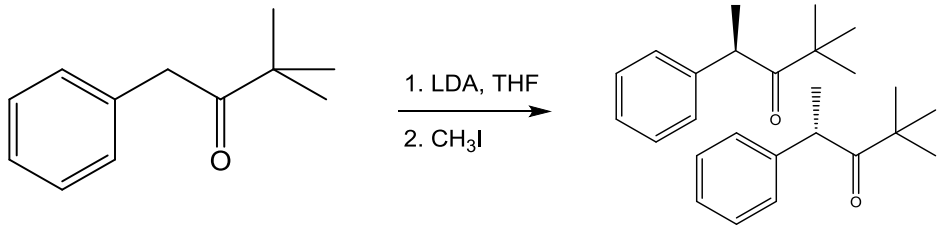
**1 = regiochemistry**

**1 = stereochemistry**

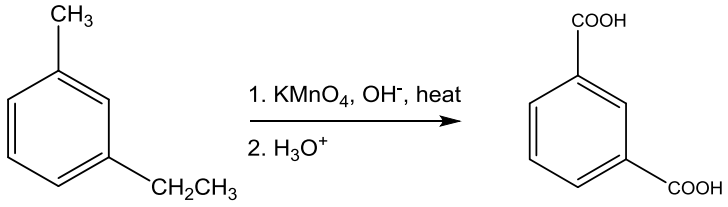
**2 = correct structure/bond angles**

(2) Write the major product(s) for each of the reactions below. Be careful to consider <u>regiochemistry</u> and <u>stereochemistry</u> when appropriate. When stereoisomers are formed as the major products, each structure must be provided for full credit.

A)




B)



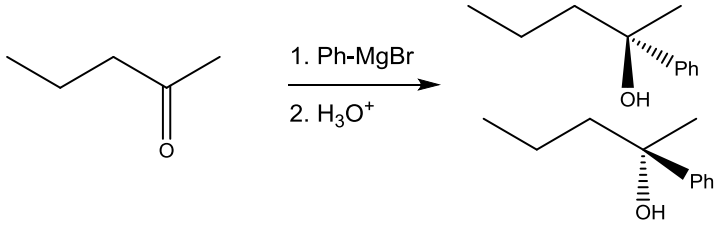

**4 pts per question:**

**1 = regiochemistry**

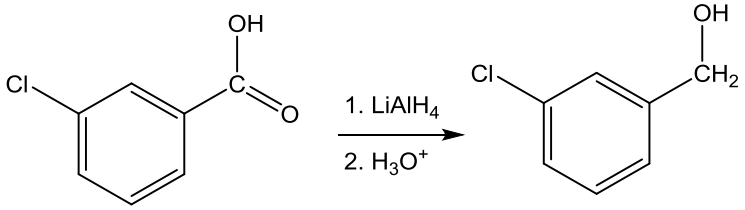
**1 = stereochemistry**

**2 = correct structure/bond angles**

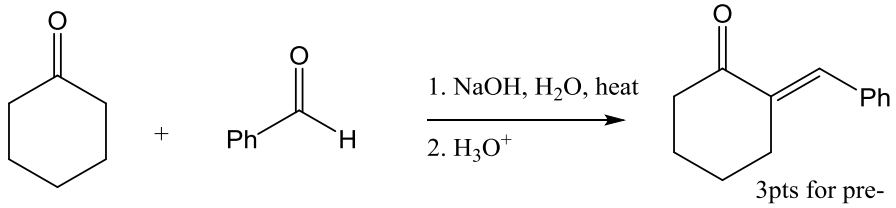
C)




D)

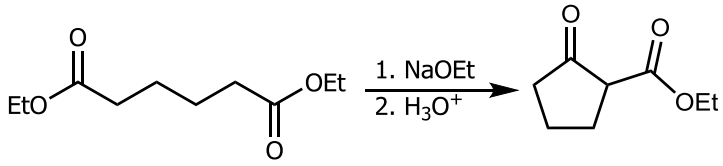



E)



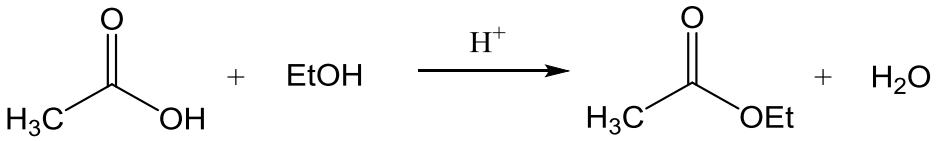

3pts for pre-dehydration alcohol

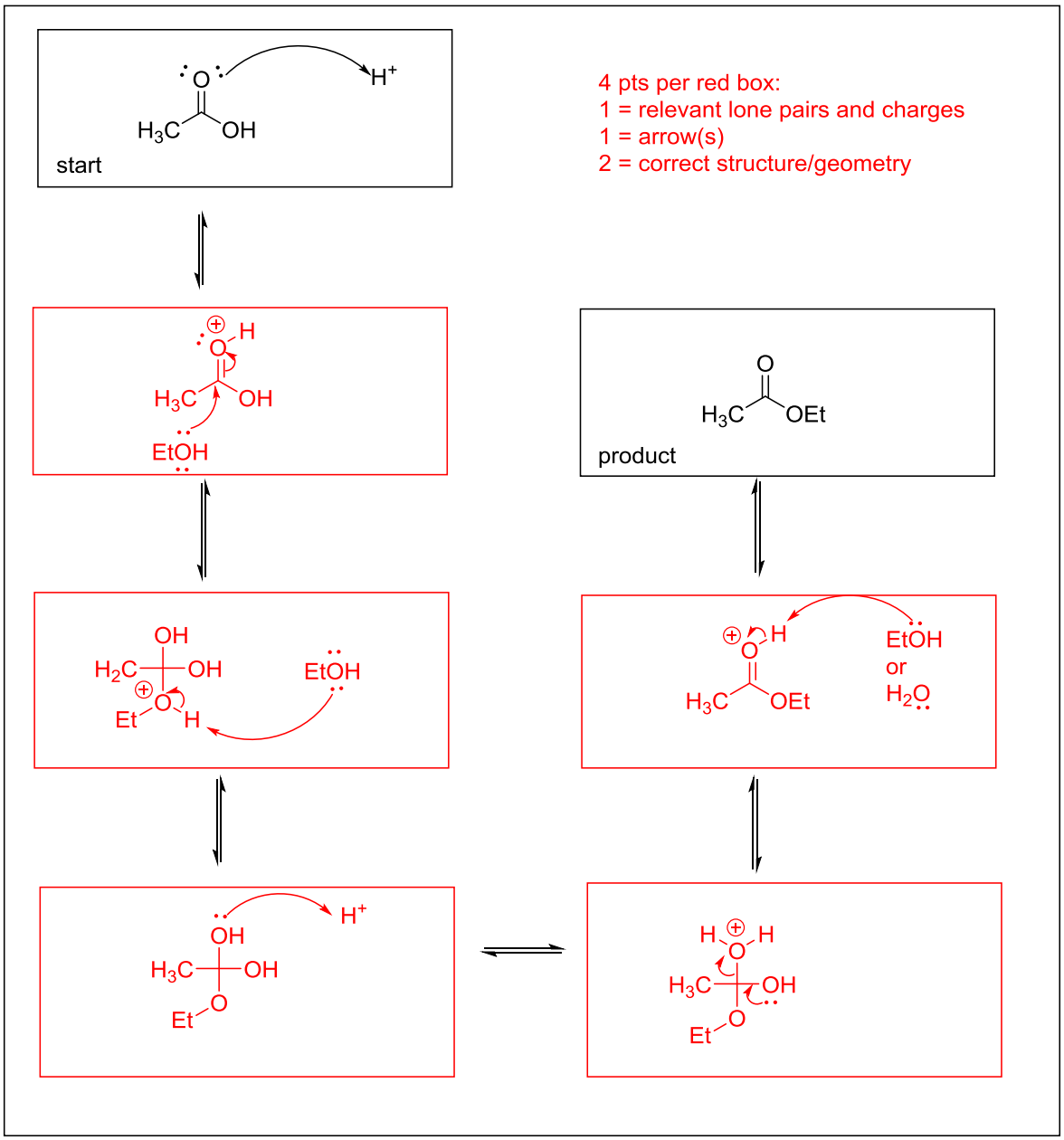
F)



## III- Mechanism

The acid-catalyzed Fischer esterification converts the carboxylic acid to its carboxylic ester. Draw all the required curved arrows, all required charges and pair of electrons to complete the step-by-step mechanism of the acid-catalyzed esterification.

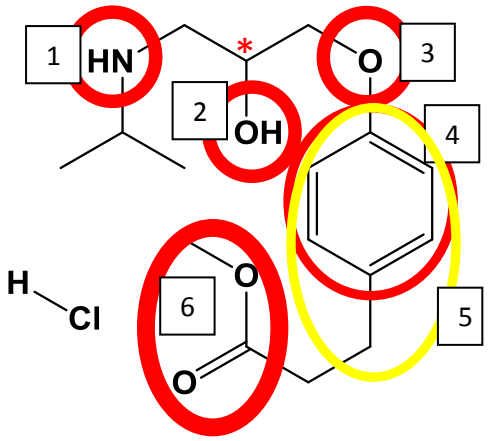


## IV- Application

"Brevibloc" or "Esmolol hydrochloride" is a beta-blocker that may be administered as an aqueous solution to a patient during surgery to slow abnormally rapid beating of the heart.

1- Systematic name is methyl 3-(4-(2-hydroxy-3-isopropylamino)propoxy)phenylpropa-noate. Circle and name 5 functional groups. **(2pts each)**
2- Is the structure shown below correct? How would you modified it? (Hint: would you inject HCl intravenously?) **No (1pt). Drawn as ammonium chloride salt (3pts).**
3- Identify a chiral center in the structure with an asterisk. **(3pts)**
4- Directions for intravenous administration of the drug caution "brevibloc should not be admixed with sodium bicarbonate". **WHY? Acid/base reaction with ammonium. It would no longer be a salt. (3pts)**




1 - Amine ($2^0$)

2 – Alcohol ($2^0$)

3 – Ether

4 – Aromatic, aryl, phenyl (red circle)

5 – Benzyl (yellow circle)

6 - Ester

## V- Bonus Question. (5 pts)

| Question | | Score |
|---|---|---|
| I- | Questions (Multiple choice & True/False) | _____/20 |
| II- | Reactions | _____/40 |
| III- | Mechanism | _____/20 |
| IV- | Applications | _____/20 |
| V- | Bonus | _____/5 |
| TOTAL | | _____/100 |