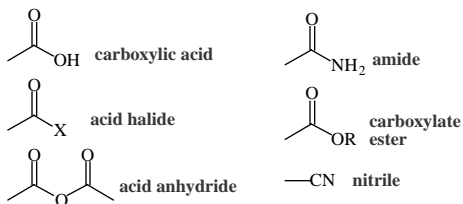


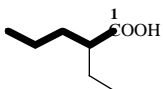
### Acyl Compounds: Derivatives of Carboxylic Acids



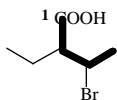
### Nomenclature: Carboxylic Acids

Simple carboxylic acids are named as derivatives of the parent alkane, using the suffix *-oic acid*

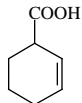
1. Select the longest continuous carbon chain, *containing the carboxylic acid group*, and derive the parent name by replacing the *-e* ending with *-oic acid*.
2. Number the carbon chain, *beginning at the end nearest to the carboxylic acid group*.
3. Number the substituents and write the name, listing substituents *alphabetically*.
4. Carboxylic acid substituents attached to rings are named using the suffix *-carboxylic acid*.



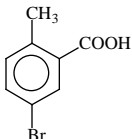
2-ethylpentanoic acid



3-bromo-2-ethylbutanoic acid



2-cyclohexenecarboxylic acid

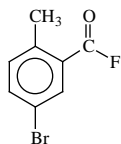
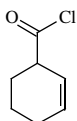
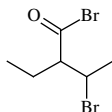
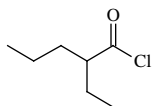


5-bromo-2-methylbenzoic acid

### Nomenclature: Acid Halides

Simple acid halides are named by identifying the acyl group, using the suffix *-oyl* followed by the halogen.

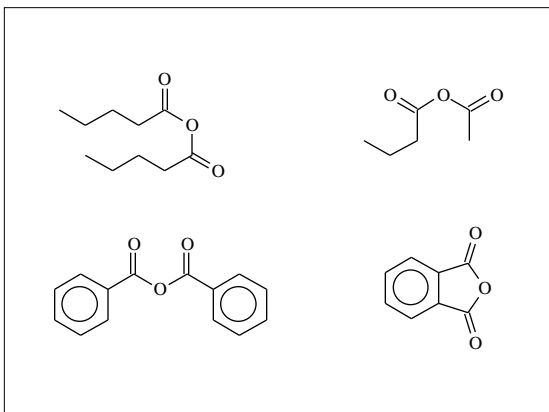
1. Select the longest continuous carbon chain, *containing the acyl group*, and derive the parent name by replacing the *-e* ending with *-oyl*.
2. Number the carbon chain, *beginning at the end nearest to the acyl group*.
3. Number the substituents and write the name, listing substituents *alphabetically*.
4. Acid halide substituents *attached to rings* are named using the suffix *-carbonyl*.



### Nomenclature: Acid Anhydrides

Simple acid anhydrides are named by replacing the ending acid with *anhydride*.

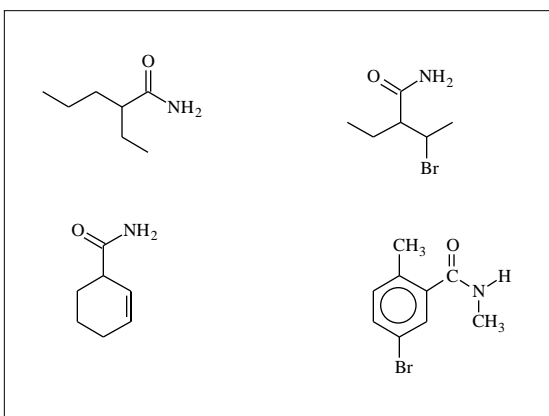
1. Select the longest continuous carbon chain, *containing the carboxylic acid group*, and derive the parent name by replacing the *-e* ending with *-oic anhydride*.
2. Number the carbon chain, *beginning at the end nearest to the acyl group*.
3. Number the substituents and write the name, listing substituents *alphabetically*.
4. If the anhydride is derived from two identical substituted carboxylic acids, use the modifier *-bis*



## Nomenclature: Amides

Simple amides are named by replacing the ending -oic acid with -amide.

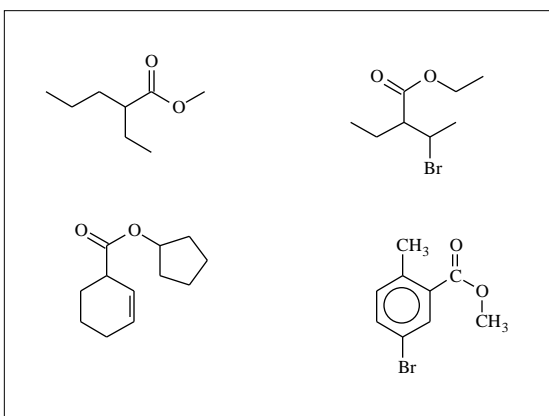
1. Select the longest continuous carbon chain, *containing the amide group*, and derive the parent name by replacing the -e ending with -amide; amides **attached to rings** are named using the suffix -carboxamide.
2. Number the carbon chain, *beginning at the end nearest to the acyl group*.
3. Number the substituents and write the name, listing substituents alphabetically.
4. If the nitrogen atom is further substituted, the substituents are preceded by *N-* to indicate that they are attached to the nitrogen.



## Nomenclature: Carboxylate Esters

Simple carboxylate esters are named as derivatives of the carboxylic acid, by changing the suffix -oic acid to -oate and indicating the alcohol.

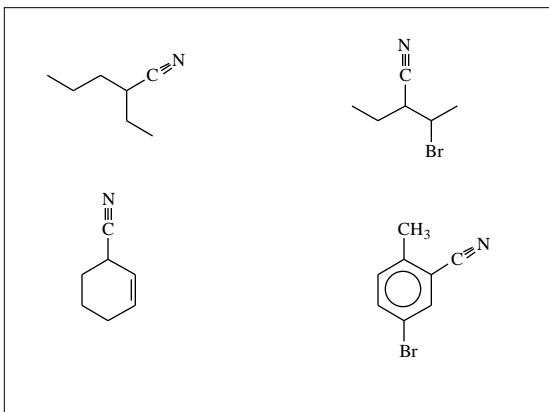
1. Select the longest continuous carbon chain, *containing the carboxylate ester group*, and derive the parent name by replacing the -e ending with -oate and naming the alcohol first.
2. Number the carbon chain, *beginning at the end nearest to the acyl group*.
3. Number the substituents and write the name, listing substituents alphabetically.
4. Carboxylic acid substituents **attached to rings** are named using the suffix -carboxylate.



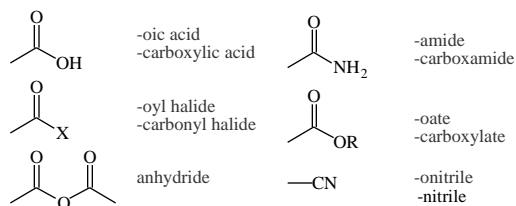
## Nomenclature: Nitriles

Simple nitriles are named as derivatives of the parent alkane, using the suffix -nitrile.

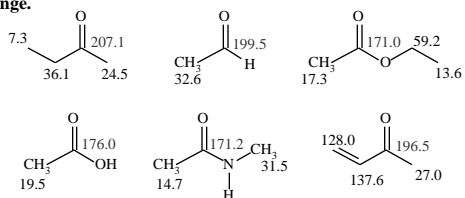
1. Select the longest continuous carbon chain, *containing the nitrile group*, and derive the parent name by attaching the ending -nitrile.
2. Number the carbon chain, *beginning at the end nearest to the nitrile group*.
3. Number the substituents and write the name, listing substituents alphabetically.
4. Carboxylic acid substituents **attached to rings** are named using the suffix -carbonitrile.
5. Complex molecules are named as derivatives of the carboxylic acid by converting the -ic acid to -onitrile.



### Summary: Nomenclature of Acyl Derivatives



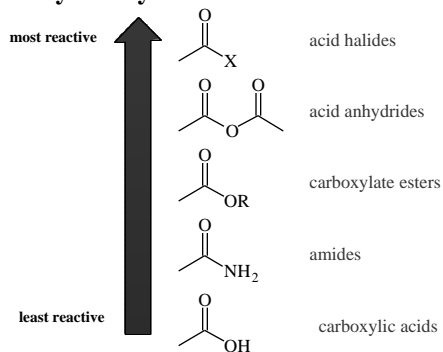
<sup>13</sup>C NMR: Carbonyls are the most highly deshielded carbons which are typically encountered in the <sup>13</sup>C NMR. Their intensity is usually weak, since there are no attached hydrogens to contribute to the Nuclear Overhauser Effect enhancement (with the exception of aldehydes). Typical chemical shifts occur in the region δ 170 - 210 with esters, carboxylic acids and amides at the low end, and simple ketones and aldehydes at the high end of the range.



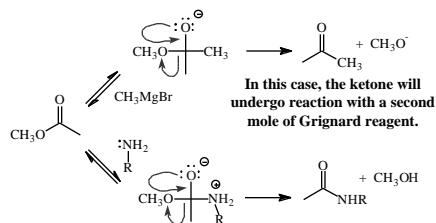
### IR Bands and NMR Peaks Associated with Acyl Derivatives

Functional Group	IR C=O	<sup>13</sup> C NMR, C=O
acid halide	1810	170
anhydride	1820-1760	167
ester	1735	171
aldehyde	1730	201
ketone	1715	205
carboxylic acid	1710	177
amide	1690	173

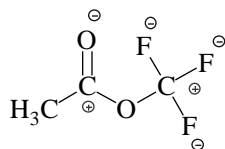
### Reactivity of Acyl Derivatives



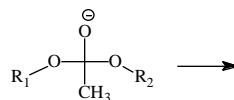
**The Addition-Elimination Mechanism of Acyl Transfer:**  
When there is a leaving group attached to the carbonyl group (CH<sub>3</sub>O<sup>-</sup> is shown) both simple anions and amines will follow an addition-elimination mechanism.



**Substituent Effects in Acyl Transfer:** Electron withdrawing substituents in the ester alcohol portion make the carbonyl carbon more electropositive and more reactive towards nucleophilic substitution.

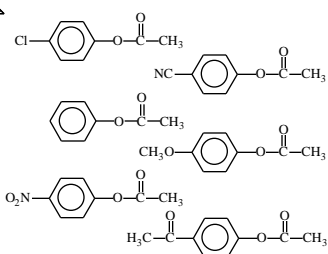


The electron withdrawing substituents in the groups around a tetrahedral intermediate will control the partitioning of that intermediate, that is, which group will be most likely to leave.



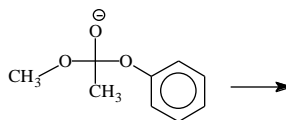
Rank the acetate esters shown below with regard to their relative reactivity.

most reactive

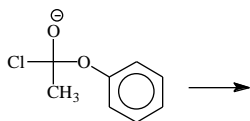


least reactive

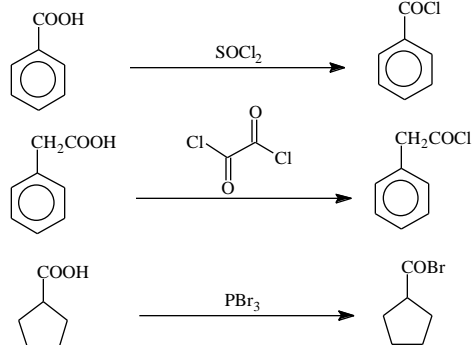
Predict the major product from the breakdown of the tetrahedral intermediate shown below:

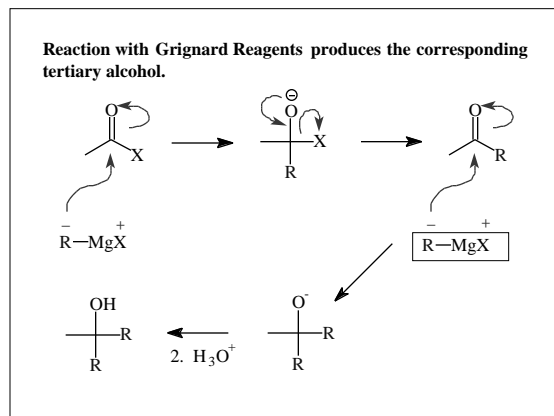
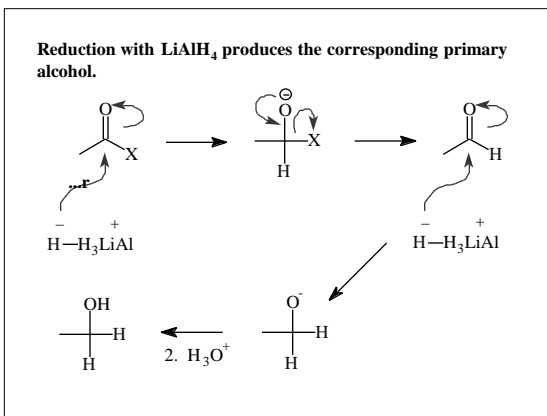
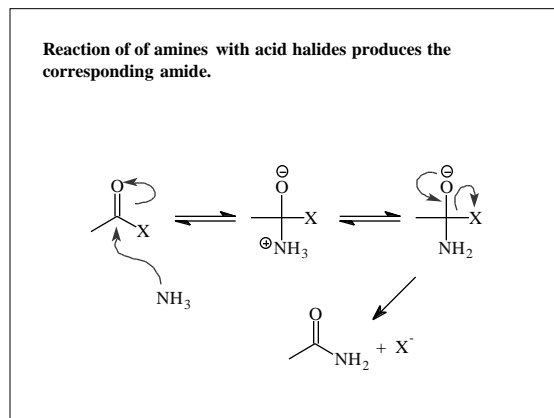
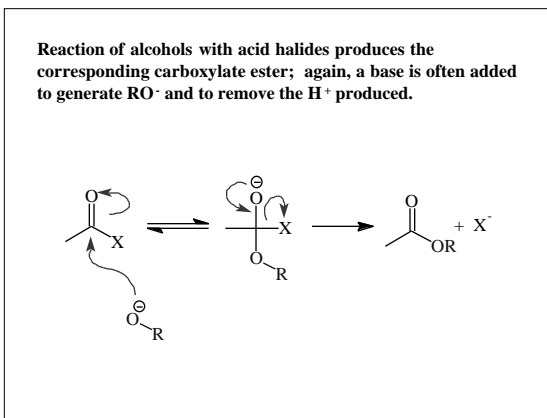
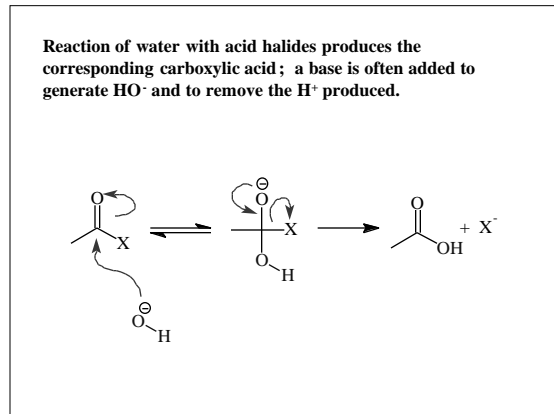
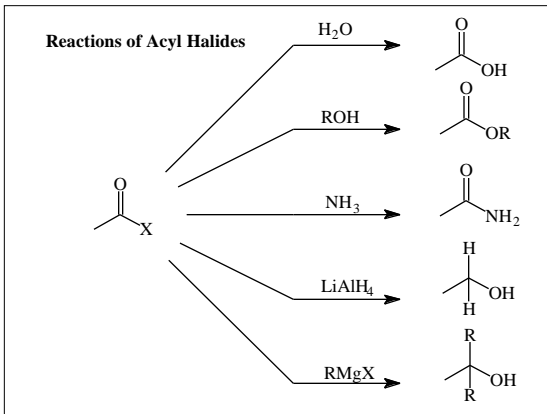


Predict the major product from the breakdown of the tetrahedral intermediate shown below:

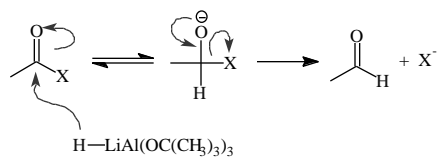


Reactions that Yield Acid Halides

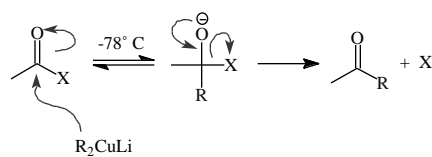




Reaction with Li tri-*tert*-butoxyaluminum Hydride produces the corresponding aldehyde.

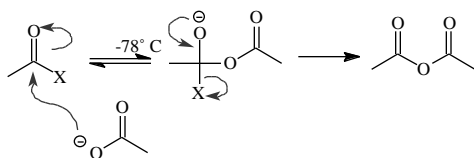


Reaction with Dialkyl-Copper-Lithium produces the corresponding ketone.

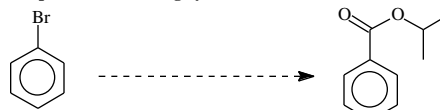


This reaction is also useful for  $\alpha$ - $\beta$  unsaturated acid halides since conjugate addition does not occur at low temperature

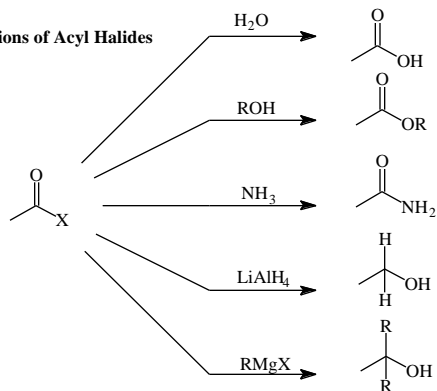
Reaction with carboxylic acids produces the corresponding anhydride.



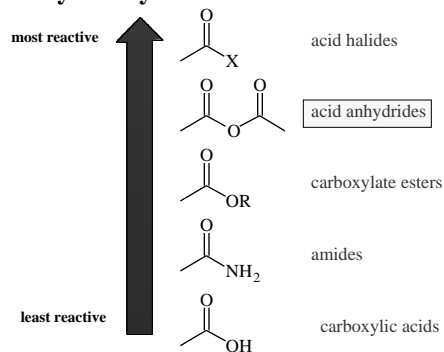
Complete the following synthetic conversion:

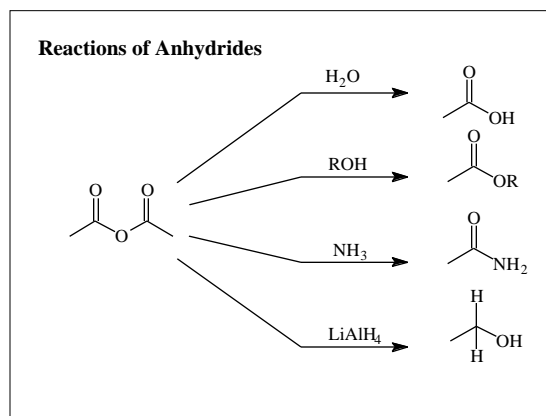
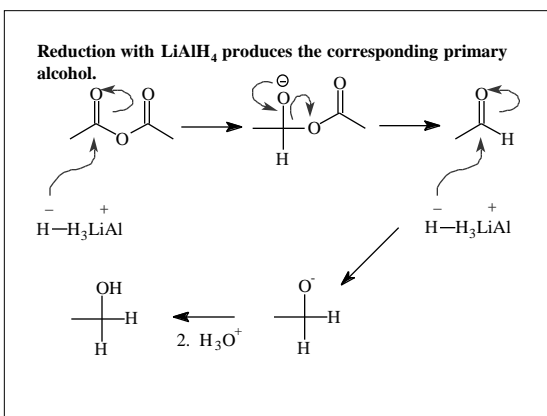
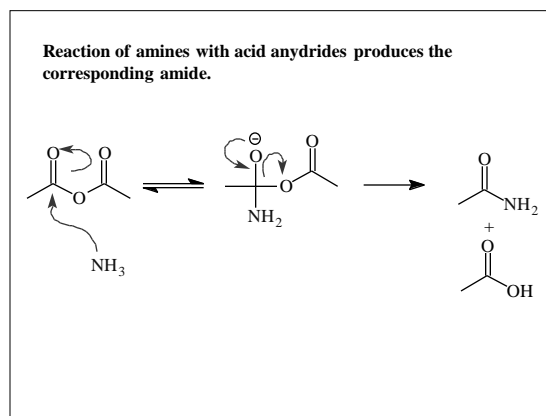
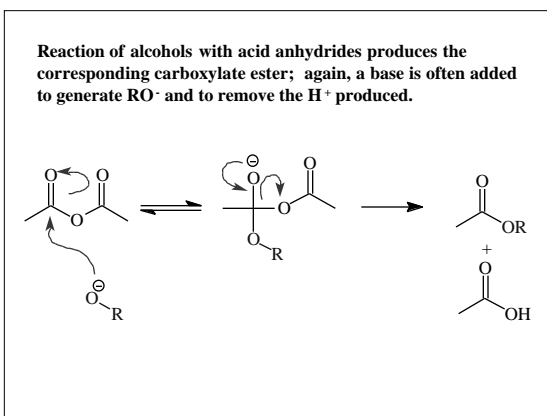
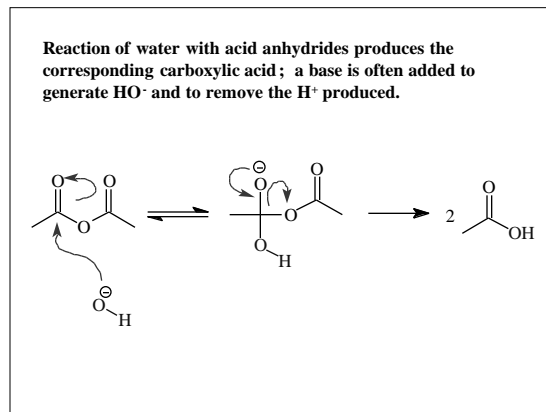
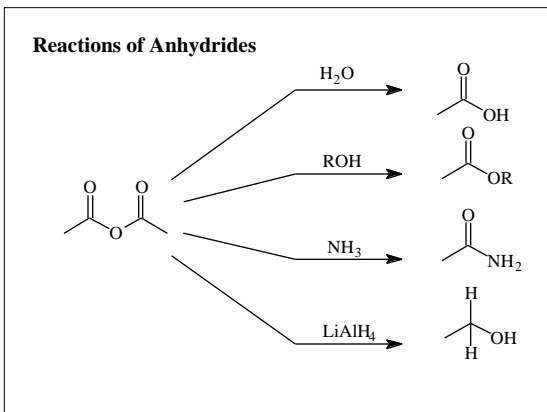


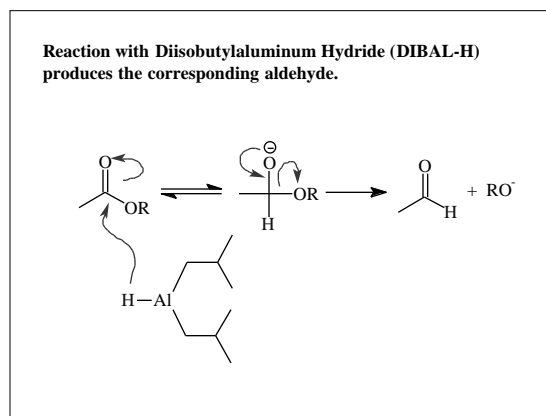
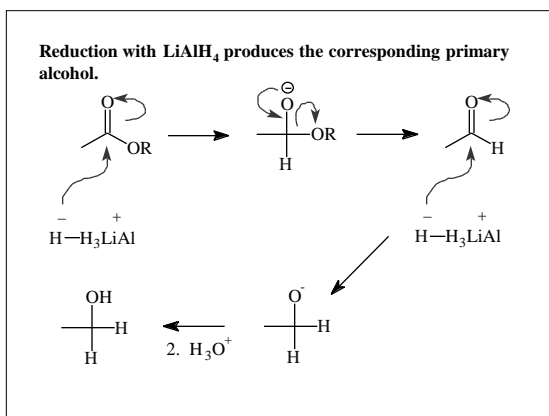
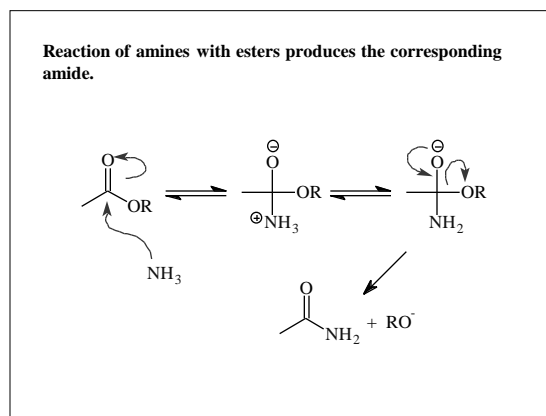
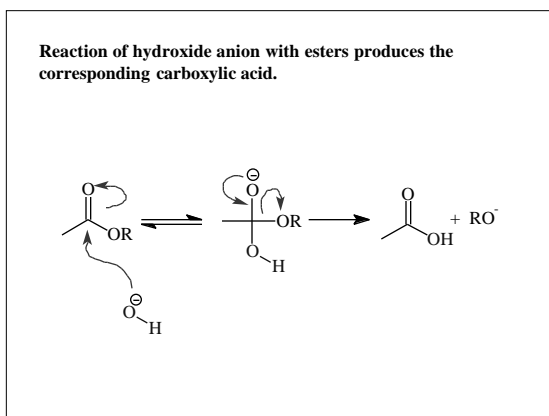
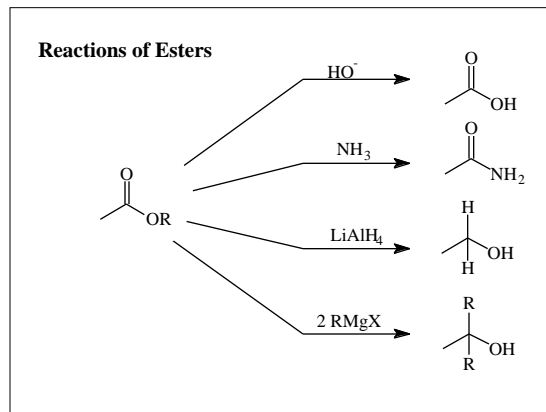
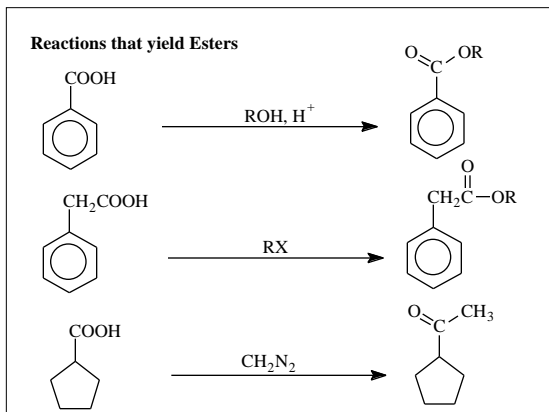
Reactions of Acyl Halides

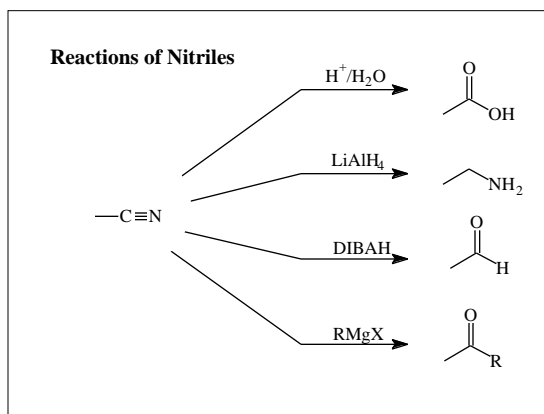
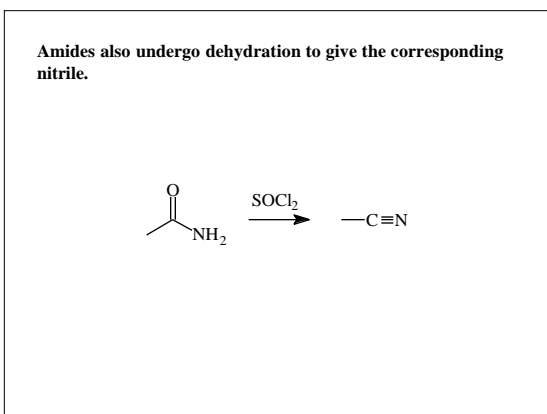
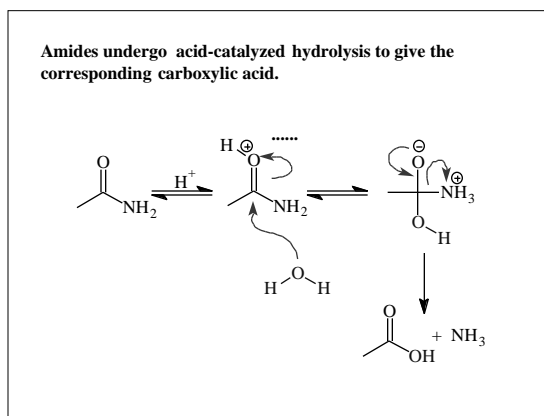
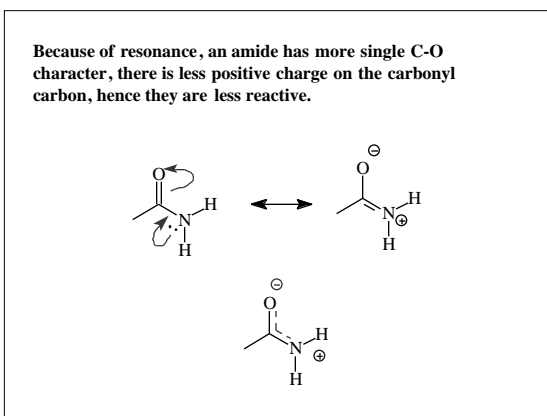
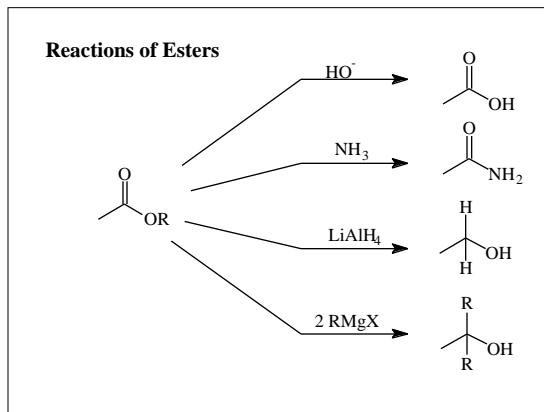
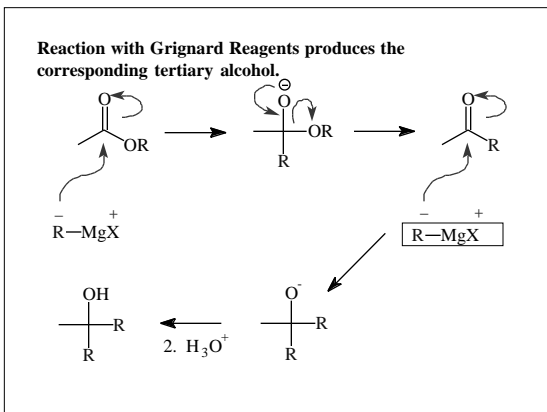


Reactivity of Acyl Derivatives

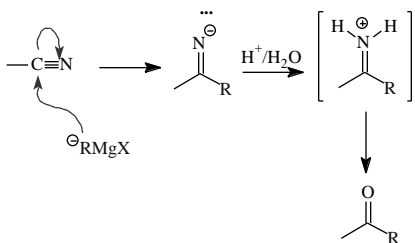




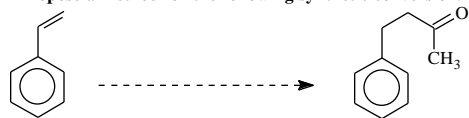




Grignard reagents add to nitriles to form imine anions which do not undergo attack by a second mole of reagent; acid hydrolysis gives the corresponding ketone.



Propose a method for the following synthetic conversion.



Suggest a method for the synthetic conversion shown below.

