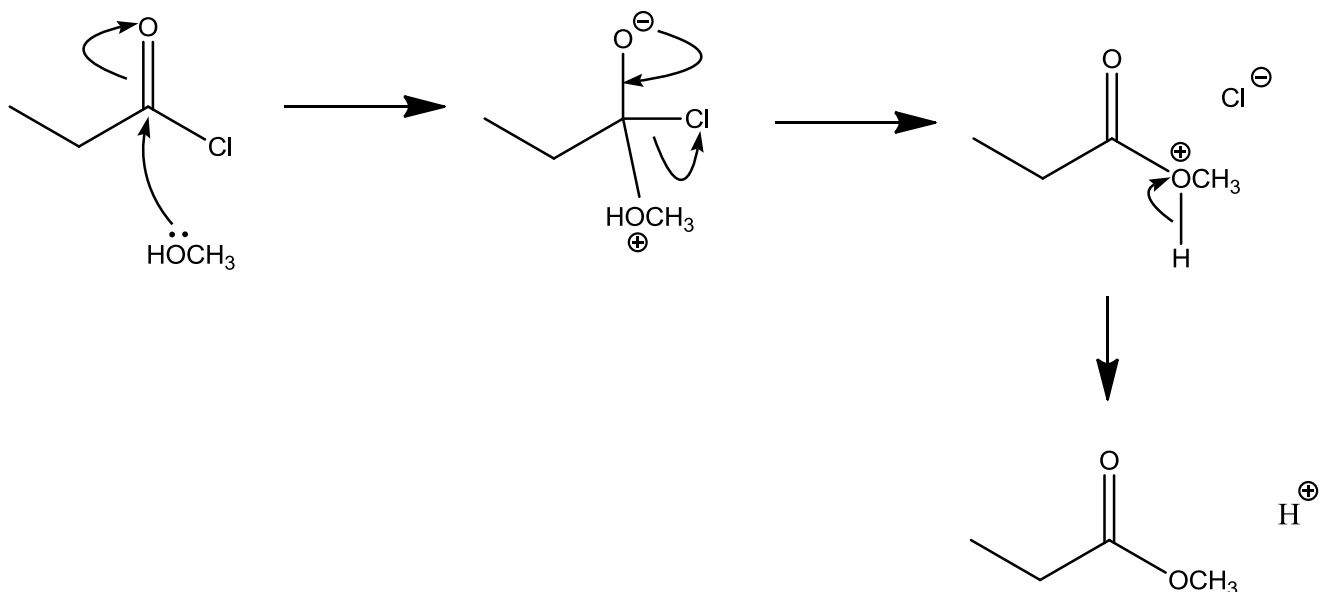


CHEM1611 Worksheet 9: Reactions of Carbonyls and Acid Derivatives

Model 1: Carboxylic Acid Derivatives

Carboxylic acid derivatives are formed from the condensation of a carboxylic acid with a second functional group, such as an alcohol or an amine. In some cases they can be formed directly. More often, the carboxylic acid must be converted to a more reactive intermediate, such as an acid chloride but the **process of condensation is essentially the same**:

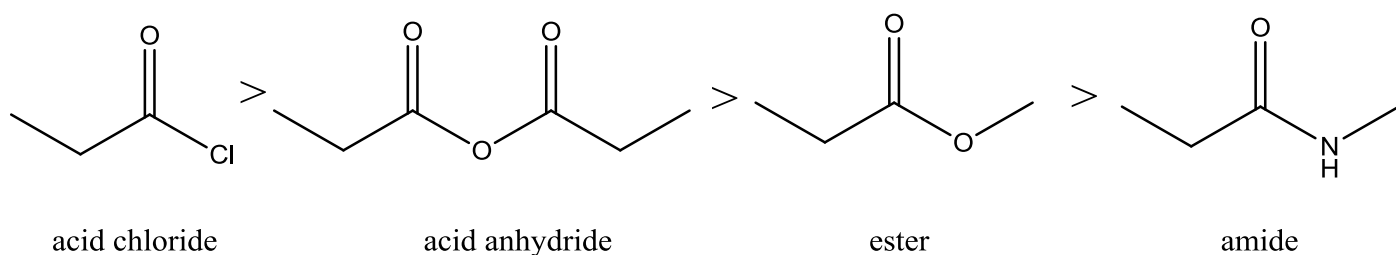


Critical thinking questions

- Using the reaction above as a model, try to devise a mechanism for the condensation of an acid chloride with an amine to form an amide.



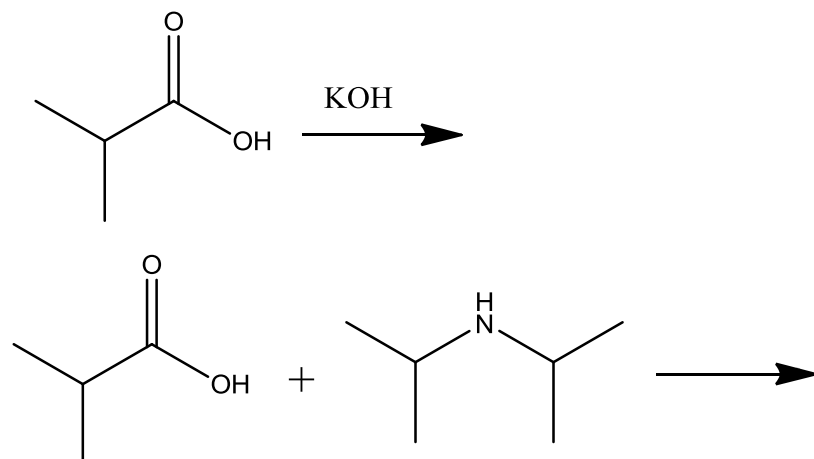
Here are the common carboxylic acid derivatives, arranged from most reactive to least reactive



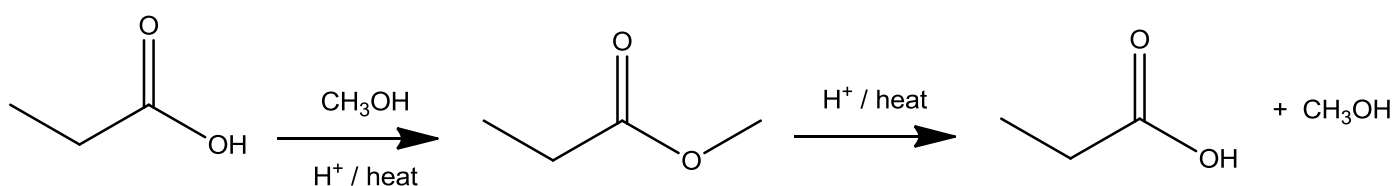
A carboxylic acid derivative can *only* be converted to a *more* stable derivative.

- How might you convert an ester into an amide? (*Hint*: look at your answer to Q1).
- What is the by-product of this reaction?

4. Carboxylic acids are, as the name suggests, capable of undergoing acid-base reactions. We also know that amines are basic. Use this to predict the outcome of the following reactions.

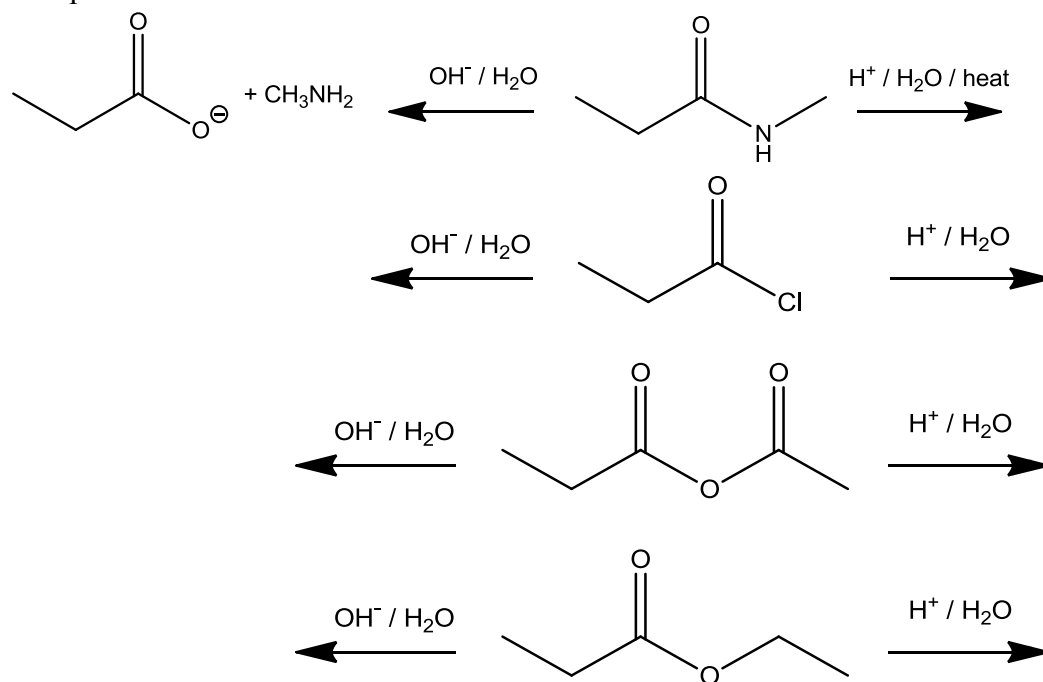


The scheme below shows the *condensation* of a carboxylic acid and an alcohol to give an ester, followed by *hydrolysis* of the ester back to the carboxylic acid and alcohol. Hydrolysis can be catalysed by acid or base



5. Overall, what is being removed or added in each step? How does this relate to the names we give these reactions (condensation and hydrolysis)?

6. Complete the schemes below.



7. An acid chloride can be hydrolysed using just water, whereas hydrolysis of an amide requires an acid (or base) and heat. Explain the origin of the difference.