

ORGANIC CHEMISTRY 2 LECTURE GUIDE 2019

BY RHETT C. SMITH, PH.D.

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Executive Editor: Rhett C. Smith, Ph.D. You can reach him through our office at:

IQ@protonguru.com

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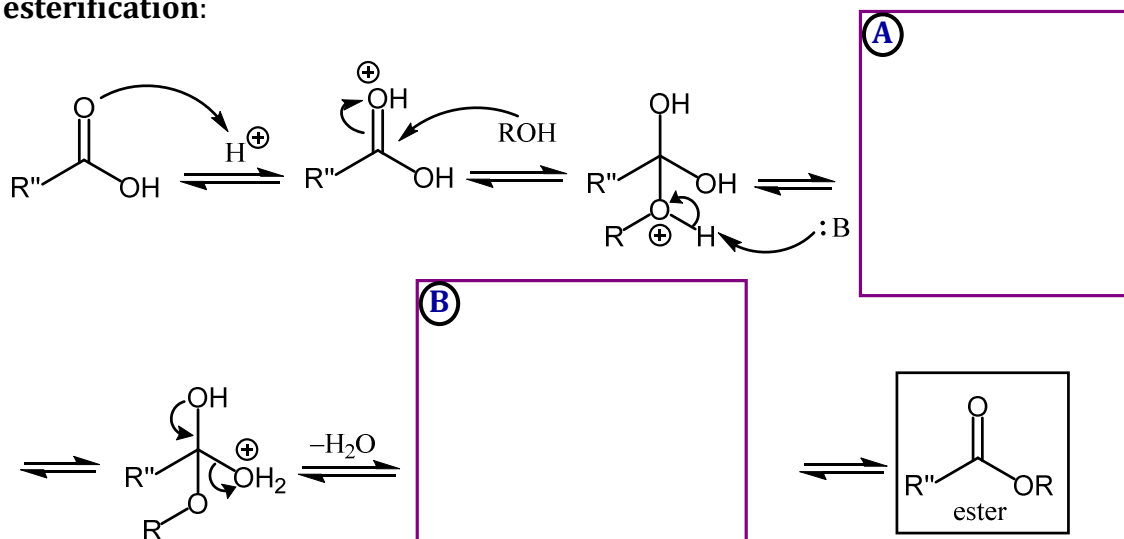
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Lesson VI.11. S_NAc Reaction of O Nucleophiles with Carboxylic Acids and Esters

Fischer esterification

It is possible to convert an -OH group to a good leaving group by protonating it as well, as we saw in reactions of alcohols with HX or H₂SO₄. If we react a carboxylic acid with an alcohol nucleophile in the presence of an acid catalyst, we will get an ester. This is called **acid-catalyzed esterification** or **Fischer esterification**:



Notes

Lesson VI.11. S_NAc Reaction of O Nucleophiles with Carboxylic Acids and Esters

Acid-catalyzed ester hydrolysis

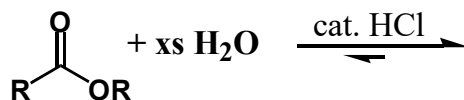
Note that all the steps are reversible, so we can push the reaction to either side of the equation by using LeChatelier's Principle.

LeChatelier's Principle:

(B)

This means that **ester hydrolysis** to convert an ester to a carboxylic acid is also possible:

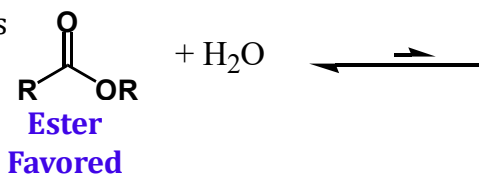
If you add lots of water:



(C)

Carboxylic acid Favored

If you add lots of alcohol:



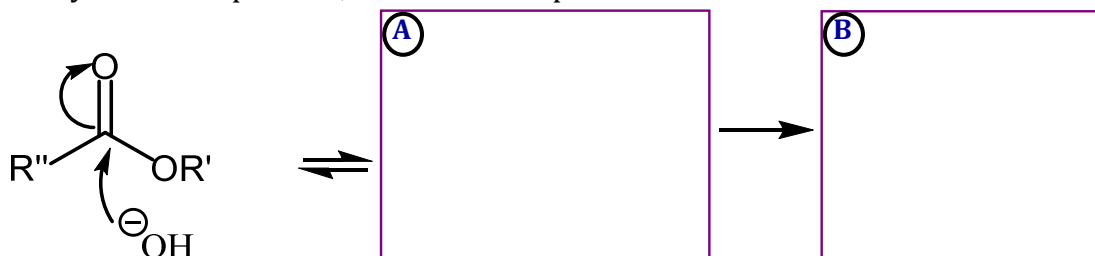
(D)

Notes

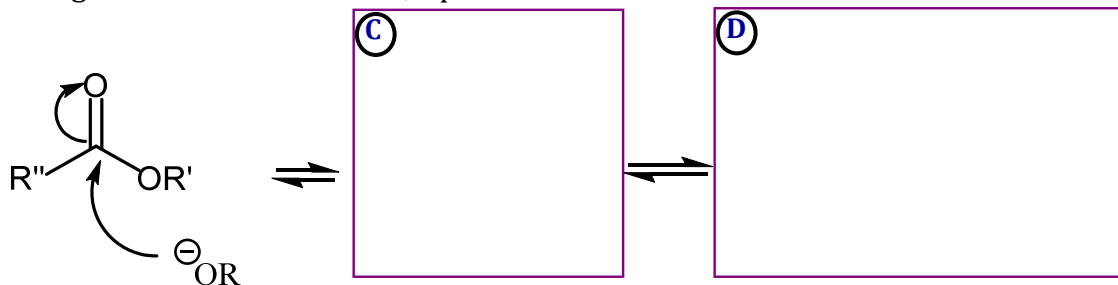
Lesson VI.11. S_NAc Reaction of O Nucleophiles with Carboxylic Acids and Esters

Base-catalyzed ester hydrolysis, transesterification

We have seen that esters can undergo acid-catalyzed hydrolysis. Hydrolysis can also be mediated by base catalysis. The presence of base leads to formation of a carboxylate as the product, so the final step is irreversible:



If an alcohol/alkoxide is used in place of the H_2O /hydroxide, one ester can be changed into a different ester, a process called **transesterification**:

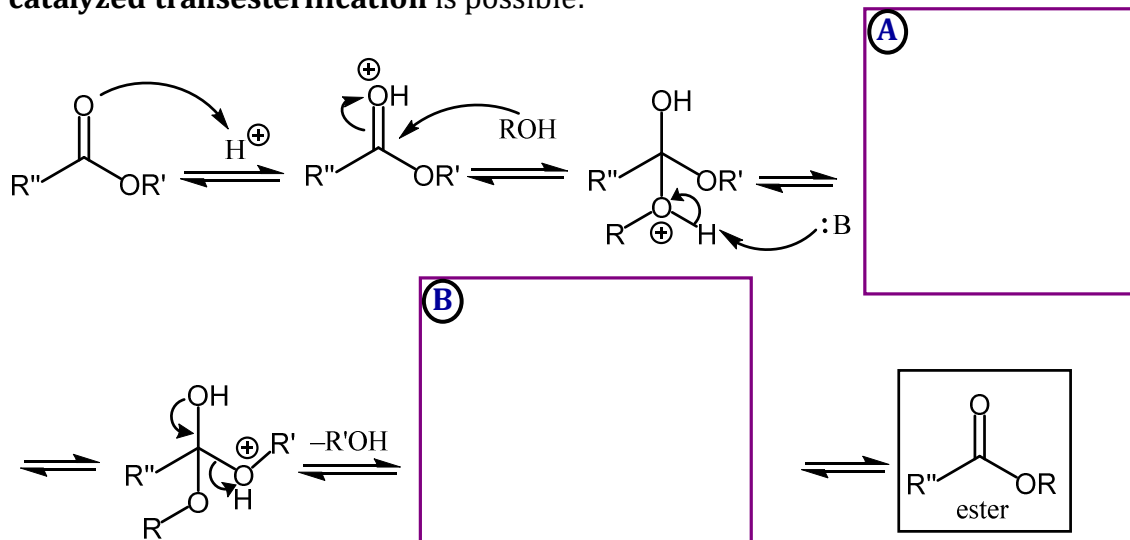


Notes

Lesson VI.11. S_NAc Reaction of Oxygen Nucleophiles with Carboxylic Acids and Esters

Acid-catalyzed transesterification

We have seen that esters can undergo acid-catalyzed hydrolysis. If an alcohol is used in place of water for reaction with ether with acid catalysis, **acid-catalyzed transesterification** is possible:



Note that this mechanism mirrors the Fischer esterification of carboxylic acids.

Notes