Today

Reactions of Carboxylic Acids
Section 15.10

Next Class

Aldehyde and Ketone Nomenclature
Section 16.1

Relative Reactivities
Section 16.2

Second Class from Today

Relative Reactivities
Section 16.2

How Aldehydes and Ketones React
Section 16.3

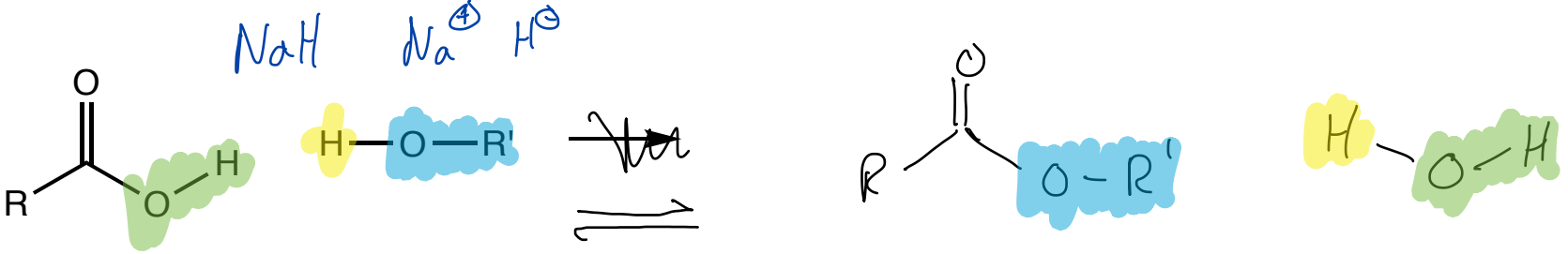
Reactions with Carbon Nucleophiles
Section 16.4

Third Class from Today

Test on Chap 15

On a separate piece of paper rework test 1 by Wednesday, March 22

Chapter 15 HW is due by March 22 at 11:59 pm



R = H, CH_3, CH_2CH_3, etc.

R' ≠ H, R' = CH_3, CH_2CH_3, etc.

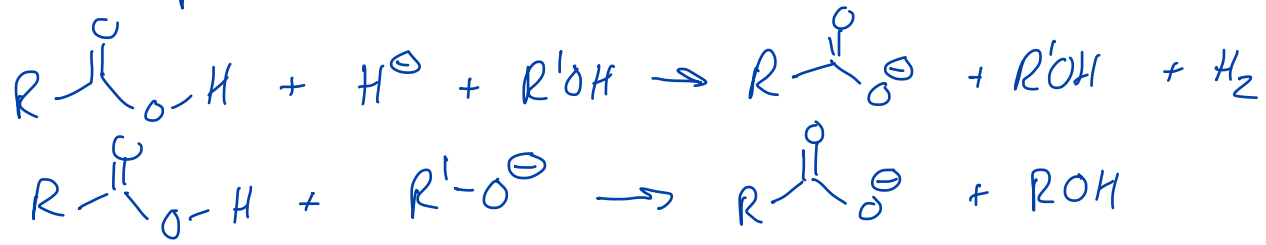
essentially the same as a transesterification

acid catalyst to speed up the reaction ✓ yep, adding acid can speed up reaction.

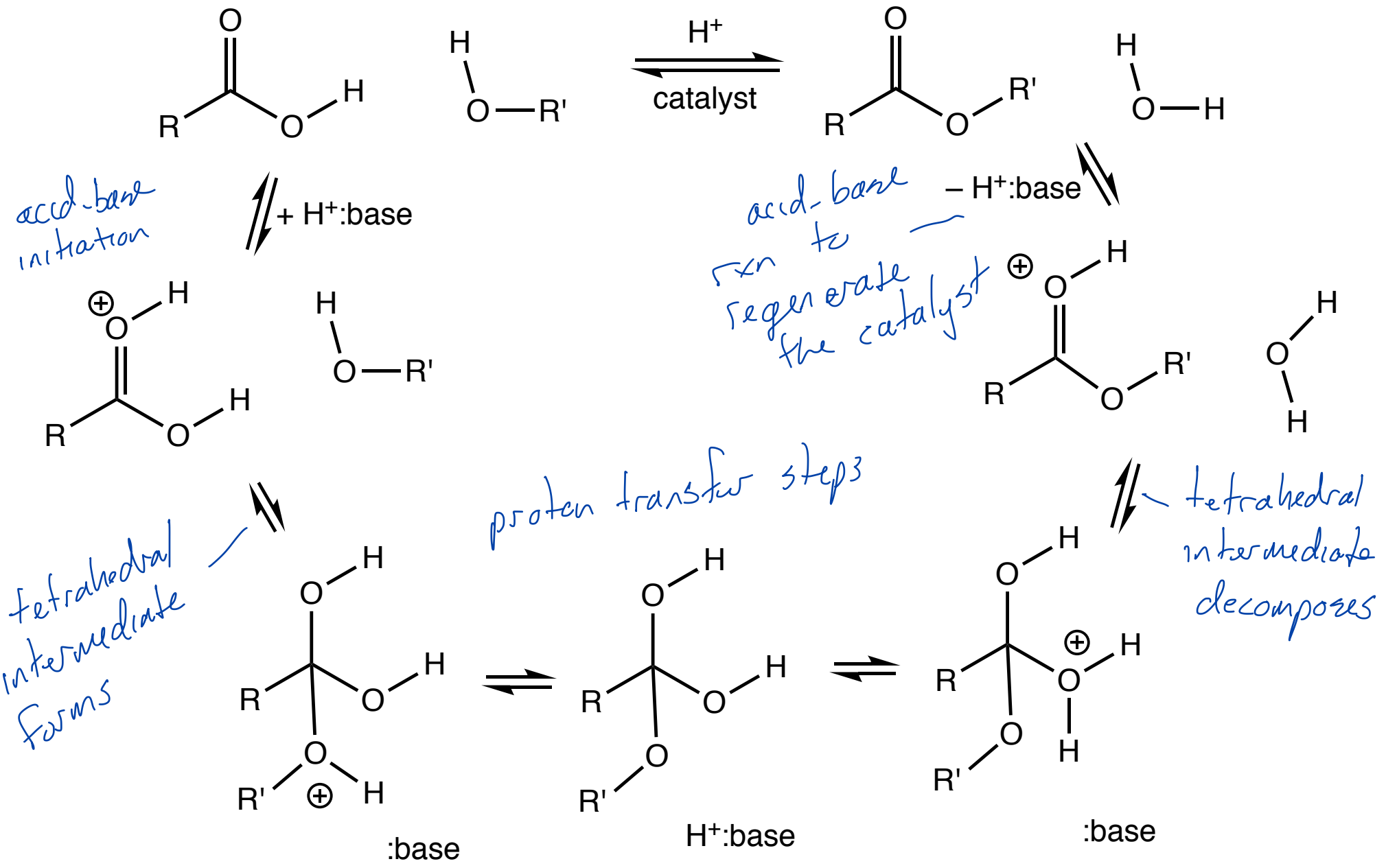
Sure even if R'OH gets protonated, since R'OH is an extremely weak base $R'OH_2^{\oplus}$ is a strong acid and can protonate the C=O

heat ✓

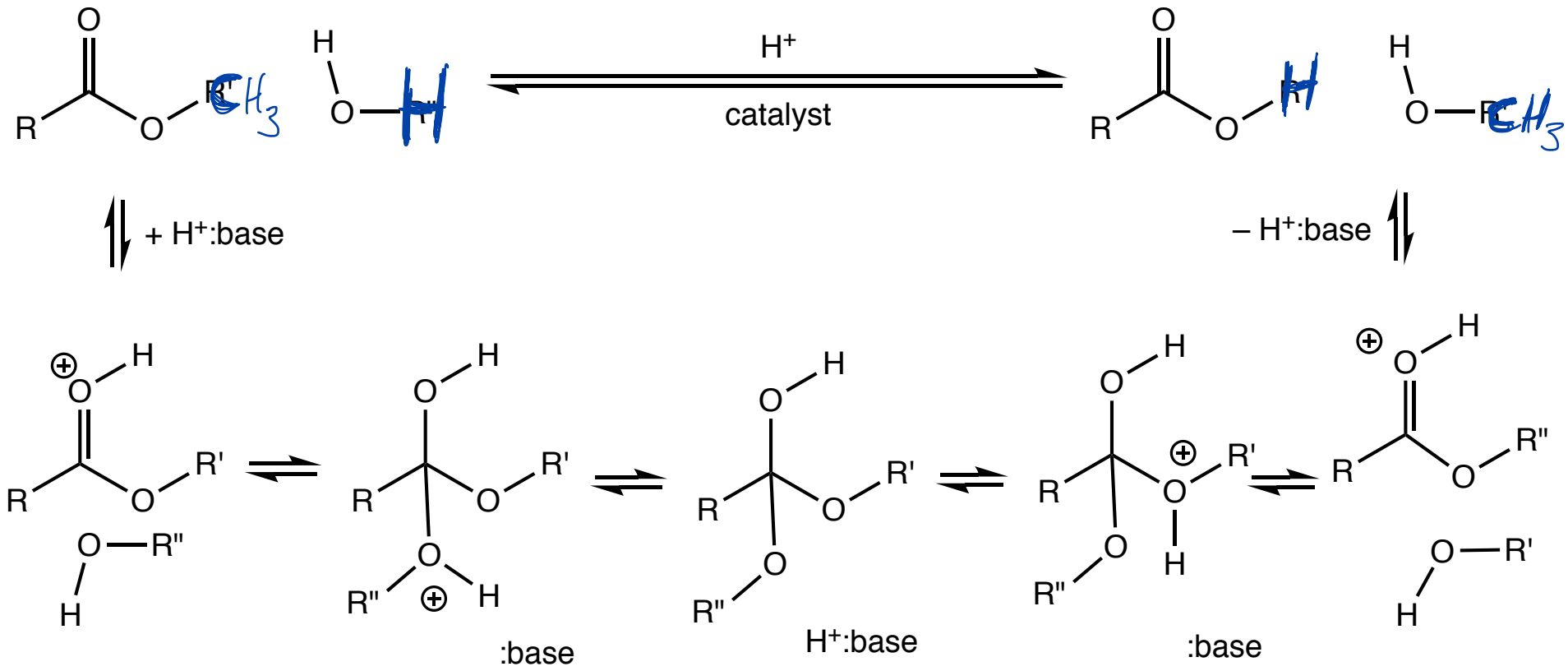
~~deprotonate~~ the nucleophile add a strong base to deprotonate the nucleophile



nope, adding base will just deprotonate the carboxylic acid making the carboxylic acid less reactive.


H+
catalyst
+ H+:base
– H+:base
acid-base initiation
acid-base to regenerate the catalyst
tetrahedral intermediate forms
proton transfer steps
tetrahedral intermediate decomposes
:base
H+:base
:base
: base = R'-O-H , H-O-H , R(C=O)-O-H

Summary: Acid Catalyzed Reactions of Carboxylic Acids and Esters with Oxygen-Based Nucleophiles



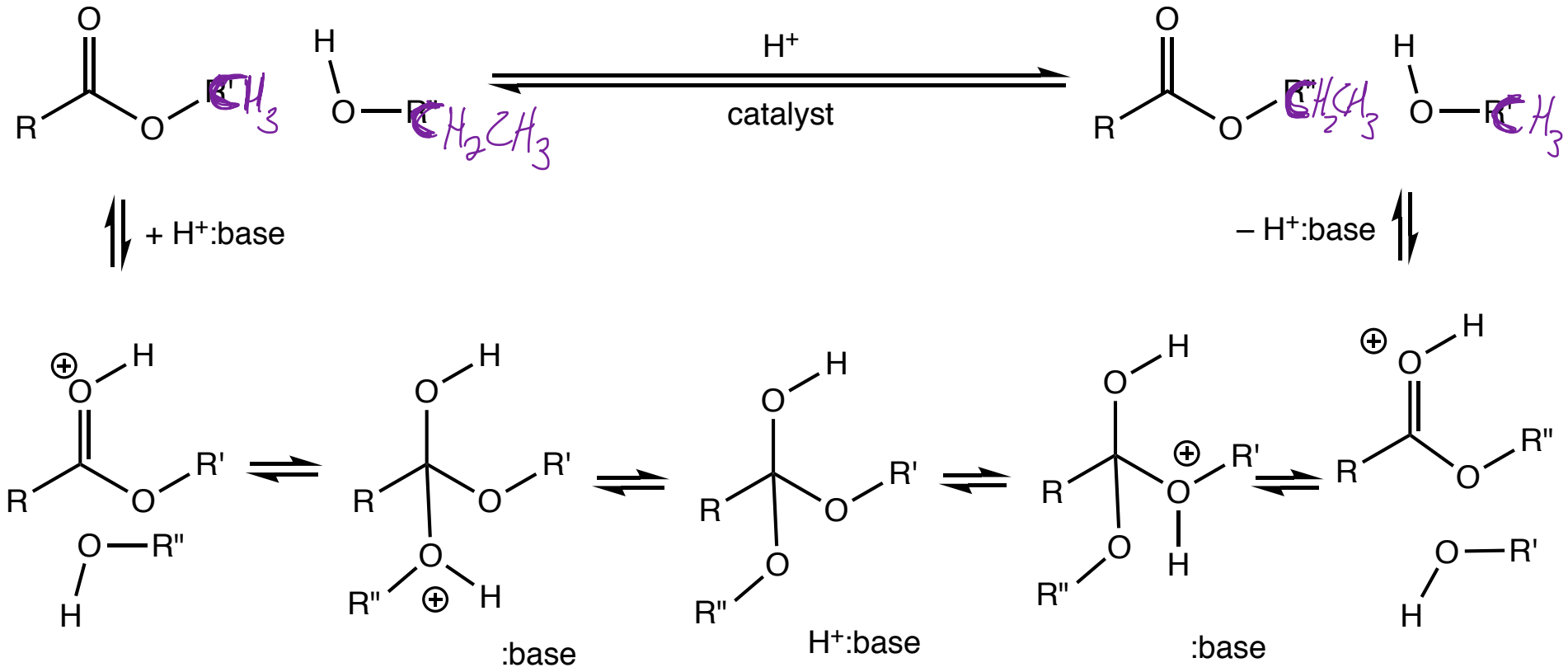
Hydrolysis of an Ester: R' = alkyl group, R" = H

Transesterification: R' = alkyl group, R" = alkyl group

Ester Synthesis: R' = H, R" = alkyl group

:base = extremely weak base like R'OH or R"OH

Summary: Acid Catalyzed Reactions of Carboxylic Acids and Esters with Oxygen-Based Nucleophiles



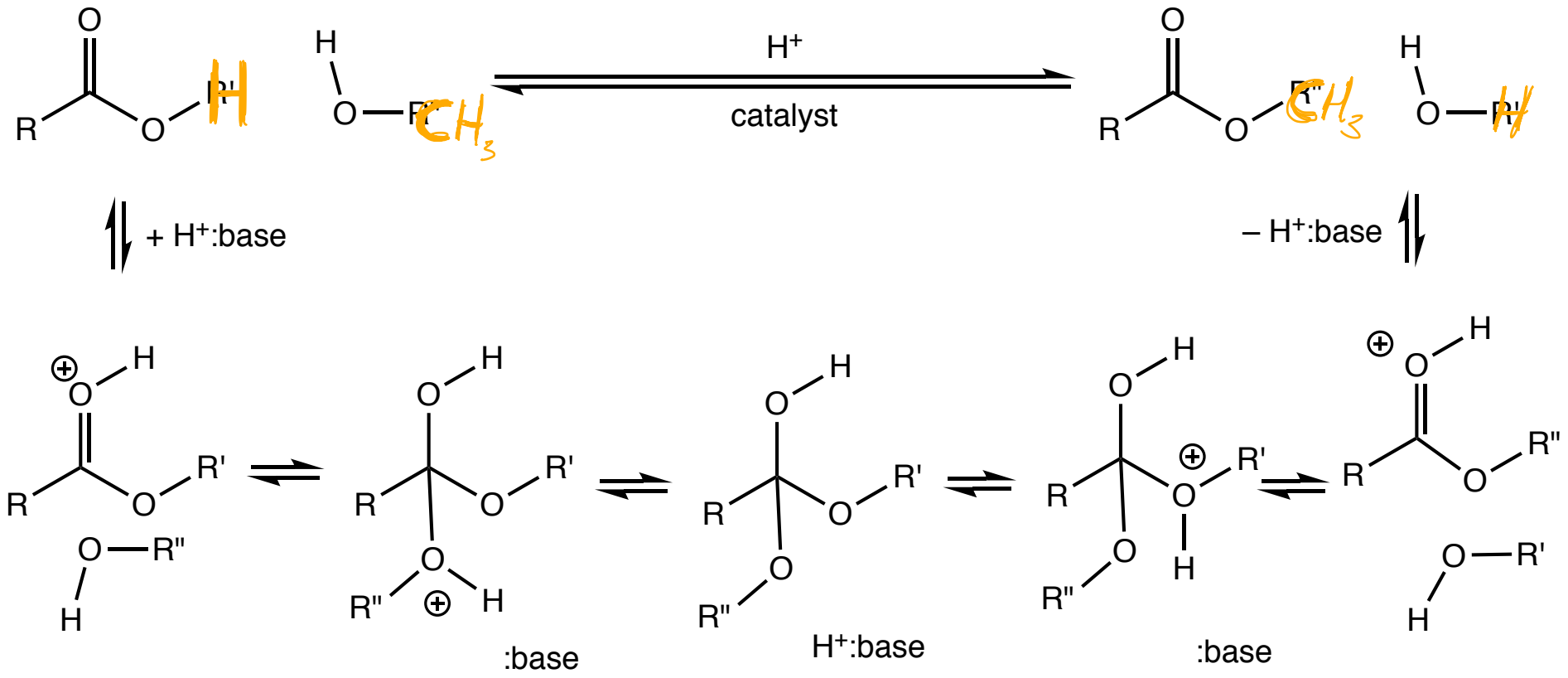
Hydrolysis of an Ester: R' = alkyl group, R" = H

Transesterification: R' = alkyl group, R" = alkyl group

Ester Synthesis: R' = H, R" = alkyl group

:base = extremely weak base like R'OH or R"OH

Summary: Acid Catalyzed Reactions of Carboxylic Acids and Esters with Oxygen-Based Nucleophiles



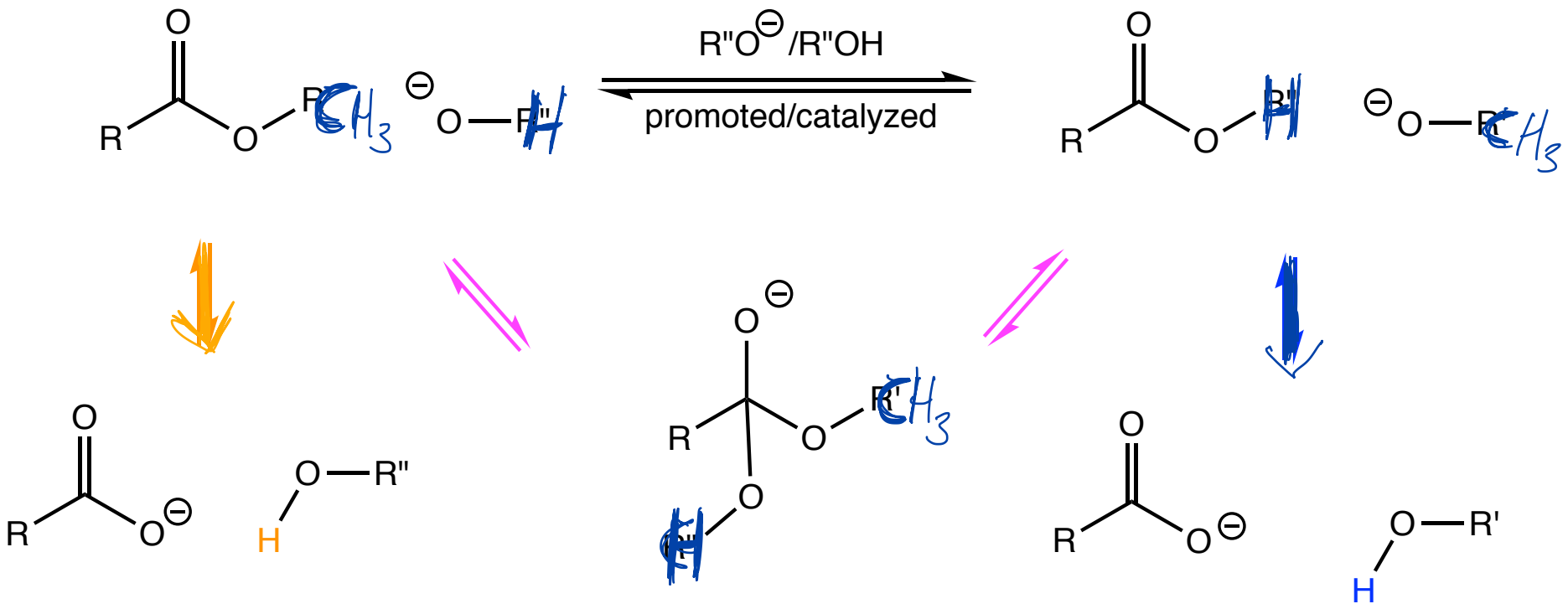
Hydrolysis of an Ester: R' = alkyl group, R" = H

Transesterification: R' = alkyl group, R" = alkyl group

Ester Synthesis: R' = H, R" = alkyl group

:base = extremely weak base like R'OH or R"OH

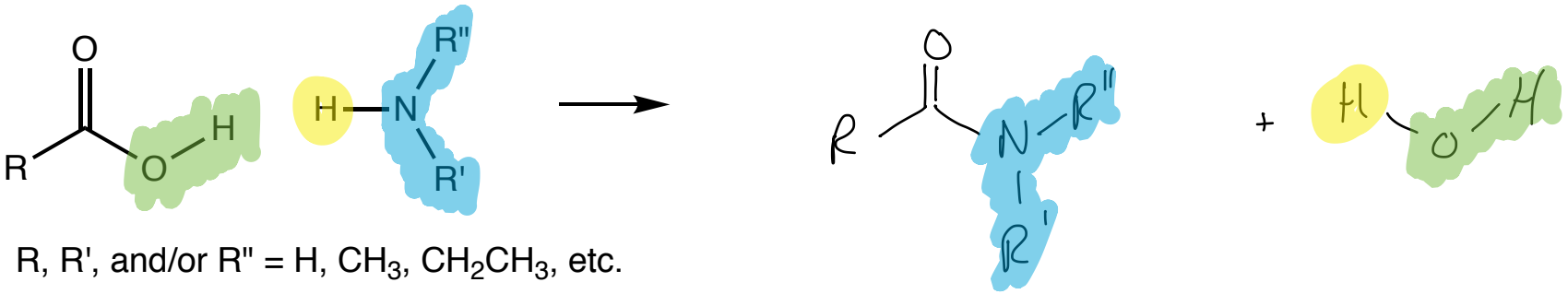
Summary: Base Reactions of Carboxylic Acids and Esters with Oxygen-Based Nucleophiles



Hydrolysis of an Ester: R' = alkyl group, R" = H

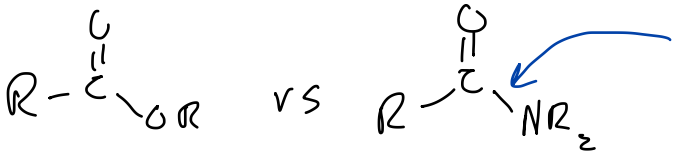
Transesterification: R' = alkyl group, R" = alkyl group catalysis

Ester Synthesis: R' = H, R" = alkyl group **doesn't work**



R, R', and/or R" = H, CH_3, CH_2CH_3, etc.

O-based vs N-based nucleophile - O atoms are less nucleophile



more π character ... stronger bond ... less reactive and NHR_2 leaving groups are not as good as H-O-H leaving groups

Thus, products are favored

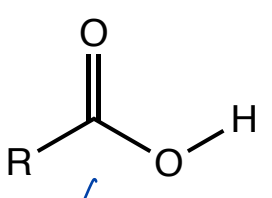
Catalyze the reaction with H^+? Nope

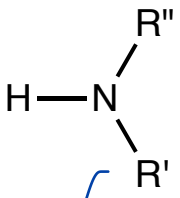
added acid will react with HNR_2 to make $H_2NR_2^+$ which is a weak acid cannot protonate the C=O and lone-pair e^- on N now hidden

Make nucleophile more nucleophile by adding a base? nope ....

The base would react with the carboxylic acid making the carboxylic acid less reactive.

Only way to speed up reaction is with heat



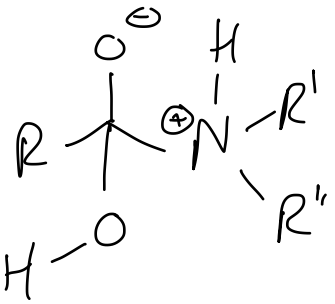


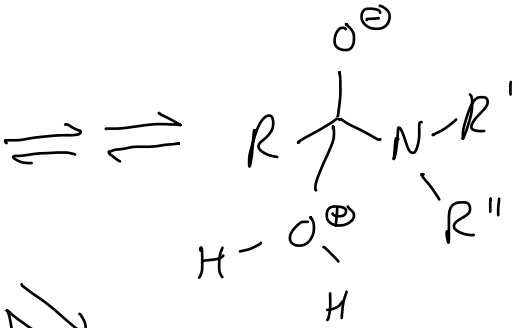
R, R', and/or R" = H, CH_3, CH_2CH_3, etc.

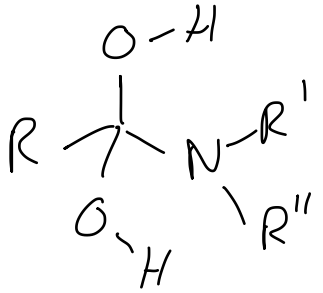
carboxylic acid

amine (organic ammonia)

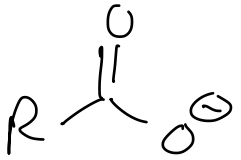
weak base

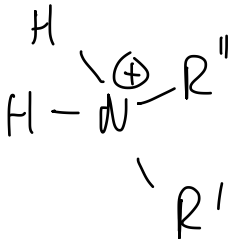


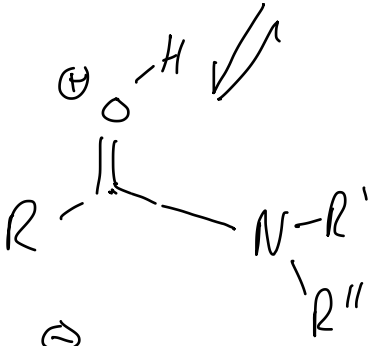


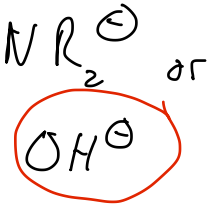


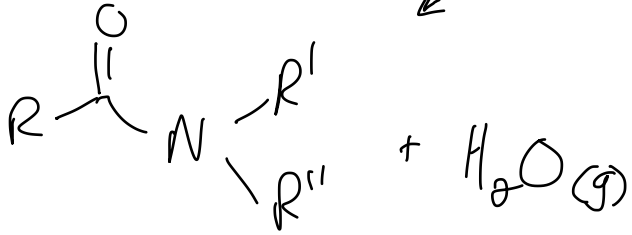
heat

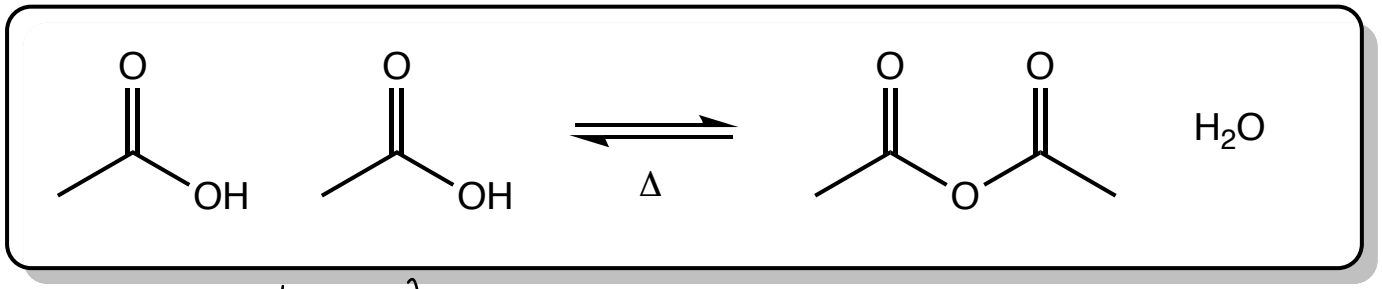




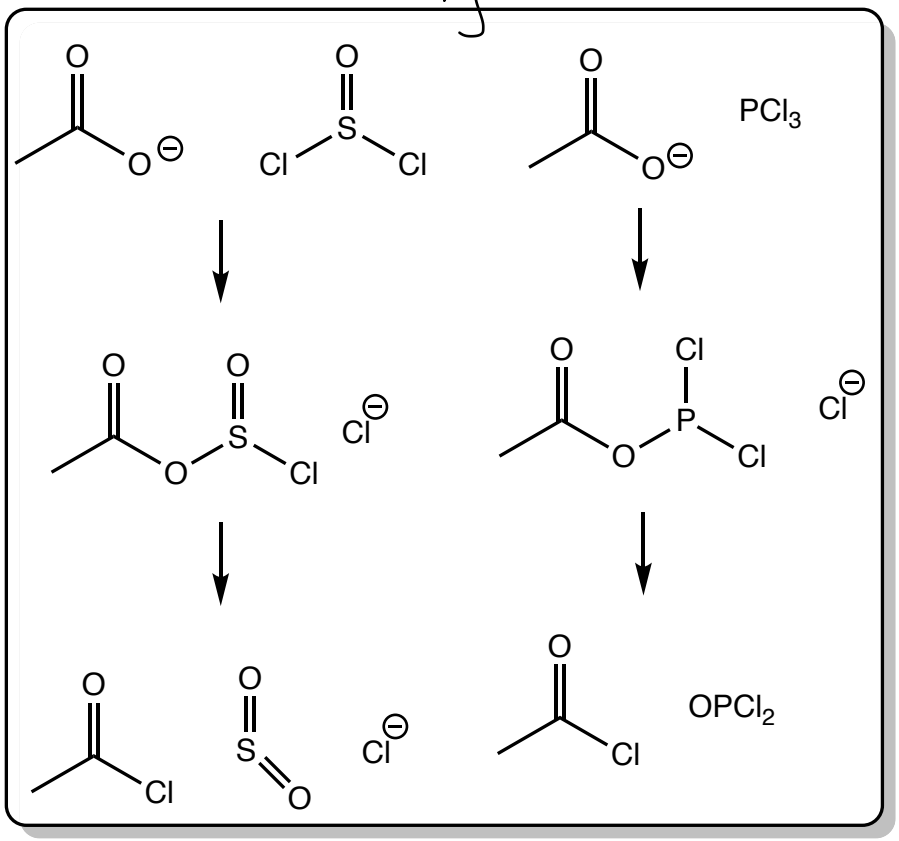








chemistry



biochemistry