

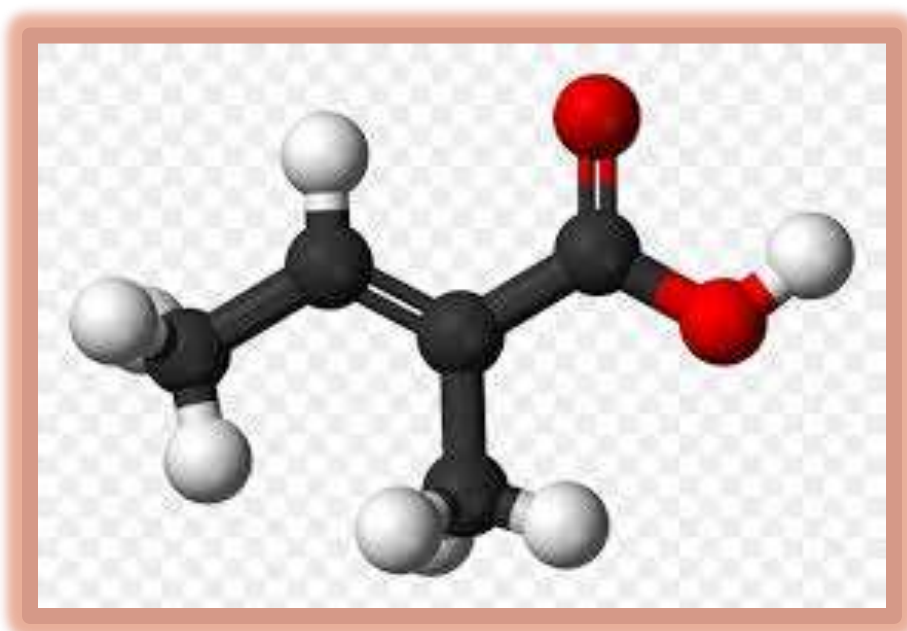
CARBOXYLIC ACIDS

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REACTIONS OF CARBOXYLIC ACIDS

Reactions due to H-atom of the carboxylic group

Reaction due to Carbonyl group $>C=O$

Reactions due to Carboxyl group

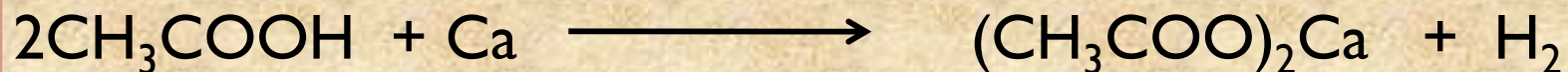
Reactions due to H-atom of the carboxylic group

The OH group of carboxylic acid has ionisable hydrogen H^+ .

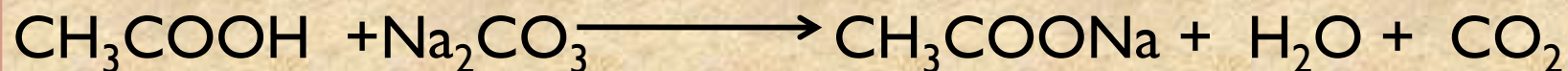
Acidic Nature



Evolution of Hydrogen



Salt formation



Reaction due to Carbonyl group $>C=O$

Carboxylic acid undergo reduction in the presence of lithium aluminium hydride to give pri. alcohols.

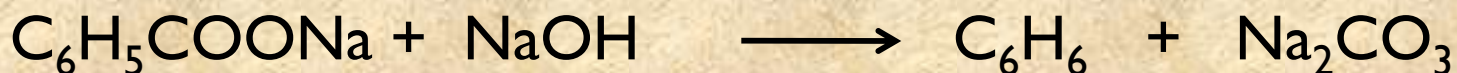


Beauveault Blanc Reaction



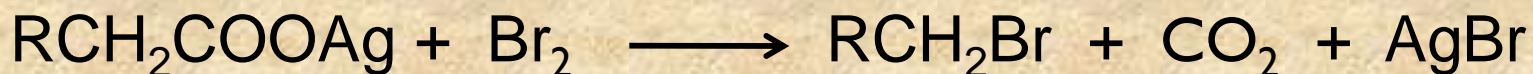
Reactions due to Carboxyl group

Decarboxylation (in presence of soda lime)



Carboxylic acids containing electron withdrawing groups such as NO_2 , CH_3CO are decarboxylated by heating alone.

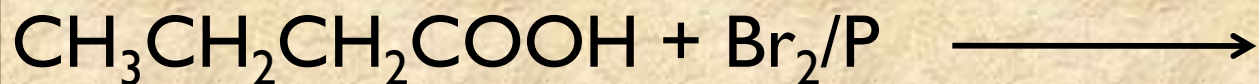
Hunsdiecker Reaction



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Halogenation

α -hydrogen of carboxylic acids can be replaced by Cl or Br to form α -halo acid in the presence of red phosphorus

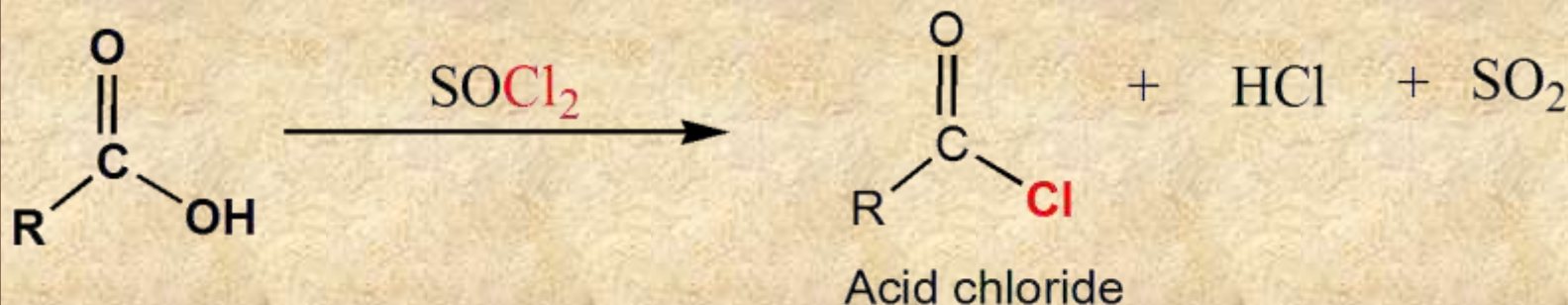


Carboxylic acids undergo reactions to produce derivatives of the acid. The most common derivatives formed are acid halides, esters, acid anhydrides and amides.

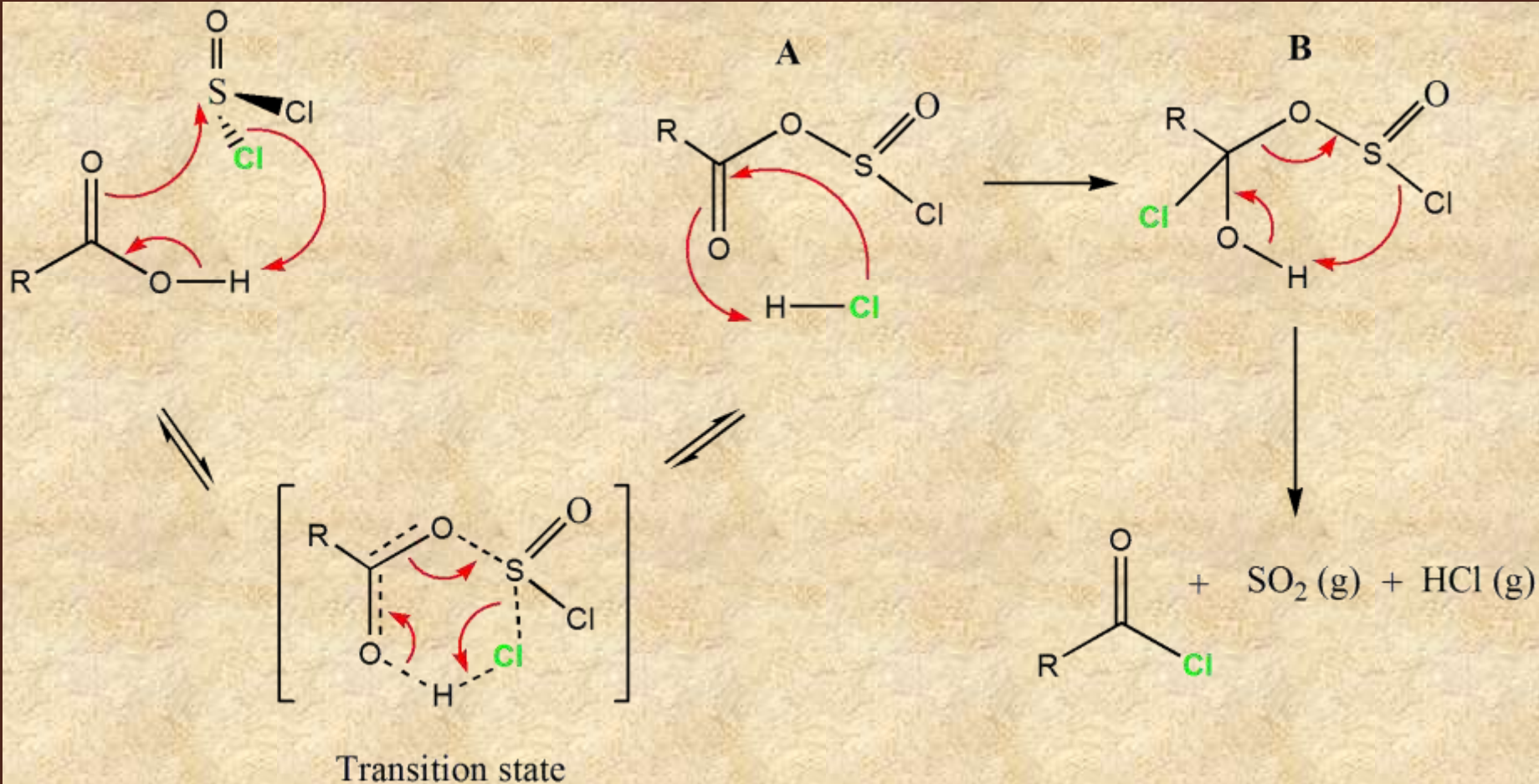
Acid chloride (ROCl)

Carboxylic acids react with phosphorous trichloride (PCl_3), phosphorous pentachloride (PCl_5), thionyl chloride (SOCl_2), and phosphorous tribromide (PBr_3) to form acyl halides.

They are the most reactive derivatives of carboxylic acid.

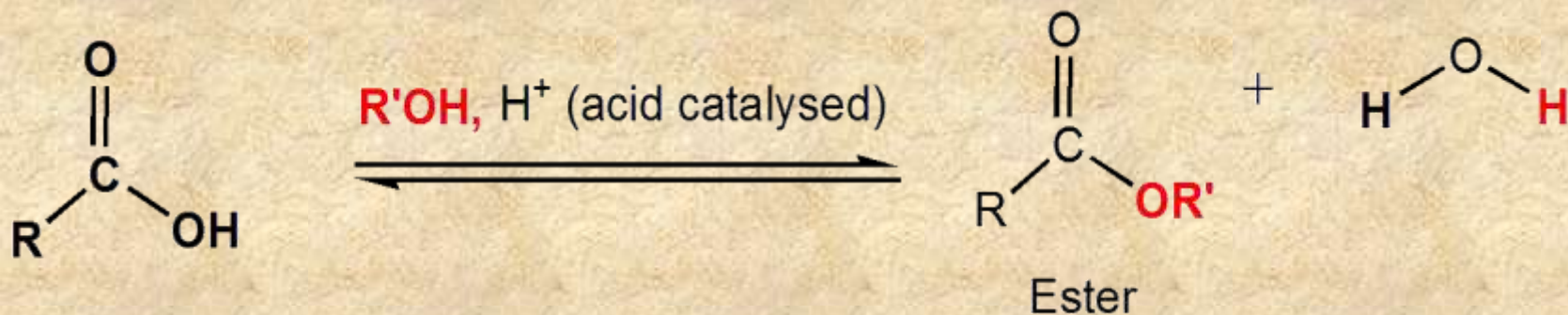


Mechanism of acid chloride formation with SOCl_2

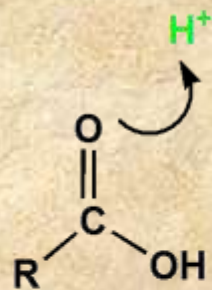


Esterification

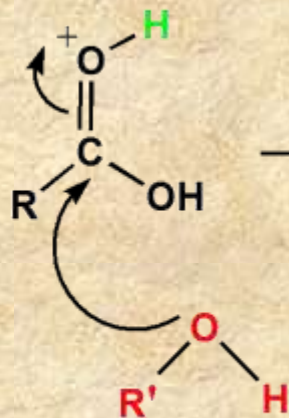
Esters are compounds formed by the reaction of carboxylic acids with alcohols, and they have a general structural formula of RCOOR . Esters containing long alkyl chains (R) are main constituents of animal and vegetable fats and oils. Many esters containing small alkyl chains are fruity in smell, and are commonly used in fragrances. The acid-catalyzed esterification of carboxylic acids with alcohols to give esters is termed *Fischer Esterification*.



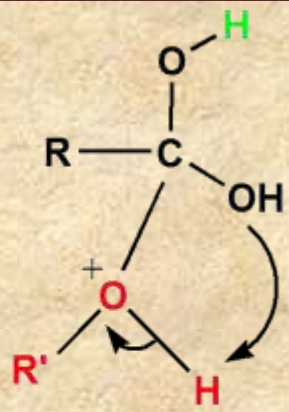
Mechanism of Fischer Esterification



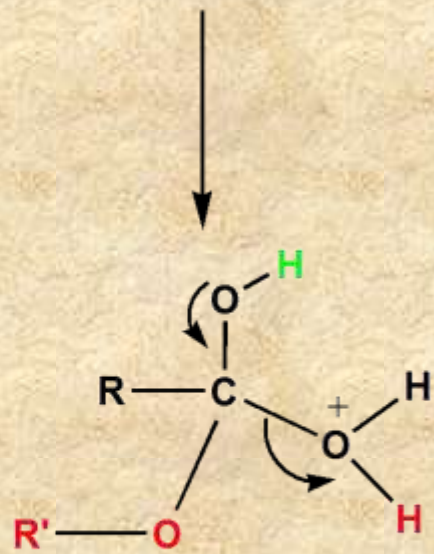
protonation of acid



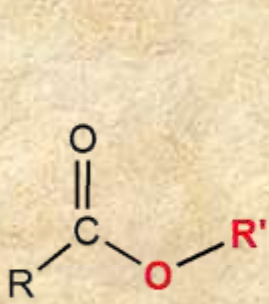
nucleophilic attack of alcohol onto carbonyl



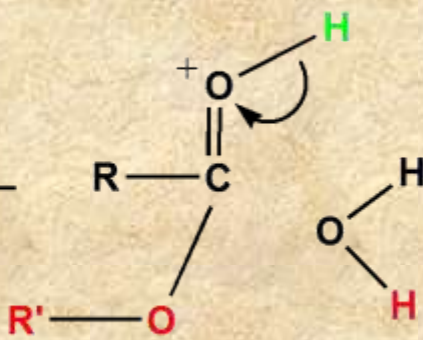
proton transfer



elimination of water



ester



deprotonation

$-\text{H}^+$

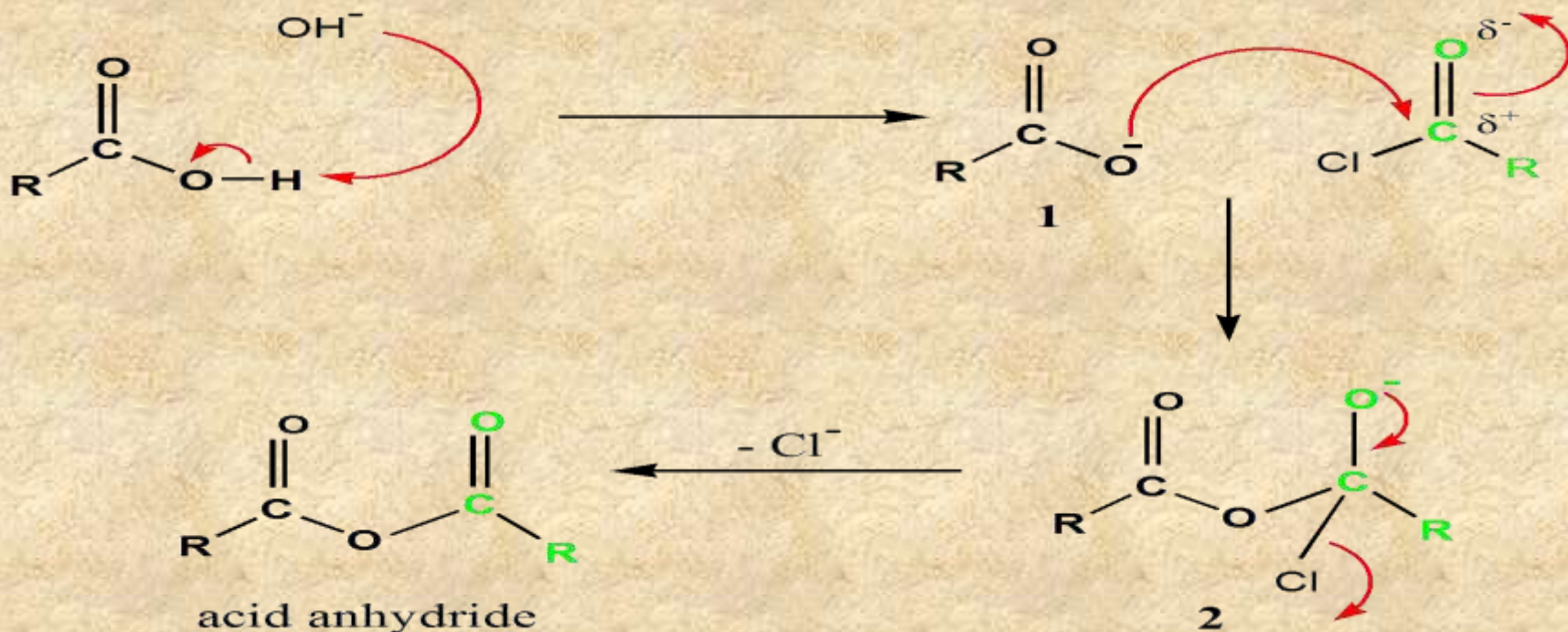
Thioester (RCOSR')

Thioesterification: A thioester is formed when a carboxylic acid reacts with a thiol (RSH) in the presence of an acid.

Thioesters are commonly found in biochemistry, the best-known example being *acetyl CoA*. The mechanism is the same as esterification (discussed above); only difference being that instead of an alcohol (R'OH), a thioalcohol (R'SH) is involved.



Acid anhydride is a compound that has *two acyl groups* ($R-C=O$) bonded to the same oxygen atom. These are formed when a carboxylic acid reacts with an acid chloride in the presence of a base. Similar to the Fischer esterification, this reaction follows an addition-elimination mechanism in which the chloride anion Cl^- is the leaving group.



Amide

Amides are compounds that contain the RCONH_2 group. The direct conversion of a carboxylic acid to an amide is difficult because amines are very basic and tend to convert carboxylic acids to their highly un-reactive carboxylate ions. Therefore, DCC (Dicyclohexylcarbodiimide) is used to drive this reaction.

Amides are ordinarily prepared by a reaction of acid chlorides with ammonia or amines.

