Topics
- Esters
  - Hydrolysis of Esters
    - Acidic Conditions
    - Basic Conditions: "Saponification"
  - Esters From Alcohols + Acyl Halides
  - Amides

\[
\text{Propionyl Acetate - Pear flavor/smell}
\]
\[
\text{Butyl Butanoate - Rum}
\]
\[
\text{Isopropyl Acetate - also banana}
\]
\[
\text{Pentyl Acetate - banana}
\]

Esters generally smell fruity and are common artificial flavors.
- They aren’t commonly used as perfume components because esters aren’t very stable all of the esterification steps are reversible. Some smells like rum, but ethanol smells like rancid butter.

Base Catalyzed Hydrolysis of Esters - Break them Apart.

\[ \text{H}_2\text{O} + \text{CH}_3\text{CO}_2\text{Na} \rightarrow \text{CH}_3\text{CO}_2\text{H} + \text{NaOH} \]

Base is strong base, acid is weak acid - You still displace OH^- about half the time, reversing the reaction much easier. Yes, OH^- and \text{CO}_2^- are both poor leaving groups.

- This process is called "Saponification" - which means "making into soap." Old soap is made from fats, which are esters and alkali from ashes.

write on this side only - do not double side for genchem office
Soaps are made from Fats which are Esters.

\[
\text{H}_2\text{C} - \overset{\text{O}}{\text{O}} - \text{H} + \text{Na}^+ + \text{H}_2\text{O} \rightarrow \text{H}_2\text{C} - \overset{\text{O}}{\text{O}} - \text{Na}^+ + \text{H}_2\text{O}
\]

\[
\text{H}_2\text{C} - \overset{\text{O}}{\text{O}} - \text{H} + \text{Na}^+ + \text{H}_2\text{O} \rightarrow \text{H}_2\text{C} - \overset{\text{O}}{\text{O}} - \text{Na}^+ + \text{H}_2\text{O}
\]

A Triglyceride (Fat)

Minerals in Wood Ash make the Base

\[
\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{NaOH}
\]

Acyl Halides - Better reaction than with acids - Not REVERSIBLE

\[
\text{H}_3\text{C} - \overset{\text{O}}{\text{C}} + \text{CH}_3 - \overset{\text{O}}{\text{H}}_2\text{O} \rightarrow \text{H}_3\text{C} - \overset{\text{O}}{\text{C}} - \text{CH}_3 + \text{H}_2\text{O}
\]
What about Amines instead of Alcohols

\[
\text{HC} - \overset{\text{O}}{\text{C}} - \overset{\text{H}}{\text{O}} + \text{NH}_3 \rightarrow \text{HC} - \overset{\text{O}}{\text{C}} - \overset{\text{H}}{\text{N}} - \overset{\text{H}}{\text{H}} + \text{H}_2\text{O}
\]

Amide

\[
\overset{\text{O}}{\text{C}} \quad \overset{\text{H}}{\text{N}} \quad \overset{\text{H}}{\text{H}}
\]

Amides aren't very basic at N - they are at O

The O\text{=N} bond doesn't rotate like a single bond.

This resonance structure contributes enough to majorly alter the reactivity of Amides.

\[
\text{HC} - \overset{\text{O}}{\text{C}} - \overset{\text{H}}{\text{H}} + \text{NH}_3 \xrightarrow{\text{His}_{\text{CO}}^{-}} \text{The Amide? Doesn't Happen!}
\]

Amides are too basic to let this work

\[
\text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+ \text{ Not a Nucleophile!}
\]

Amides are the building blocks of Proteins

Amino Acids
Amino Acids

H₂N-CHR-CHR'-COOH + H₂N-CHR-CHR'-COOH → H₂O

A Peptide

Long Chains = Peptides
Very Very Long Chains = Proteins

Amides are much harder to hydrolyze than Esters.
Because of the resonance form - this makes them more useful in biological systems.

H₂N-CHR-CHR'-COOH → Na⁺OH⁻ → H₂O + H₂N-R