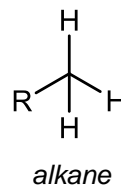
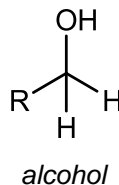
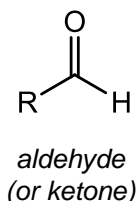
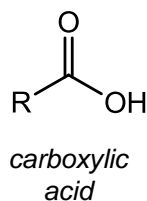


Carboxylic Acids and Reduction/Oxidation



- Loss of H₂
- Addition of O₂ or O

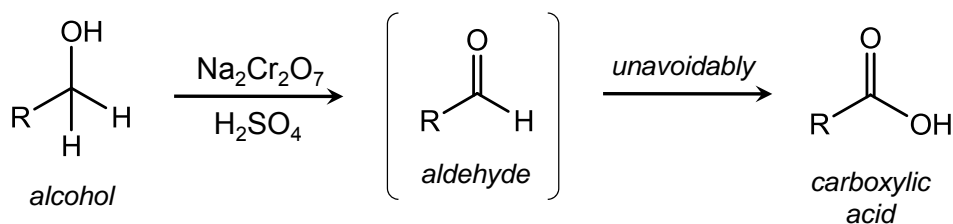


Neither oxidation nor reduction: Addition or loss of H⁺, H₂O, or HX

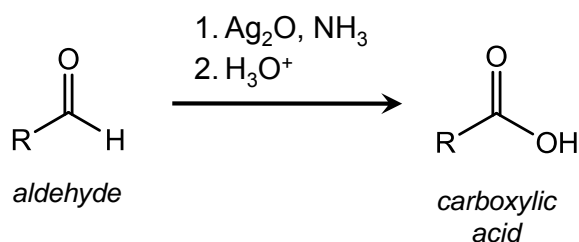
Carboxylic acids are the most oxidized functional group of carbon.

Carboxylic Acids via Oxidation

Chromate oxidation of primary alcohols:



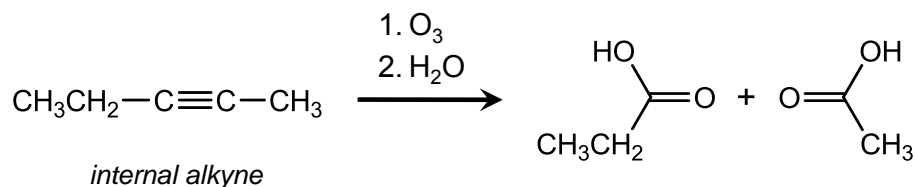
Oxidation of aldehydes with Tollens' reagent:



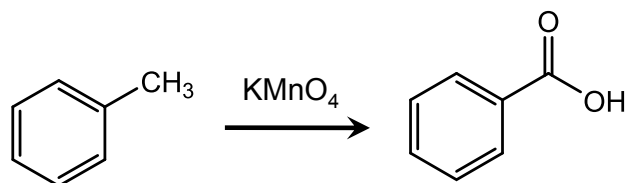
*Selective for aldehydes;
will not oxidize alcohols.*

Carboxylic Acids via Oxidation

Oxidative cleavage of alkynes:



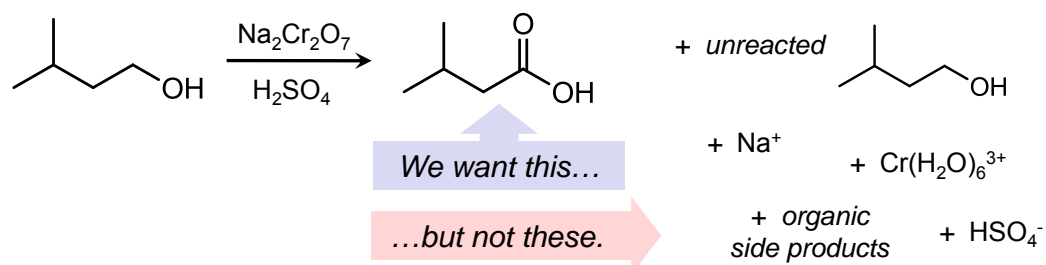
Oxidation of benzylic carbons:



Purifying Carboxylic Acids by Acid-Base Extraction

Acidic and basic organic molecules can be separated from other substances by manipulating their protonation state and solubility.

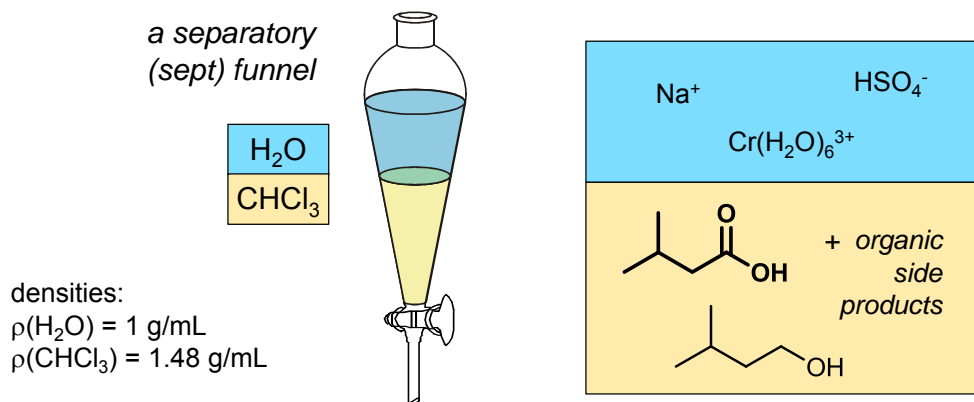
Let's say we run a reaction.



How do we isolate our desired product from the other materials, without using distillation or chromatography?

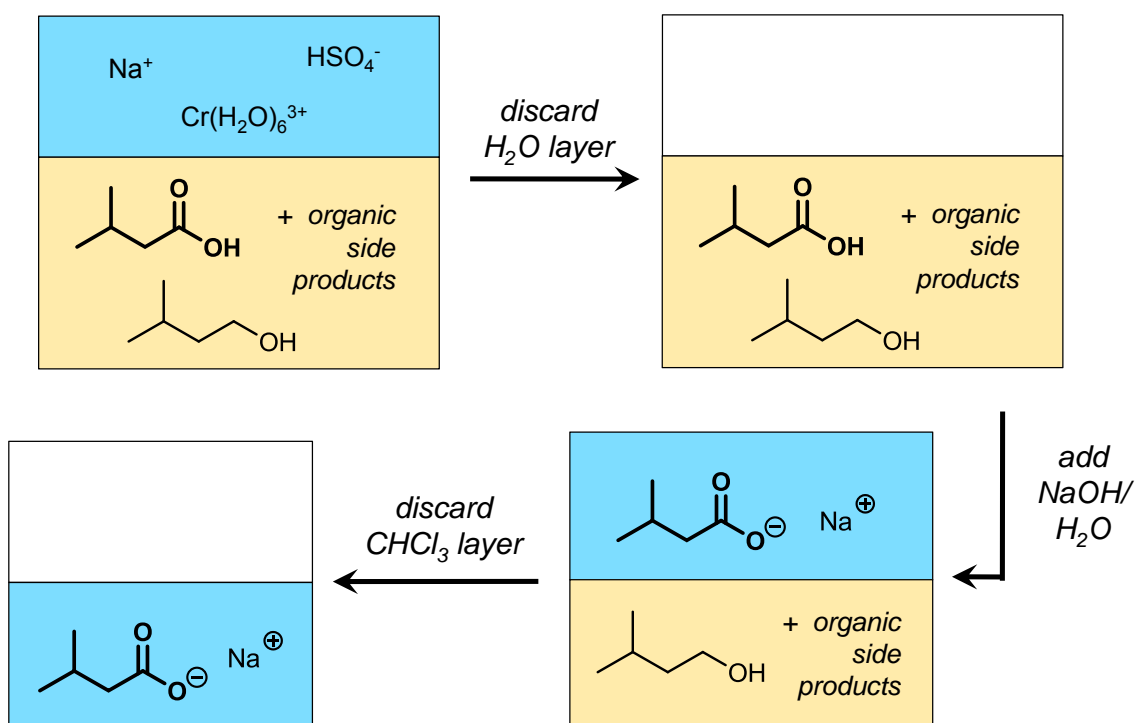
Acid-Base Extraction

Step 1: Remove inorganics from organics via differential solubility.

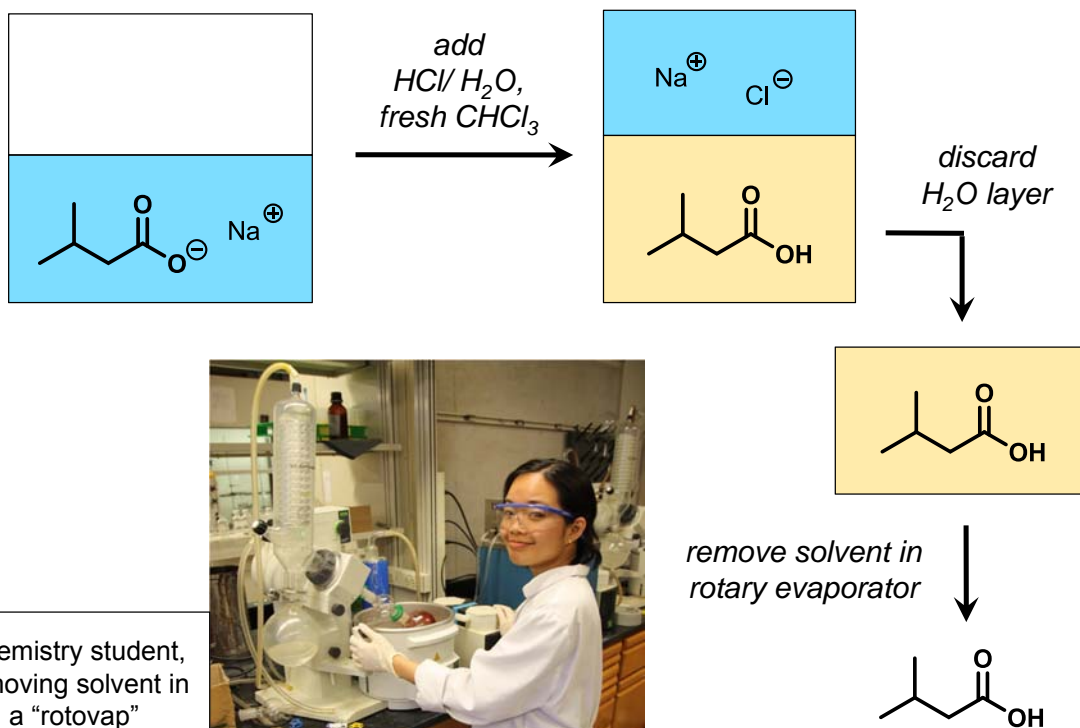


A large density difference ensures the two liquids separate completely and quickly. (Much faster than, say, oil and water.)

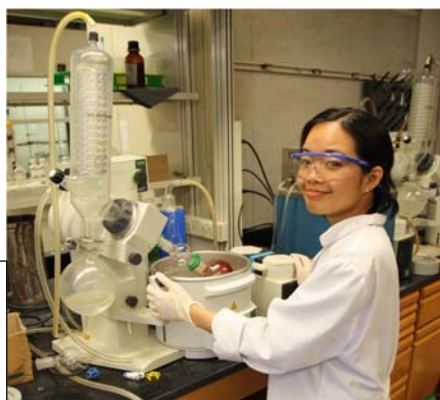
Step 2: Add basic water to deprotonate carboxylic acid, and transfer it to the aqueous phase.



Step 3: Re-acidify carboxylate to return it to organic solution.
Remove solvent *in vacuo* to yield pure acid.

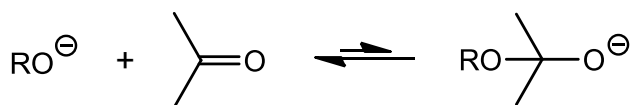


Chemistry student,
removing solvent in
a "rotovap"



Nucleophilic Addition to Carbonyls

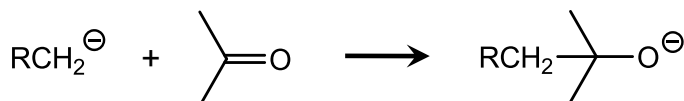
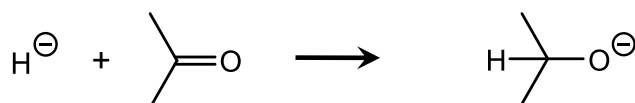
Heteroatom electron donors add **reversibly** to C=O groups.



Equilibrium driven
to the left by
entropy.

Also true for Cl^{\ominus} , HS^{\ominus} , NH_3 nucleophiles.

Hydrogen anions ("hydride") and carbon anions add **irreversibly** to C=O groups.



Reaction driven to the
right by instability of
charge on H⁻, RCH₂⁻.