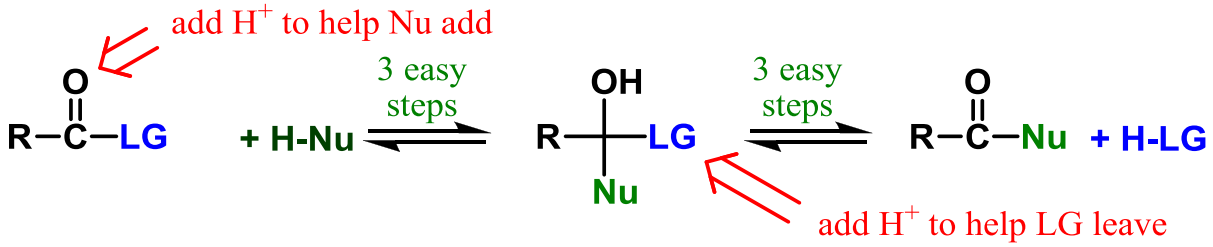
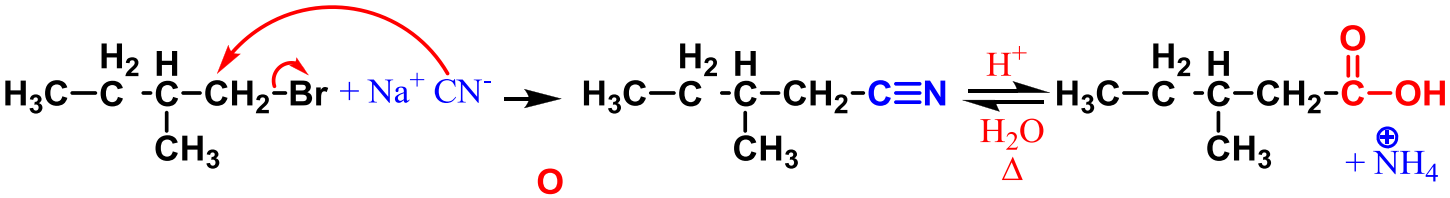
Overheads: - Outline

Recap Friday: Reactions of Carbonyl Compounds With Poor LG's



Nitrile Hydrolysis: 3 extra steps (need to add second H_2O)

Application:

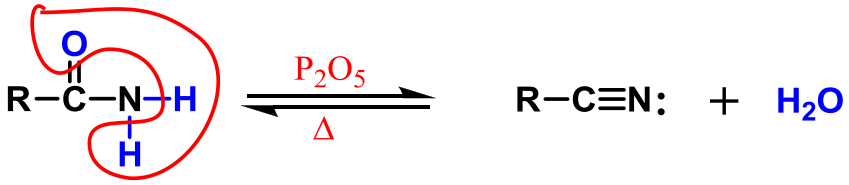


overall: $R-Br \longrightarrow R-C(=O)-OH$ (added a C)

$\Rightarrow$ gets us from R-Br to carbonyl-land :-)
- can use to make other carbonyls

Other Reactions of Carbonyl Compounds:

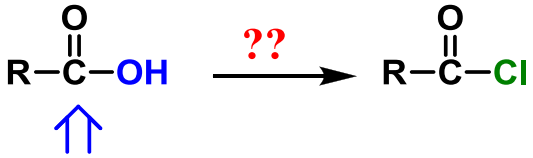
1) Amides:
- remove H_2O to make nitriles (reverse of first 5 steps of nitrile hydrolysis)



P_2O_5 reacts with water $\therefore$ drives eqm $\longrightarrow$

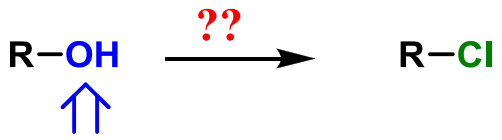
$$P_2O_5 + 3\ H_2O \rightleftharpoons 2\ H_3PO_4$$

2) Carboxylic Acids
- Seen that we can use acyl halides to make all others... but how do we make acyl halides??



cheapest, easiest to get (naturally occuring, or by nitrile hydrolysis, oxidation etc)

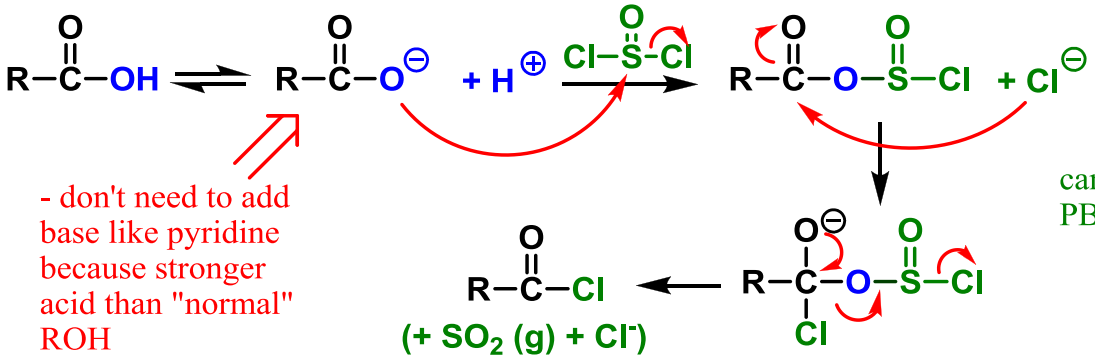
Q: How do we turn OH into Cl?



need to turn into better LG

HCl? - Cl- better LG than H_2O, so equilibrium goes wrong way

$SOCl_2$

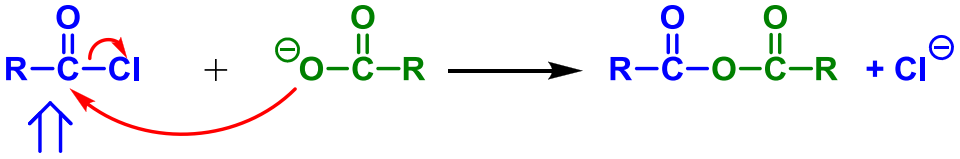


- don't need to add base like pyridine because stronger acid than "normal" ROH

can also sure PCl_3, PBr_3, $SOBr_2$ etc

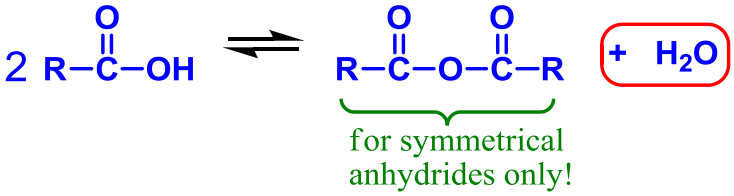
To make anhydride:

1) From acyl halide



limited availability (must make)

2) From carboxylic acid (better way)

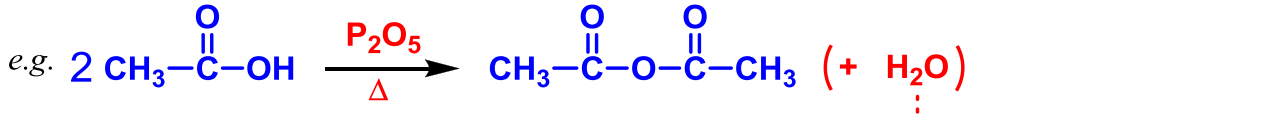


for symmetrical anhydrides only!

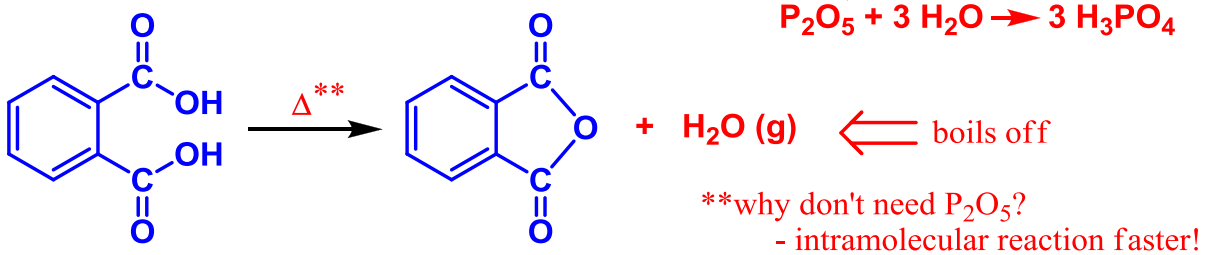
need to remove H_2O to shift equilibrium

To shift eq'm:

1) heat to distill off H_2O (doesn't always work)
2) Add something to react with H_2O → P_2O_5!



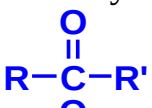
$P_2O_5 + 3\ H_2O \rightarrow 3\ H_3PO_4$

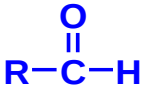


phthalic acid → phthalic anhydride

**why don't need P_2O_5?
- intramolecular reaction faster!

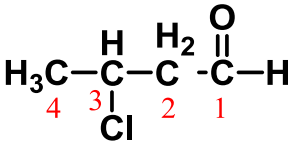
Next Up: Carbonyls with NO LG (Ch. 17 or 18 in 6th ed)

ketone:  (R, R' ≠ H)

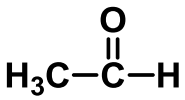
aldehyde: 

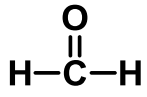
Naming Aldehydes:

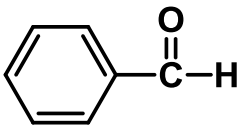
- choose longest C chain that includes C of C=O (= C#1)
- replace –e with –al

 3-chlorobutanal ⇒ note -al = aldehyde; -ol = alcohol

Common Names:

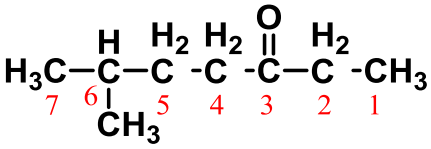
 IUPAC: ethanal — Common: acetaldehyde

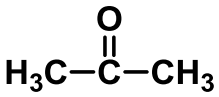
 IUPAC: methanal — Common: formaldehyde → formalin = $H_2C{=}O/H_2O$

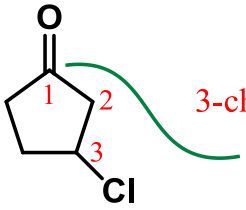
 benzaldehyde

Naming Ketones:

- choose longest C chain that includes C of C=O (NOT C#1!!)
- replace –e with –one
- locate position of C=O, counting from closest end

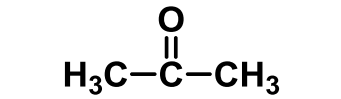
 6-methyl-3-heptanone

 propanone → why don't we need to specify 2-propanone?

Can be cyclic:  3-chlorocyclopentanone

must be #1, so don't specify

Common Names:

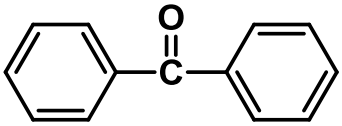


Common: acetone

Can also name as "alkyl" "alky" ketone

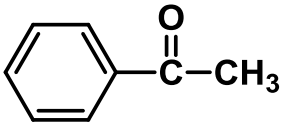
≡ dimethyl ketone

used in industry



benzophenone

≡ diphenyl ketone

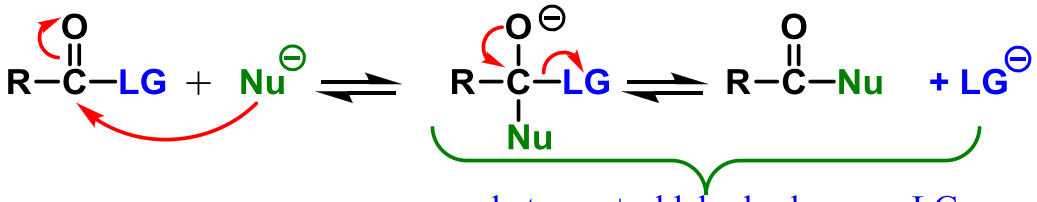


acetophenone

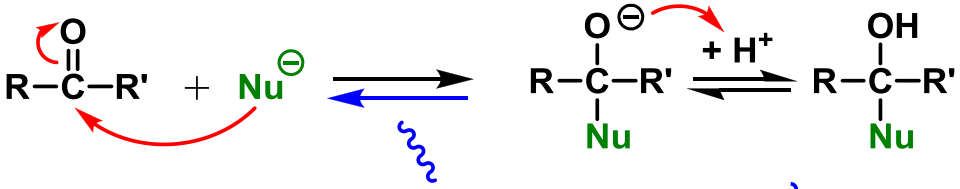
≡ methyl phenyl ketone 3 words!

Reactions of Ketones and Aldehydes

To date:

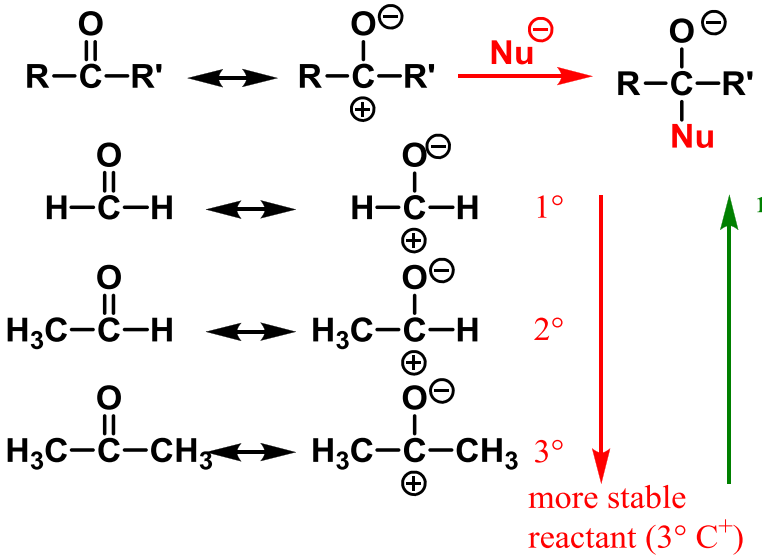


ketones + aldehydes have no LG
∴ can't do 2nd step



some Nu- add reversibly ⇌
some Nu- only go → (if Nu- not LG) } more later

Ketones *vs* Aldehydes: Which react faster?



more reactive

more stable reactant (ketone)
does not want to react
∴ ketone slower

*also steric hinderance

more stable reactant (3° C^+)