

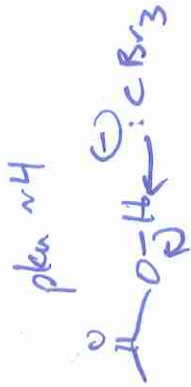
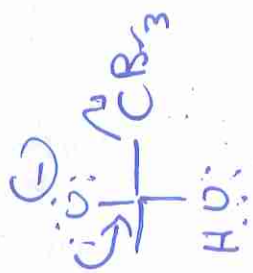
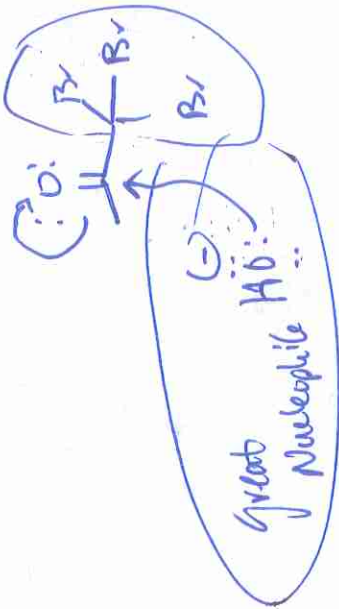
Transformation	Reagent	Mechanism
$1^\circ \text{OH} \rightarrow \text{Alcohol} \rightarrow \text{Aldehyde} \rightarrow \text{Ketone}$ $2^\circ \text{OH} \rightarrow \text{Alcohol} \rightarrow \text{Aldehyde} \rightarrow \text{Ketone}$ $3^\circ \text{OH} \rightarrow \text{Alcohol} \rightarrow \text{Ketone}$	H_2CrO_4 $\text{HO}-\text{Cr}(=\text{O})_2-\text{OH}$	<p>Stronger oxidizing agent</p> <p>Mechanism: $\text{H}_2\text{CrO}_4 + \text{R}_2\text{CHOH} \rightarrow \text{H}_2\text{CrO}_5 + \text{R}_2\text{C=O} + \text{H}_2\text{O}$</p> <p>$\text{Cr VI} \rightarrow \text{Cr IV} \rightarrow \text{Cr III}$</p>
$\text{OH} \rightarrow \text{Aldehyde}$ $\text{OH} \rightarrow \text{Aldehyde}$	PCC	<p>No Mech \rightarrow No H_2O!</p> <p>Why oxidation stops at aldehyde</p>
$(\text{R}_2\text{CHO}) \rightarrow \text{Aldehyde}$ $\text{R}_2\text{C=N} \rightarrow \text{Aldehyde}$	$\text{H}_2 / \text{Pd}, \text{Pt}, \text{Ni}$ OR $1) \text{NaBH}_4 \text{ or } \text{LiAlH}_4$ $2) \text{H}_2\text{O}$	<p>Always quench metal (A, B) Hydride reagents w/ H_2O!</p>
$\text{Aldehyde or Ketone} \rightarrow \text{Imine}$	$\text{H}_2\text{N}-\text{R}$ $\text{R}=\text{C}_2\text{N}_2\text{O}$ $\text{pH} \sim 4 (\text{H}^+)$	<p>Need Acid to make $\text{H}_2\text{O} \rightarrow$ good LG!</p> <p>KRE C=N where there was a C=O</p>
$\text{Aldehyde or Ketone} \rightarrow \text{Enol}$	Wittig-Kishner $\text{H}_2\text{N}-\text{NH}_2, \text{H}_2\text{SO}$ Clemmensen Zn(Hg), HCl cat. H^+ or H_2O^+	<p>Basic W.K. \rightarrow lose $\text{N}_2 \rightarrow$ drives reaction \rightarrow Watch for base sensitive groups</p> <p>In Mech packet.</p> <p>Acidic Clemmensen \rightarrow No mech \rightarrow Watch for H^+ sensitive \rightarrow H^+ sensitive \rightarrow H^+ sensitive</p>
$\text{Enol} \rightarrow \text{Keto}$	cat. HO^-	<p>Neutral OH^-</p> <p>Enol</p> <p>Enolate</p> <p>Negatively charged</p>
$\text{Aldehyde} \rightarrow \text{Ketone}$ $\text{Ketone} \rightarrow \text{Enol}$	$\text{HO}-\text{C}(=\text{O})-\text{CH}_3$ Br_2	<p>If your in acid w/ a Carbonyl you can form an "Alpha" α</p> <p>Br or Cl \rightarrow α to a Carbonyl</p>
$\text{Aldehyde} \rightarrow \text{Ketone}$ $\text{Ketone} \rightarrow \text{Enol}$	Br_2	<p>Enol</p> <p>Enolate</p> <p>Negatively charged</p>

Transformation	Reagent	Mechanism
$\text{R}-\text{C}(=\text{O})-\text{CH}_3 \xrightarrow{1) \text{ } \ominus \text{O}^-} \text{R}-\text{C}(\text{O}^-)=\text{CH}_2$ Methyl Ketone	1) HO^- , Br_2 2) H_2O mild	In Base \rightarrow so create enolate R^- $\text{R}-\text{C}(=\text{O})-\text{CH}_3 + \text{HO}^- \rightleftharpoons \text{R}-\text{C}(\text{O}^-)=\text{CH}_2 + \text{H}_2\text{O}$ This is more acidic than this H atom % of Inductive $\text{R}-\text{C}(=\text{O})-\text{CH}_2-\text{Br} \rightarrow \text{R}-\text{C}(=\text{O})-\text{CH}_2-\text{H}$ HCR ₃
$\text{R}-\text{C}(=\text{O})-\text{OH} \rightarrow \text{R}-\text{C}(=\text{O})-\text{OR}'$	excess ROH H^+ cat. H_2SO_4 , HCl	Equilibrium process \rightarrow Excess ROH drives reaction to ester Need to protonate $\text{C}=\text{O}$ before ROH can attack Note: a 5 or 6 membered ring can form H_2O \rightarrow Lactone
$\text{R}-\text{C}(=\text{O})-\text{OH} \rightarrow \text{R}-\text{C}(=\text{O})-\text{Cl}$ Acid Chloride	SOCl_2	SO_2 Cl^- as by products
$\text{R}-\text{OH} \rightarrow \text{R}-\text{OH}$	1) LiAlH_4 2) H_2O	No mech KRE
$\text{R}-\text{C}(=\text{O})-\text{CH}_2-\text{OH} \rightarrow \text{R}-\text{C}(=\text{O})-\text{CO}_2$ β -keto acid	Δ (heating)	$\text{R}-\text{C}(=\text{O})-\text{CH}_2-\text{OH} \rightarrow \text{R}-\text{C}(=\text{O})-\text{CO}_2$
$\text{R}-\text{C}\equiv\text{N} \rightarrow \text{R}-\text{C}(=\text{O})-\text{OH}$	H_3O^+ Heat	Acid Promoted KRE
$\text{R}-\text{C}(=\text{O})-\text{R}' \xrightarrow{2 \text{ } \ominus \text{O}^-} \text{R}-\text{C}(\text{O}^-)_2-\text{R}'$	H_2O (cat. H^+)	Anhydrides are reactive enough for H_2O to attack directly. Acid is produced in the rxn. Don't require $\text{C}=\text{O}$ to be protonated (acid chlorides too)

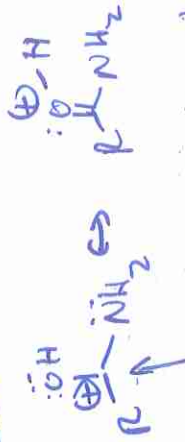
Transformation	Reagent	Mechanism
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR} \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}$	ROH	KRE
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR} \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{N}}-\text{R}'$	$\text{H}-\overset{\text{N}}{\underset{\text{R}''}{ }}-\text{R}'$	<p>$\text{H}_2\text{NR}'\text{R}''$ is a better base (H₂NR'R'' pKa ~10) I.e. of amine would only react with ROH (pKa 3-5) 0.5 eq of product</p>
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl} \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}$	$\frac{\text{ROH}}{\text{H}_2\text{O}}$	KRE
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl} \rightarrow \text{R}-\overset{\ominus}{\text{O}}-\overset{\text{O}}{\parallel}{\text{C}}-\text{R}$	$\text{O}=\overset{\ominus}{\text{C}}-\text{R}$	KRE
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{Cl} \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{N}}-\text{R}'$	$\frac{\text{H}-\overset{\text{N}}{\underset{\text{R}'}{ }}-\text{R}}$	KRE
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}' \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}$	$\frac{\text{1) 1 eq NaOH}}{\text{2) H}_3\text{O}^+}$	<p>Base Promoted KRE ← Equilibrium Process → Excess H₂O drives rxn to acid</p>
$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}' \rightarrow \text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OR}''$	$\frac{\text{H}_2\text{SO}_4}{\text{excess}} \text{R}''\text{OH}$	KRE

Transformation	Reagent	Mechanism
$R-\overset{\overset{O}{\parallel}}{C}-Cl \rightarrow R-\overset{\overset{O}{\parallel}}{C}-R'$	$1) (R')_2CuLi$ $2) H_2O$	<p>Gilman w/ Acid Chloride!</p> <p>KRE</p>
$R-\overset{\overset{O}{\parallel}}{C}-OR \rightarrow R-\overset{\overset{OH}{\parallel}}{C}-R'$	$1) 2.0 eq$ $R'-MgBr$ $2) H_2O^{\oplus} / \text{acid}$	<p>Grignard w/ Ester!</p> <p>KRE</p>
$R-\overset{\overset{O}{\parallel}}{C}-OR \rightarrow R-\overset{\overset{OH}{\parallel}}{C}-R'$	$1) LiAlH_4$ $2) H_2O$	<p>KRE</p>
$R-\overset{\overset{O}{\parallel}}{C}-R' \rightarrow R-\overset{\overset{O}{\parallel}}{C}-N(R'')_2$	$R'-N(R'')$	<p>Amine needs at least 1 H atom</p> <p>KRE</p> <p>$H-N(R'')$ is a worse base than $\rightarrow O$</p>
		<p>R''</p> <p>$H_2N^{\oplus}(R'')$ pKa ~ 10</p> <p>$\rightarrow OH$</p> <p>pKa ~ 16</p> <p>KRE</p>
		<p>KRE</p>
		<p>KRE</p>

Good LG



↓



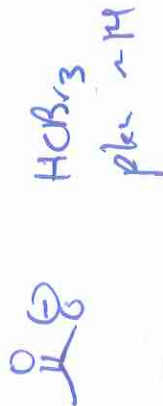
This contributing structure shows that protonating carbonyl makes it more electrophilic

OK electrophile

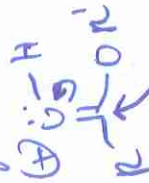
↑ Add



HO⁻ isn't a good enough Nucl!



great electrophile (after the carbonyl is protonated)



OK nucleophile → It can react,

w/ great electrophiles!

Beyond the scope of our class!



Explains why H^+ not Br^- picks up this H^+

↑↑
 Weaker acid than HBr (-8)

