

Reductions and Oxidations

- Oxidation
- an increase in the number of bonds to electronegative atoms
 - a decrease in the number of bonds to hydrogen

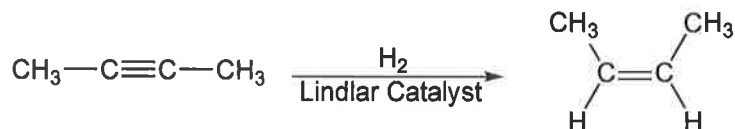
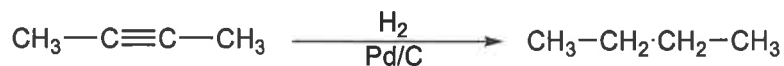
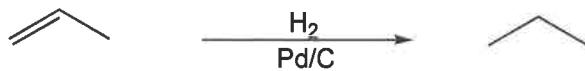
- Reduction
- a decrease in the number of bonds to electronegative atoms
 - an increase in the number of bonds to hydrogen

Species	Oxidation Level
CH_4 , $\text{CH}_3\text{-CH}_3$	0
$\text{CH}_3\text{-Br}$, $\text{CH}_3\text{-OH}$	1
CH_2Cl_2 , $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	2
CHCl_3 , $\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	3
CCl_4 , $\text{O}=\text{C}=\text{O}$, $\text{H}_2\text{N}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$	4

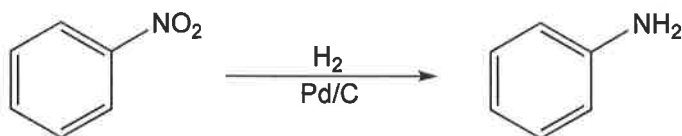
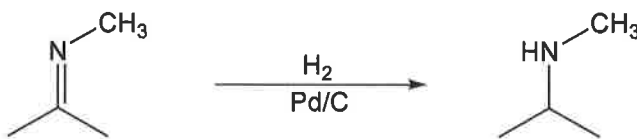
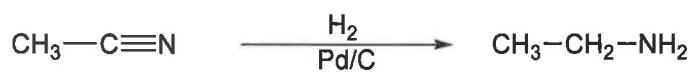
Reductions...

- Hydrogenations

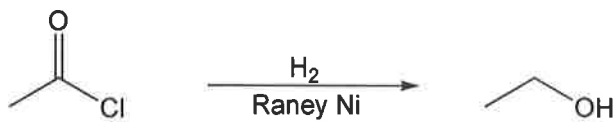
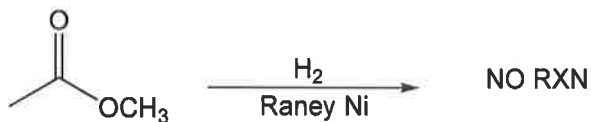
- C-C π -bonds



- N-C and N-O π -bonds

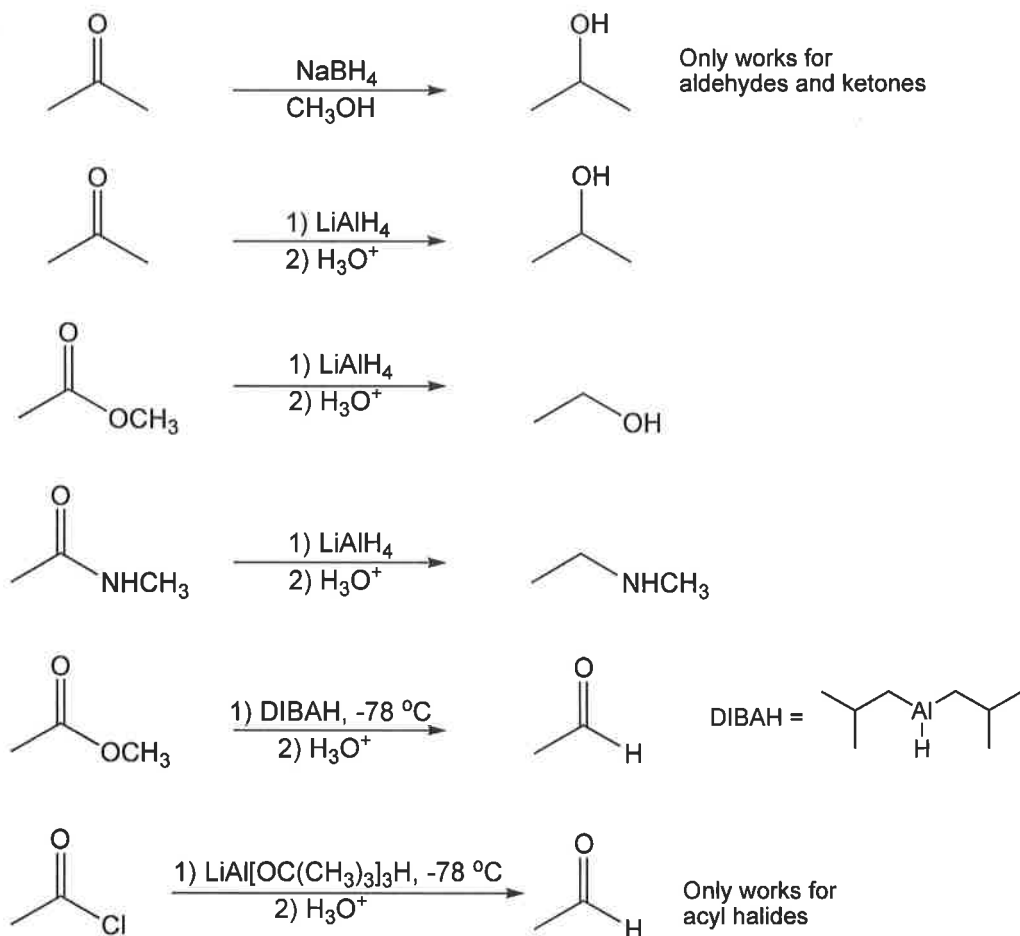


- Some O-C π -bonds



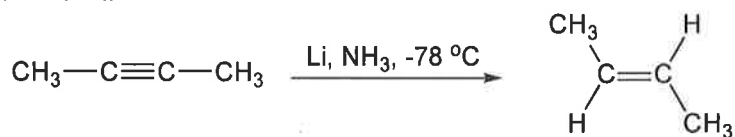
- Metal Hydrides

- O-C and N-C π -bonds

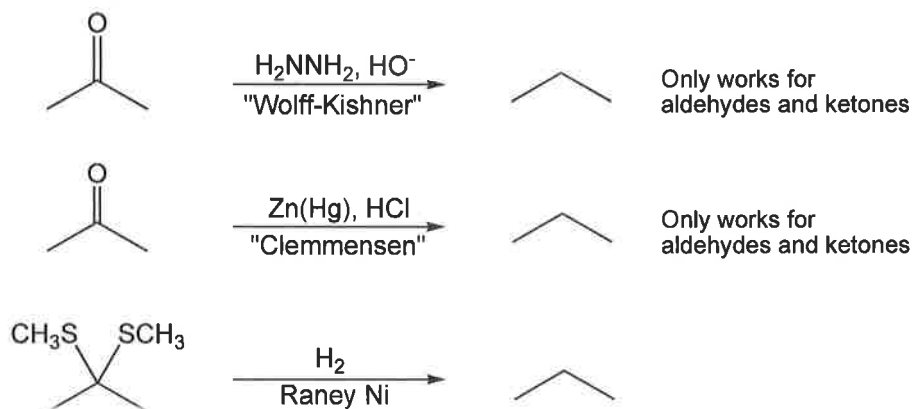


- Other

- Metal/ammonia



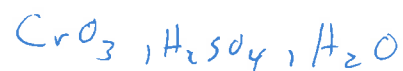
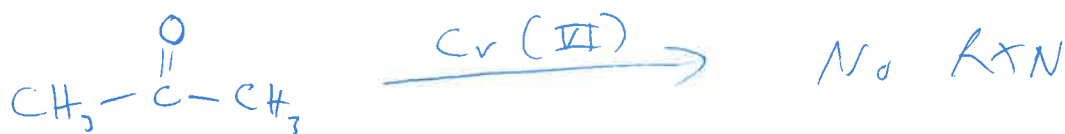
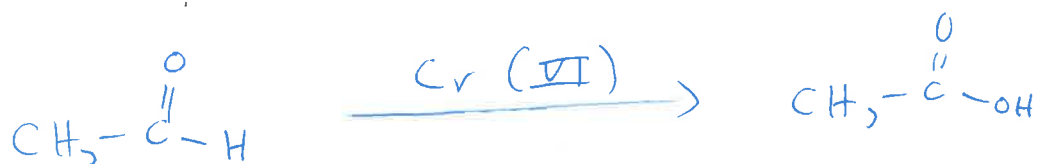
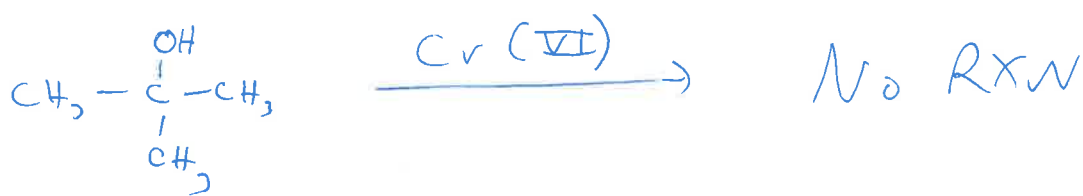
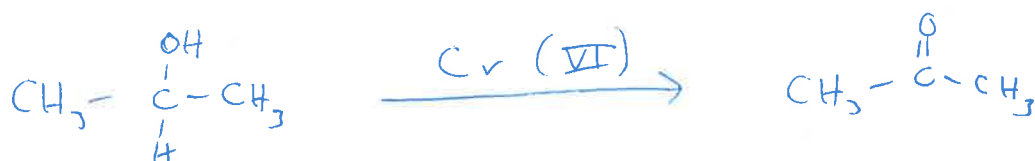
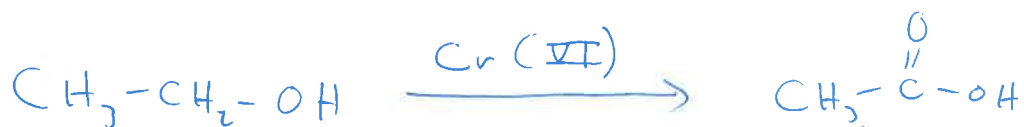
- Deoxygenations



Oxidations

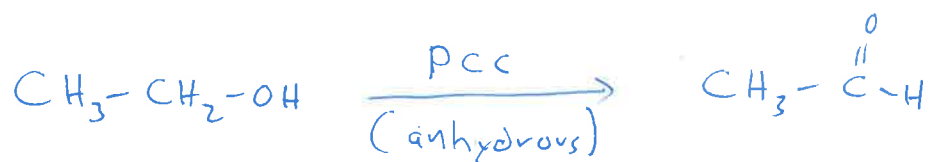
- Cr (VI) Reagents

• "Jones Oxidations"

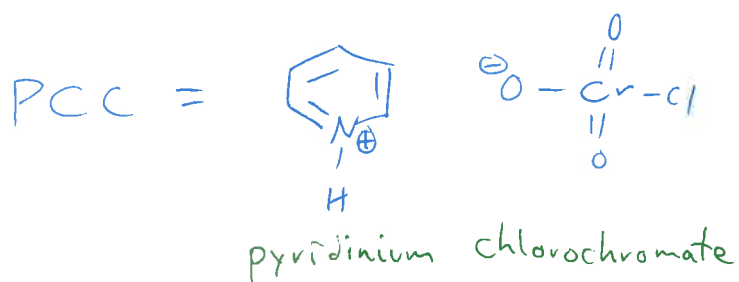


Special Oxidations

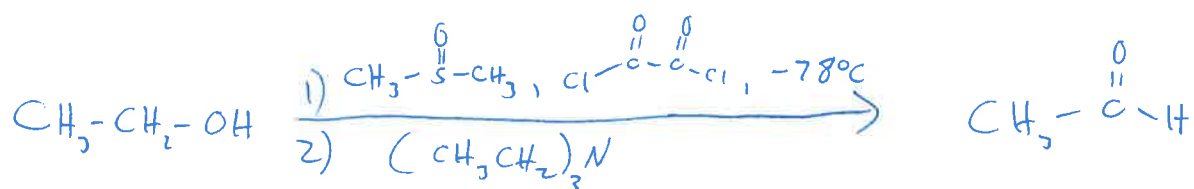
- PCC



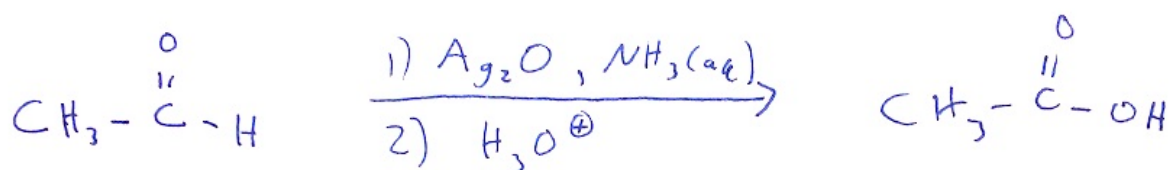
- stops at aldehyde



- Swern Oxidation

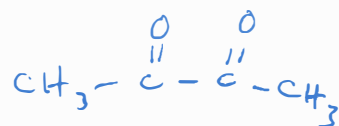
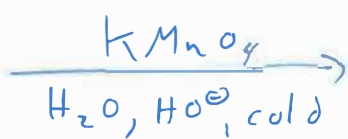
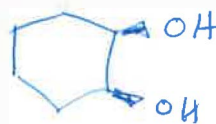
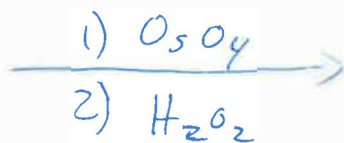
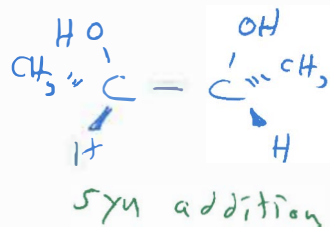
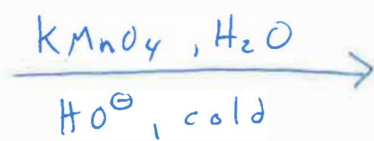
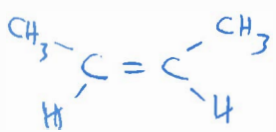


- Tollens Oxidation

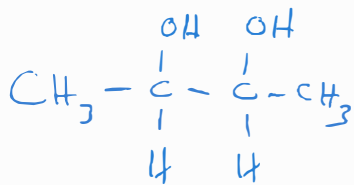


- only works on aldehydes

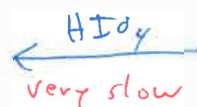
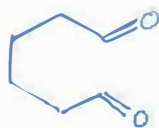
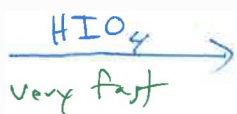
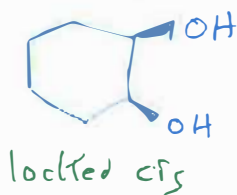
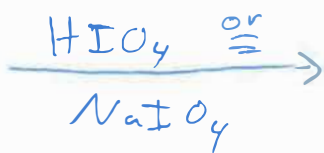
Dihydroxylation



Periodic Cleavage

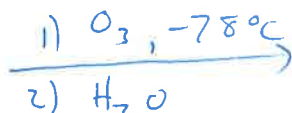
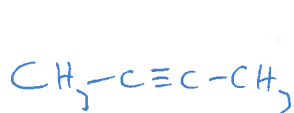
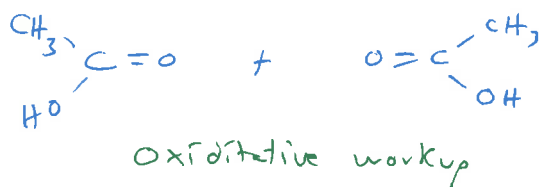
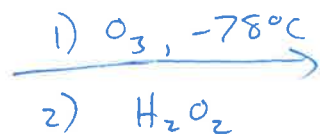
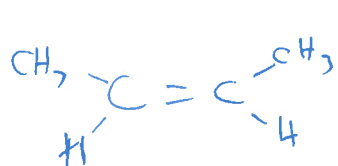
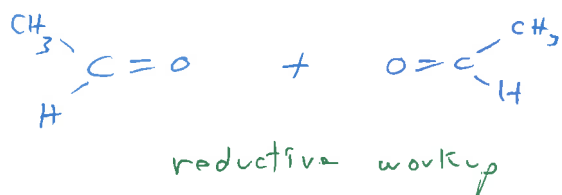
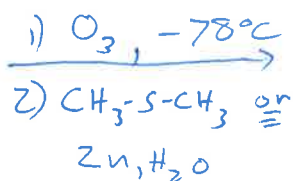
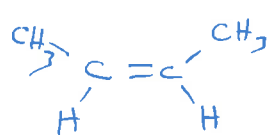


a vicinal diol

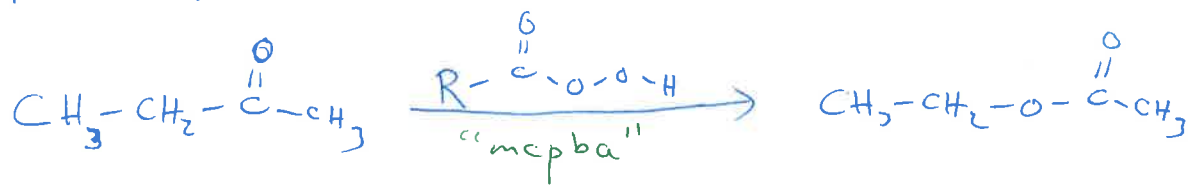


locked trans

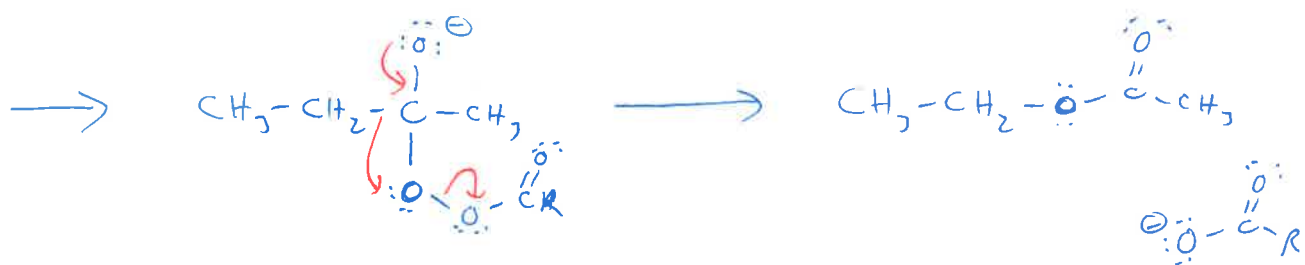
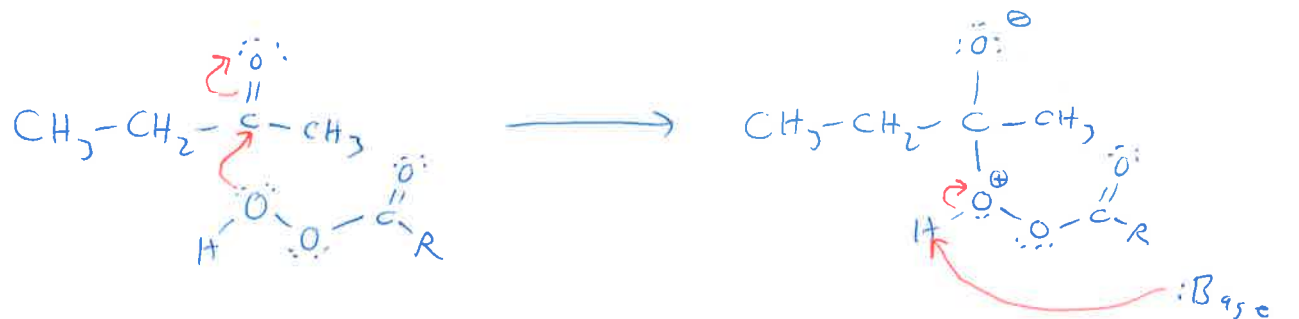
Ozonolysis



Baeyer-Villiger Oxidation

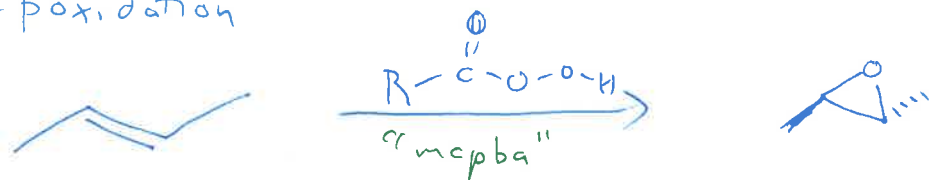


- Migration trends for B/V



- B/V turns ketones into esters

Epoxidation

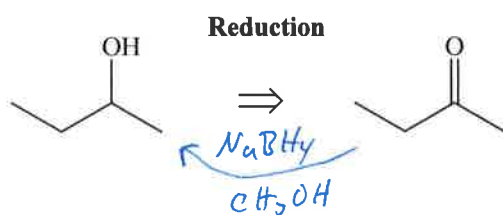
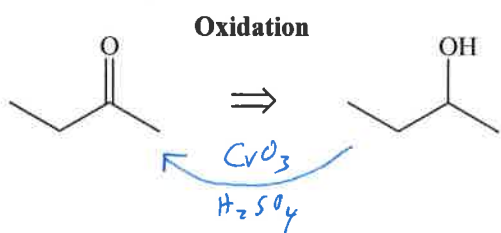
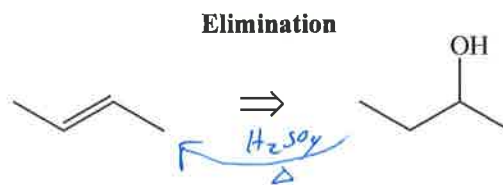
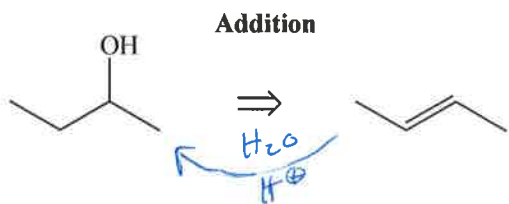


Functional Group Interconversion

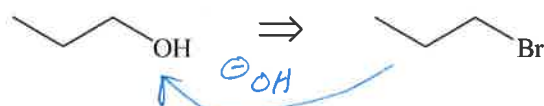
You now know enough chemistry to turn nearly any functional group into any other functional group:

⇒ is a retrosynthetic arrow

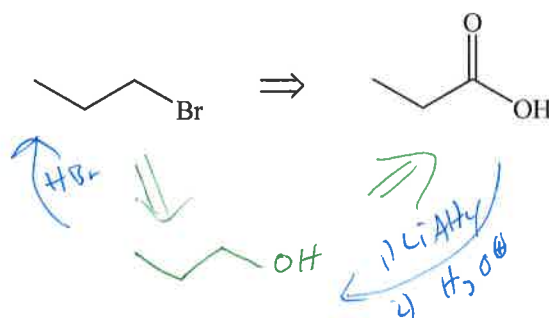
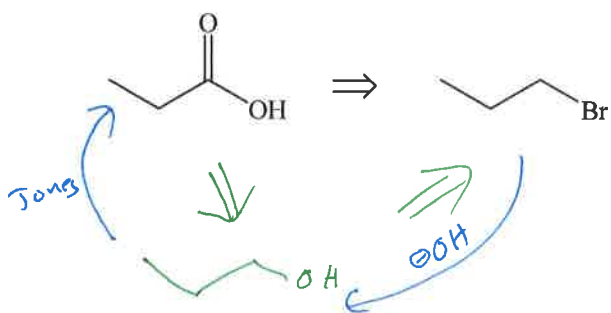
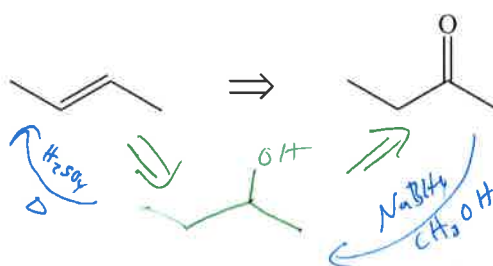
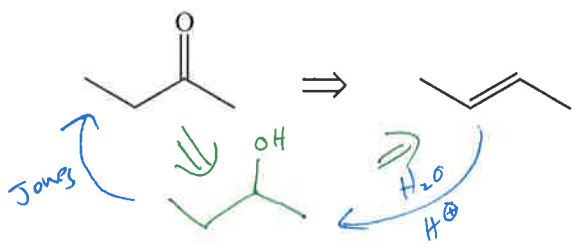
Single Step



Substitution



Multiple Step

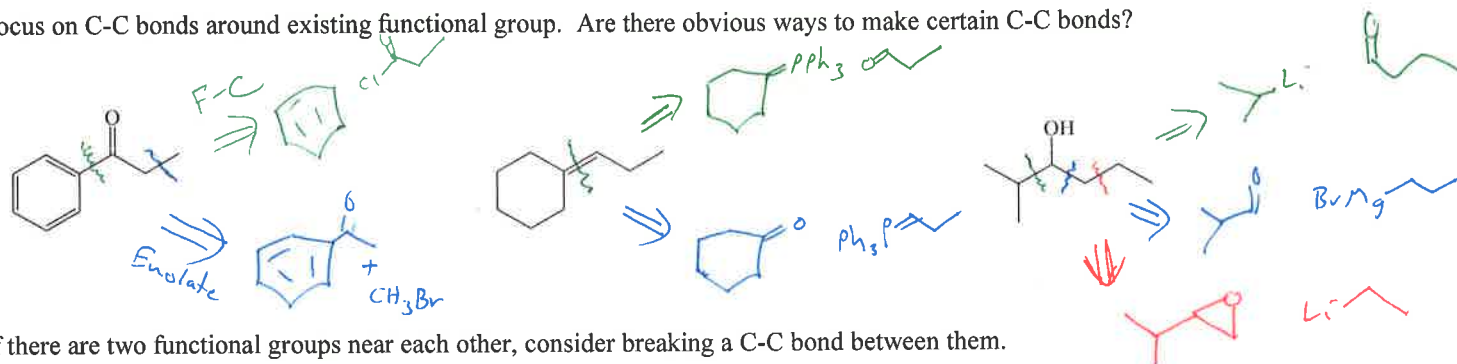


Carbon-Carbon Bond Forming Reactions

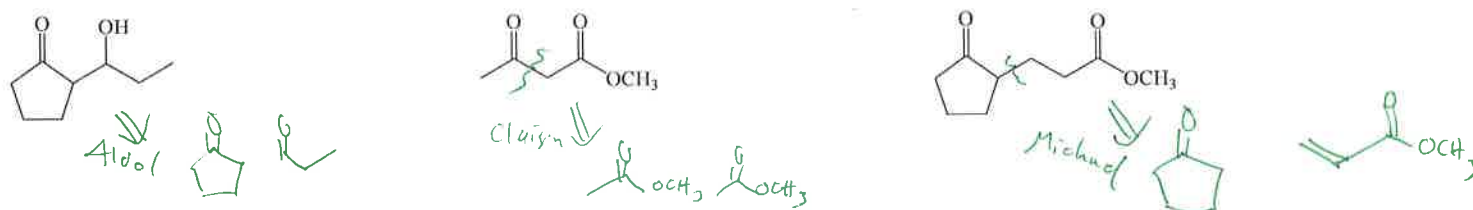
<u>Nucleophile</u>	<u>Electrophile</u>	<u>Nucleophile</u>	<u>Electrophile</u>
Grignard	Epoxides Carbonyls	Arenes	Alkyl Halides Acyl Halides
Organolithium	Alkyl Halides Epoxides Carbonyls	Ylides	Aldehydes/Ketones
Gilman	Alkyl Halides α,β -Unsaturated Carbonyls	Enolates/Enamines	Alkyl Halides Carbonyls α,β -Unsaturated Carbonyls
Acetylides	Epoxides Alkyl Halides Carbonyls	Cyanide	Alkyl Halides Aldehydes/Ketones α,β -Unsaturated Carbonyls

Dissecting a Carbon Skeleton Retrosynthetically

- Focus on C-C bonds around existing functional group. Are there obvious ways to make certain C-C bonds?



- If there are two functional groups near each other, consider breaking a C-C bond between them.



- Can functional groups be interconverted to allow obvious ways to make certain C-C bonds?

