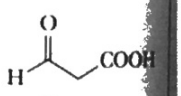
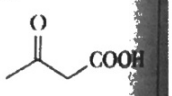
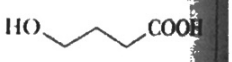
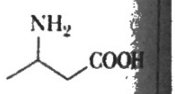
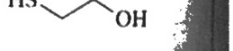
02-13-2017 MTW

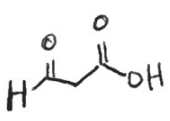
Nomenclature Summary

1. Look for the longest carbon chain
    a. Parent chain with the most amount of substituents
    b. Parent chain with highest precedence functional group

Prefix	Number of Carbon Atoms	Prefix	Number of Carbon Atoms
meth-	1	undec-	11
eth-	2	dodec-	12
prop-	3	tridec-	13
but-	4	tetradec-	14
pent-	5	pentadec-	15
hex-	6	hexadec-	16
hept-	7	heptadec-	17
oct-	8	octadec-	18
non-	9	nonadec-	19
dec-	10	eicos-	20

2. Precedence: will define the longest carbon chain
    a. At the end of this list will be –yne, -ene, -ane (in that order)
    b. If the substituents or functional groups of alkynes, alkenes, alkanes are also present, the prefix will be –yn-, -en-, -yl-

	Functional Group	Suffix if higher priority	Prefix if lower priority	Example when the functional group has lower priority
↑ Increasing precedence	Carboxyl	-oic acid	—	
	Aldehyde	-al	oxo-	3-Oxopropanoic acid 
	Ketone	-one	oxo-	3-Oxobutanoic acid 
	Alcohol	-ol	hydroxy-	4-Hydroxybutanoic acid 
	Amino	-amine	amino-	3-Aminobutanoic acid 
	Sulfhydryl	-thiol	mercapto	2-Mercaptoethanol 



3. Numbering
    a. Longest functional group parent chain starting at end with
        i. Either the highest precedence functional group appearing with lowest number
        ii. First substituent or where you have most substituents with lowest numbers

4. Substituents generally are named in alphabetical order except:
   a. The prefixes *di-*, *tri-*, *tetra-*, etc.
   b. The prefixes *n-*, *sec-*, *tert-*

Name	Condensed Structural Formula	Name	Condensed Structural Formula
Methyl (Me)	$-CH_3$	1,1-Dimethylethyl (*tert*-butyl, *t*-Bu)	$-C(CH_3)_3$
Ethyl (Et)	$-CH_2CH_3$	Pentyl	$-CH_2CH_2CH_2CH_2CH_3$
Propyl (Pr)	$-CH_2CH_2CH_3$	3-Methylbutyl (isopentyl)	$-CH_2CH_2CH(CH_3)_2$
1-Methylethyl (isopropyl, iPr)	$-CH(CH_3)_2$	Butyl (Bu)	$-CH_2CH_2CH_2CH_3$
2-Methylpropyl (isobutyl, iBu)	$-CH_2CH(CH_3)_2$	2-Methylbutyl	$-CH_2CH(CH_3)CH_2CH_3$
1-Methylpropyl (*sec*-butyl, *s*-Bu)	$-CH(CH_3)CH_2CH_3$	2,2-Dimethylpropyl (neopentyl)	$-CH_2C(CH_3)_3$

5. Hyphens appear between letters and numbers (or characters like parentheses)
6. Lists of numbers are separated by commas
7. Stereochemical designations (R/S or E/Z)
   a. All appear in parentheses before the entire name
   b. Designate number for each stereochemical designation (unless it is the only chiral center or alkene)
   c. Chiral centers before alkene designations

---

1. Identify the highest priority functional group, that determines the suffix for the name.

2. Identify the longest carbon chain, that will establish the parent name of the molecule. Be sure to keep track of any double or triple bonds, as those will replace "an" with "en" or "yn" in the parent name.

3. Number the parent chain so that the highest priority functional group gets the lower number.

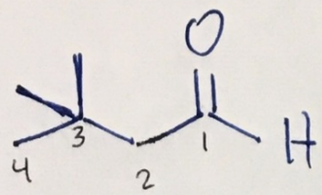
4. Identify the substituents on the parent chain.

5. Identify the stereochemistry (*R,S*) or alkene geometry (*E,Z*).

6. Write the entire name from left to right by listing the elements of the name in reverse order of this list: *R,S* or *E,Z* in parentheses, followed by substituents listed in alphabetical order with numbers (separated from the words by dashes) followed by the main chain then finally the suffix.

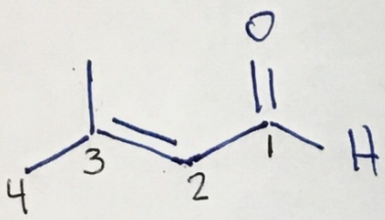
From the Video Dr. Iverson sent out regarding nomenclature last week – make sure you check it out!

(3) (3)



- aldehyde -al
- 4 carbon chain butan
- dimethyl
- 3,3

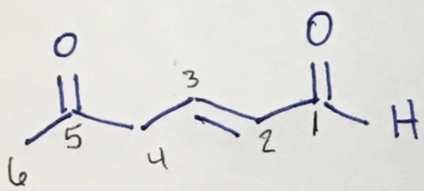
3,3-dimethyl butanal



- aldehyde -al
- 4 carbon chain -buten-
  - double bond
- 3-methyl
- 2-ene

3-methyl-2-butenal

3-methylbut-2-enal

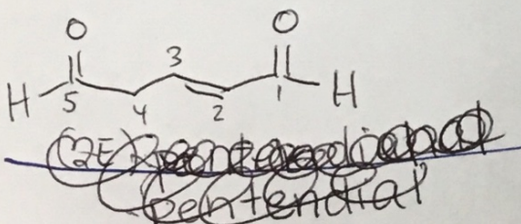


- aldehyde -al
- 6 carbon chain] -hexen-
- double bond (2)
- oxo (5)
- double bond is E

(2E)-5-oxo-2-hexenal

~~(2E)-5-oxohex-2-enal~~

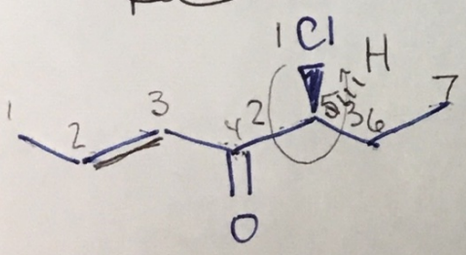
(2E)-5-oxohex-2-enal



~~(2E) pentanedial~~

~~pentendial~~

(2E) pent-2-endial



- Ketone -one
- hepten-
- double bond (2) (E)
- chloro (5) (S)

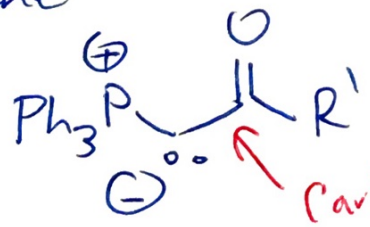
(5S, 2E)-5-chloro-2-hepten-4-one

(S, E)-5-chlorohept-2-en-4-one

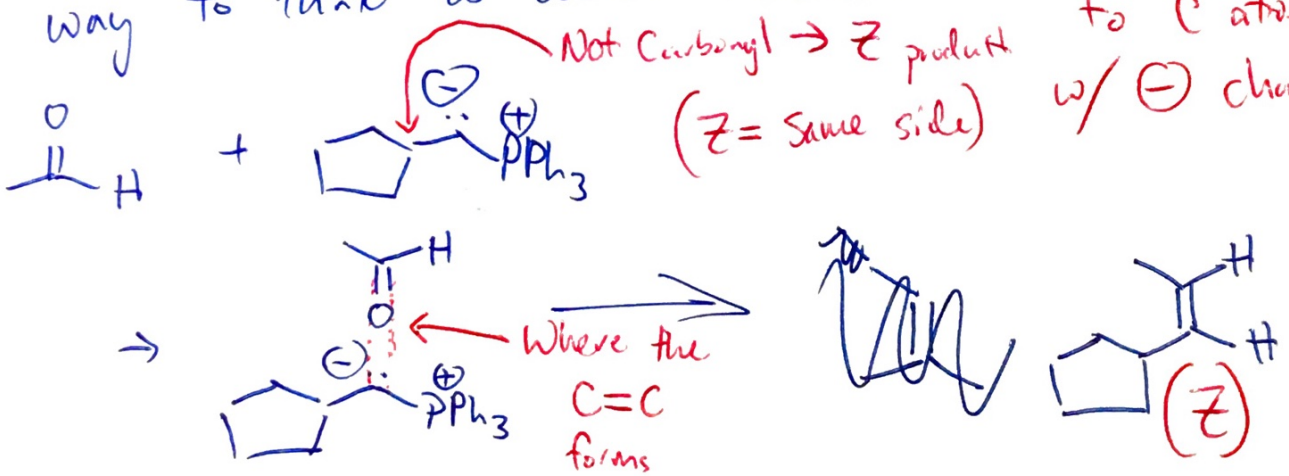
MTW 2/13/17

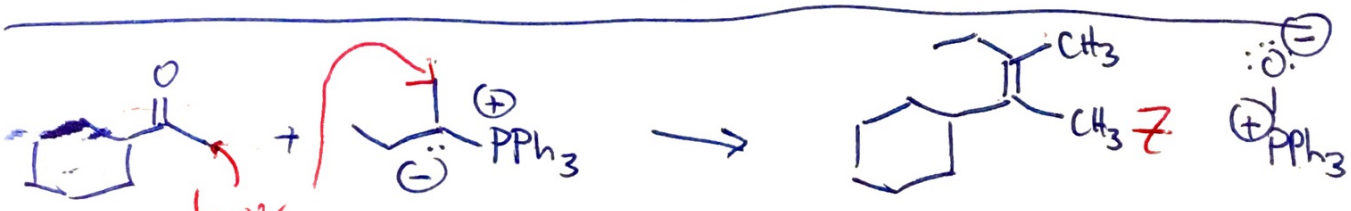
Wittig Reaction

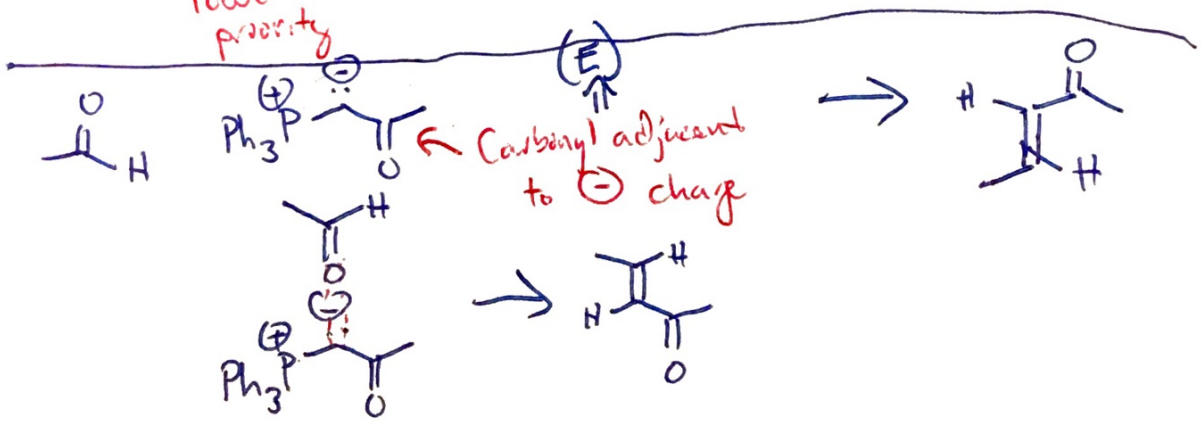
Reaction gives Z alkenes EXCEPT when the negatively charged carbon is adjacent to a carbonyl → then get E alkene

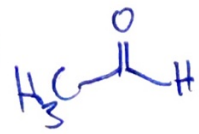
ex. 

A way to think of overall reaction:





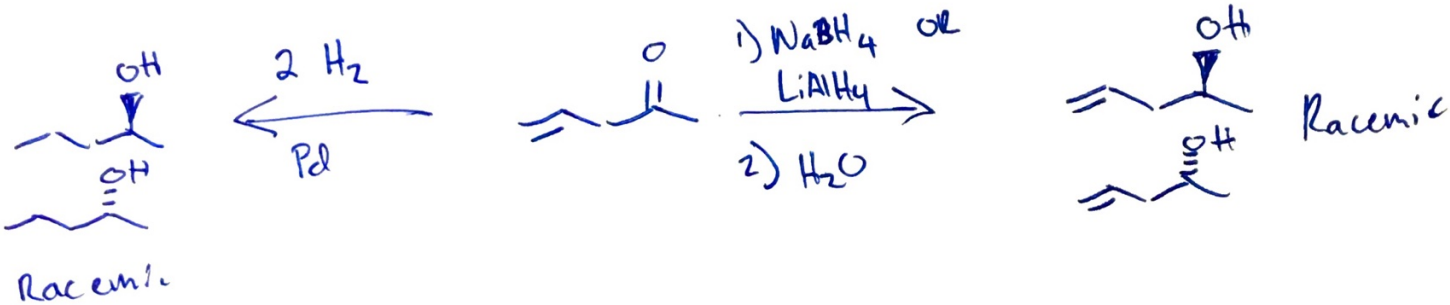


Note: 

NOT a carbonyl here so get Z

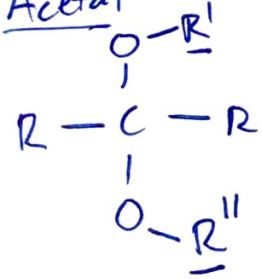
Reduction of Ketones & Aldehydes

- H_2 / Pd
- Metal Hydride Reagents ($NaBH_4$ / $LiAlH_4$)



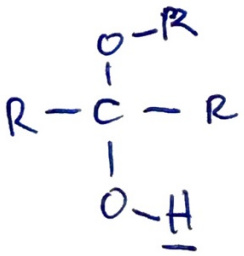
Acetals

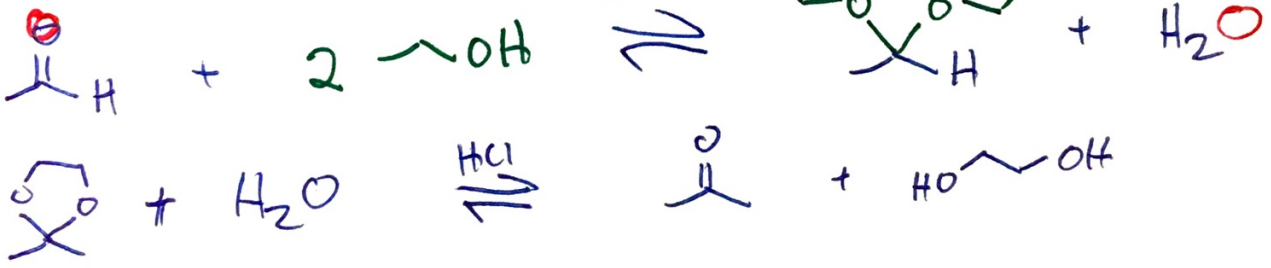
Acetal

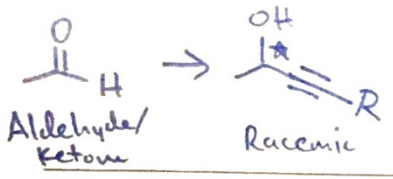
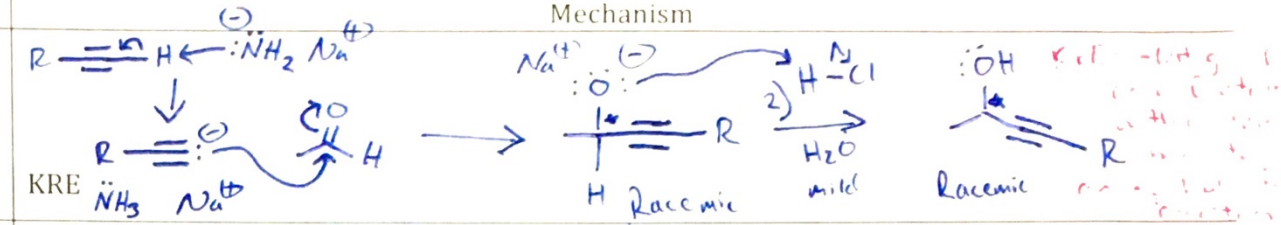
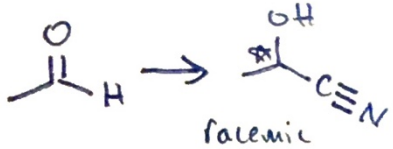
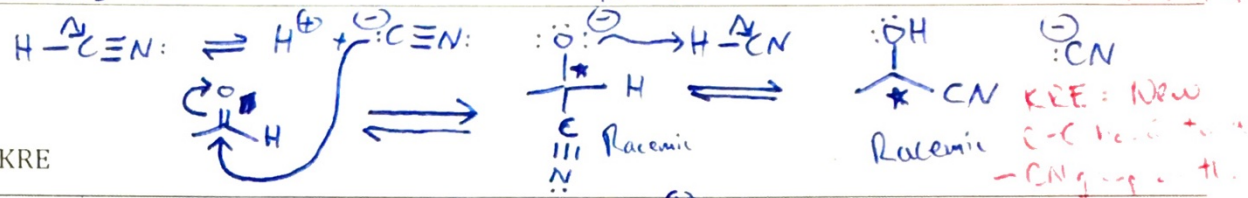
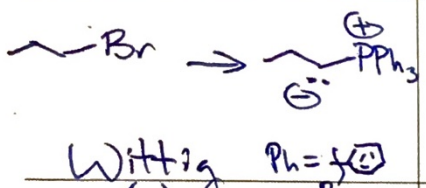
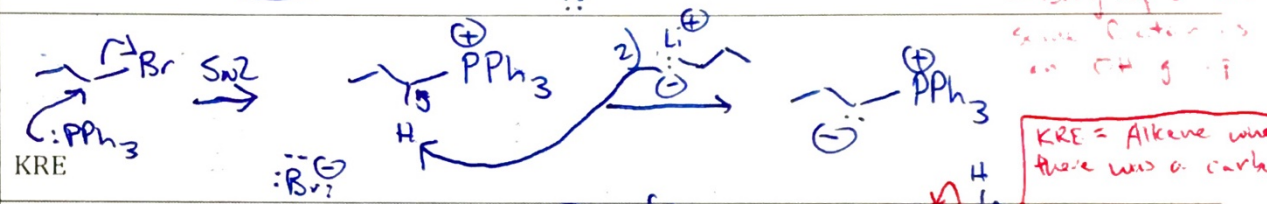
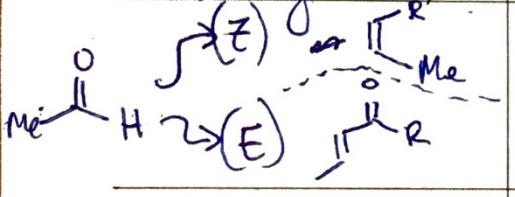
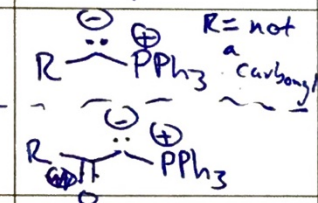
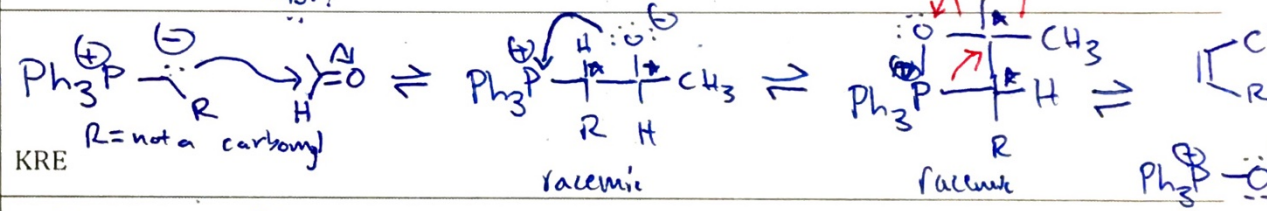
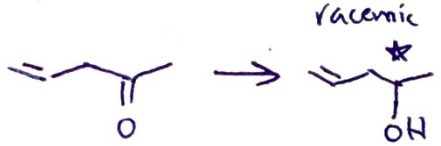
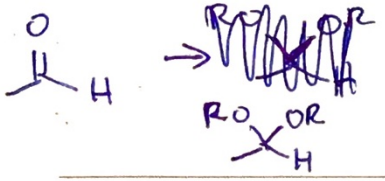


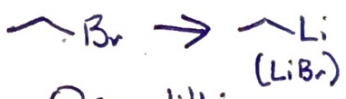
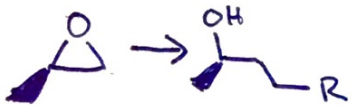
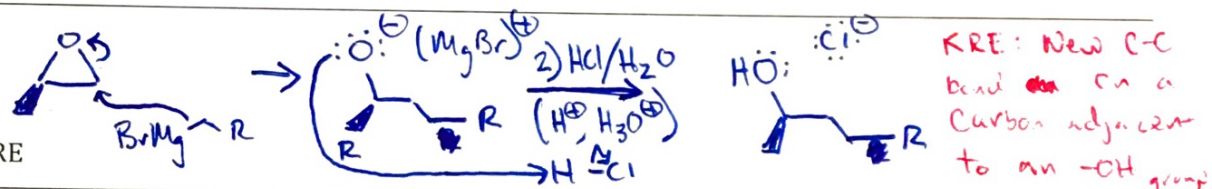
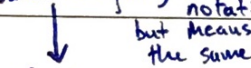
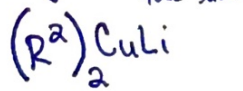
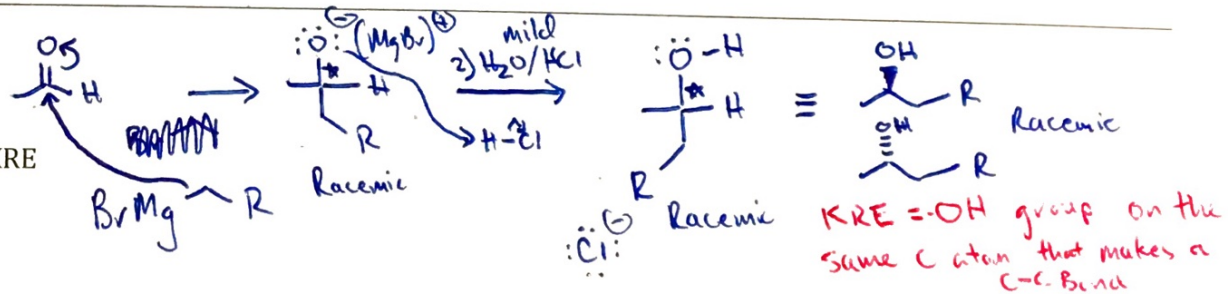
R= Carbon

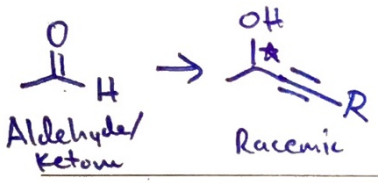
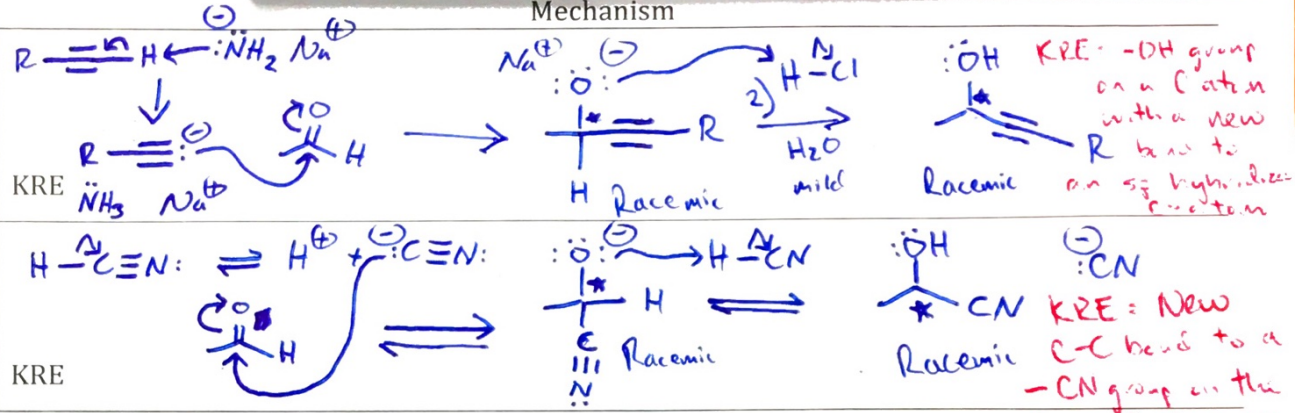
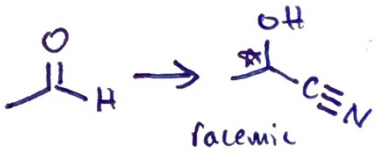
Hemiacetal





Transformation	Reagent	Mechanism
 Aldehyde/ Ketone → Racemic	1) $Na^{\oplus}{}^{\ominus}:\equiv R$ 2) HCl/H_2O mild	 KRE
 racemic	HCN $(H-C\equiv N:)$	 KRE
 Wittig	1) PPh_3 2) $nBuLi$ n-Butyl Lithium	 KRE KRE = Alkene where there was a carbonyl
	 R = not a carbonyl	 KRE R = not a carbonyl racemic racemic
 racemic	1) $NaBH_4$ or $LiAlH_4$ 2) H_2O	Mech: Class notes from Mon 2/6 → Mechanism A Nucleophilic H atom! $(H:^{\ominus})$ KRE
	2 ROH cat. $H^{\oplus}$ (H_2SO_4)	Mech. Packet. Need to protonate carbonyl (Oxygen) before alcohol can attack! KRE KRE: Two bonds to Oxygen on sp^3 Carbon
		KRE

Transformation	Reagent	Mechanism
 Grignard	Mg^0 *ether	None (No mech) KRE
 Organolithium	2 Li^0	None (No mech) KRE
 Gilman Reagent	CuI	None (No mech) KRE
	1) R–Li, R–MgBr, $(R)_2CuLi$ 2) HCl/H_2O mild	 KRE: New C-C bond on a Carbon adjacent to an –OH group
	 Same Reagent, different notation but means the same thing! 	No mech → 1° haloalkane + Gilman KRE: New C-C Bond in an alkane KRE
		No mech → Vinylhalide + Gilman KRE: New C-C bond in an alkene KRE
 Aldehydes & Ketones	1) R–MgBr (Not R–Cl) 2) H_2O/HCl mild	 KRE: –OH group on the same C atom that makes a C-C Bond

Transformation	Reagent	Mechanism
	1) $Na^{\oplus}{}^{\ominus}:\equiv R$ 2) HCl/H_2O mild	
	HCN $(H-C\equiv N:)$	
		KRE
		KRE
		KRE
		KRE
		KRE