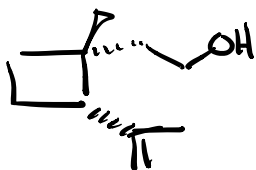


## Chapter 13 Alcohols & Phenols



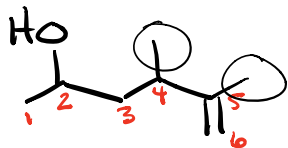
Grandisol  
Pheromone male boll weevil

## Nomenclature

- Parent chain must contain hydroxyl

- hydroxyl should always receive lowest possible #

hydroxyl > alkene or yne



4,5-dimethyl

5-ene

2-ol

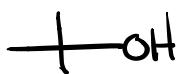
hex

4,5-dimethylhex-5-en-2-ol

## Common names



isopropanol

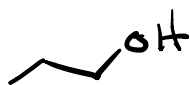


tert-butanol

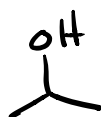


benzyl alcohol

## Classification



1°



2°



3°

## Phenol

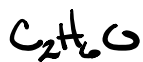


phenol



Substituent  
Phenyl

# Physical properties



Structural Isomers



Dimethyl ether

-24°C

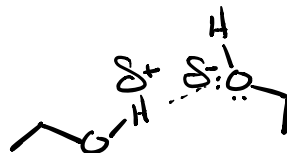
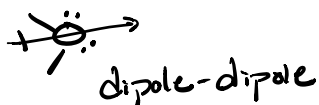
gas @ room temp



ethanol

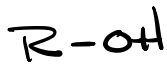
78°C

R<sub>2</sub>O



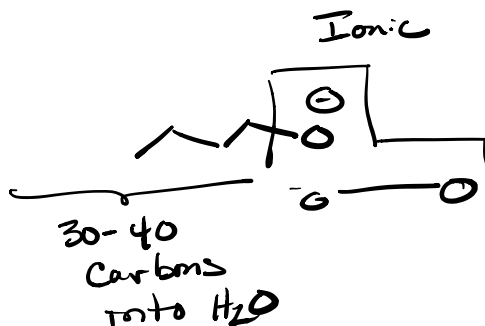
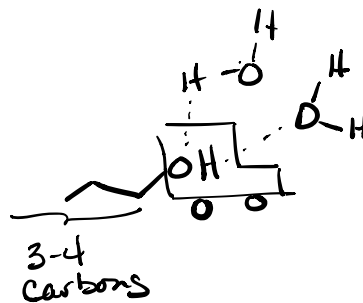
H-bonding

## Water Solubility

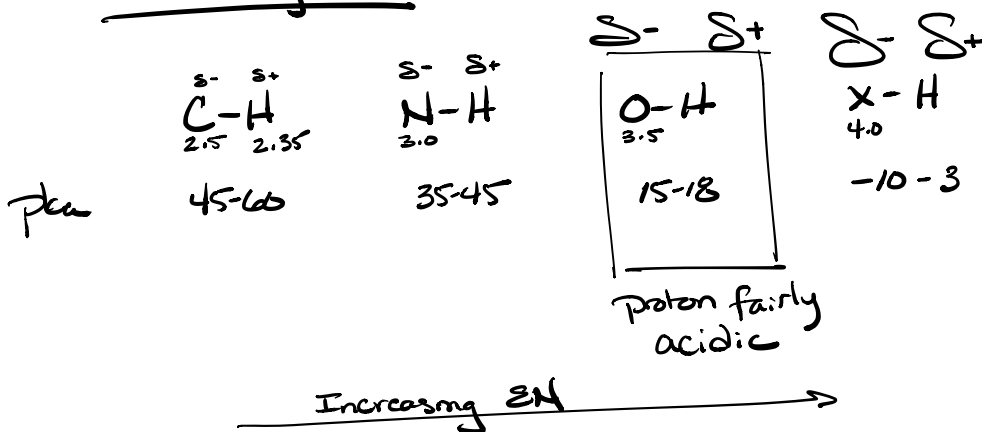


Polar head

Can solubilize  
upto 4 Carbons  
in H<sub>2</sub>O



# Acidity



Reagents for Deprotonation - making oxygen nucleophiles

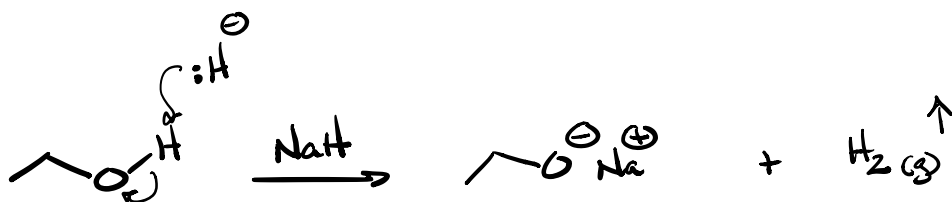
Hydrides    NaH, KH, CaH<sub>2</sub>

atom  
H  
lp<sup>+</sup>  
le<sup>-</sup>

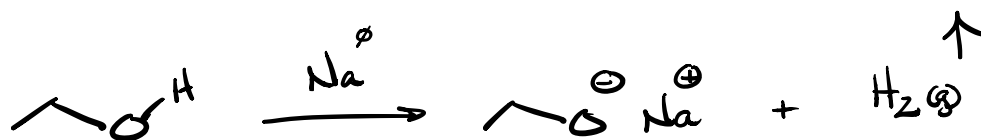
proton  
H<sup>+</sup>  
lp<sup>+</sup>  
∅e<sup>-</sup>

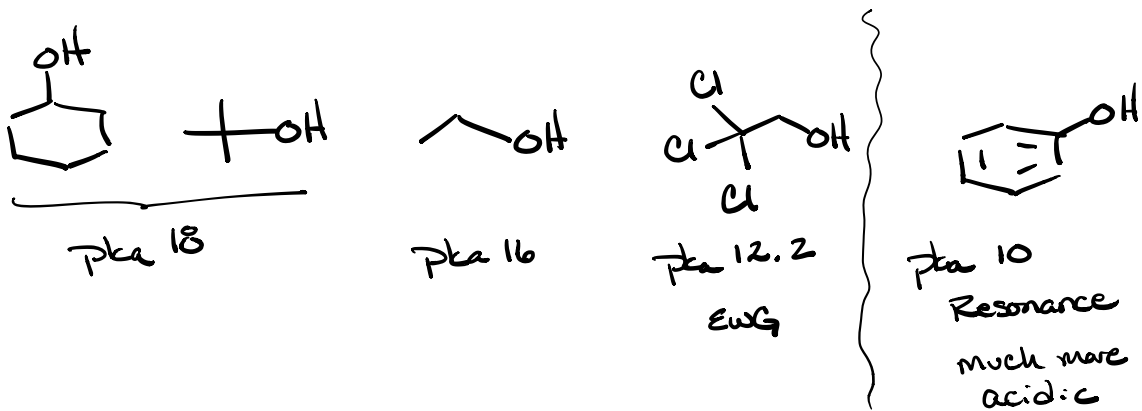
hydride  
H<sup>-</sup>  
lp<sup>+</sup>  
2e<sup>-</sup>

O<sup>2-</sup> oxide  
N<sup>3-</sup> Nitride  
F<sup>-</sup> Fluoride  
H<sup>-</sup> hydride

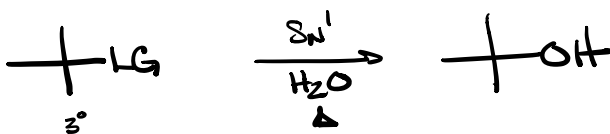
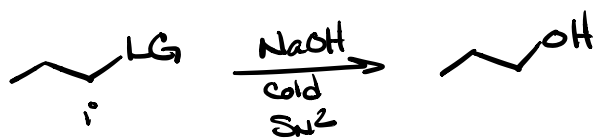


Alkali metals    Na, K, Li

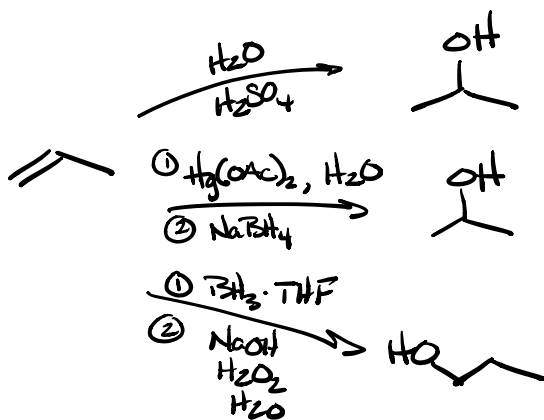




### Synthesis Review



Hydrations  $\rightarrow$



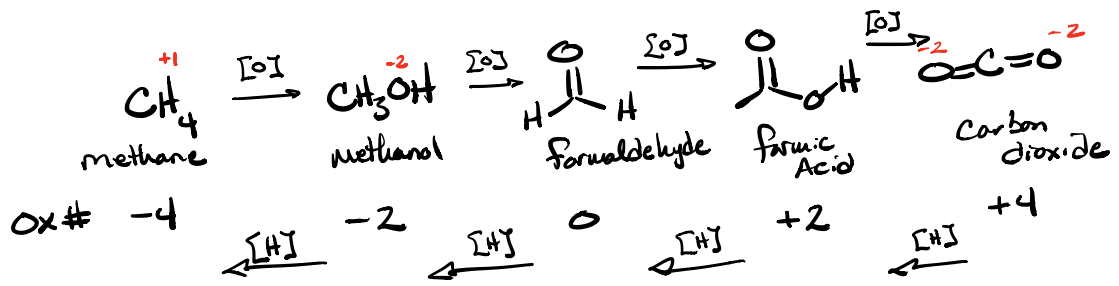
forms  $\text{C}^+$   
 $\Rightarrow$  hydride & alkyl shifts

no shifts

directed by electronics



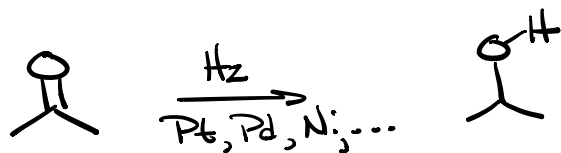
Oxidation States



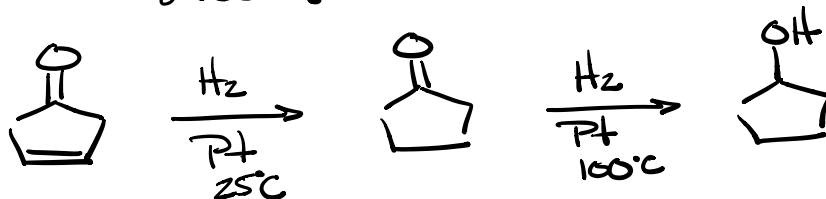
[O] oxidation → the gain of oxygen or loss of hydrogen  
(Loss of e<sup>-</sup>)

[H] Reduction → the gain of hydrogen or loss of oxygen  
(Gain of e<sup>-</sup>)

# Reducing Agents

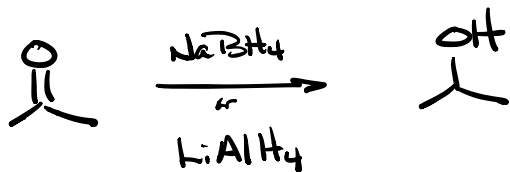


\* Requires higher temps than alkenes

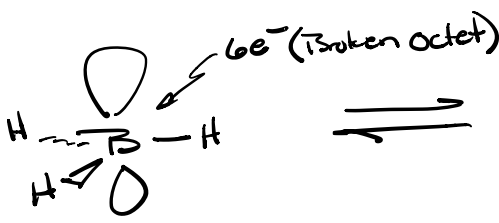
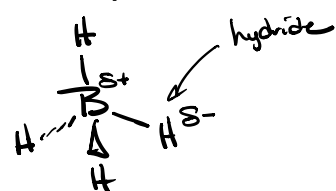
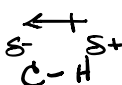


Can be selective

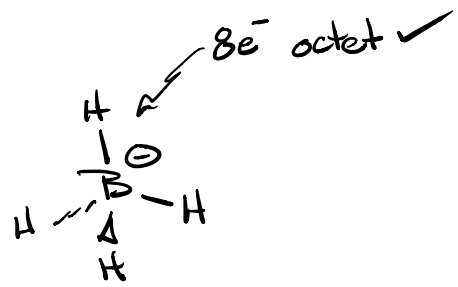
# Reduction with hydrides

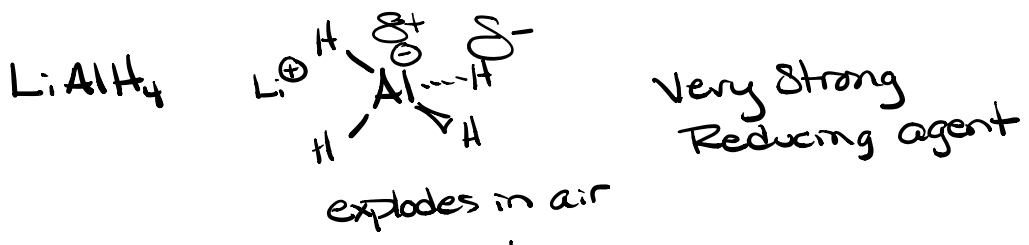
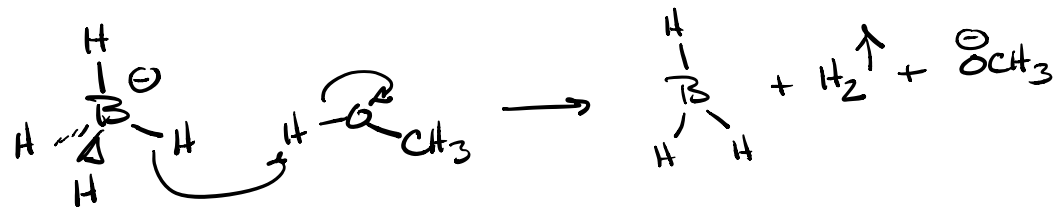
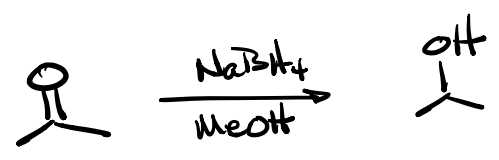
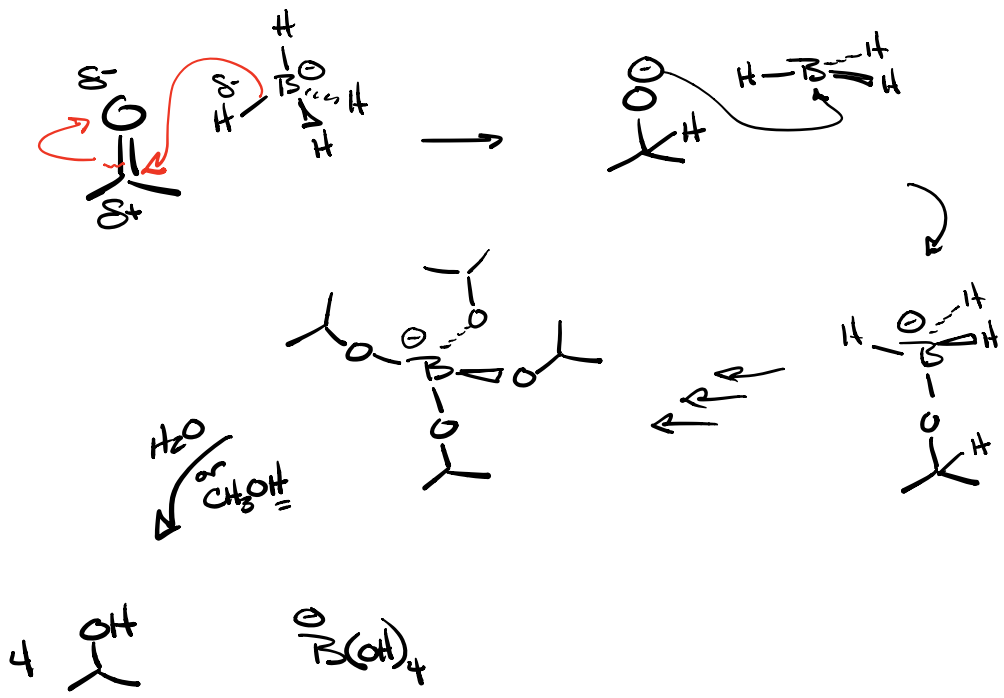


$\text{NaBH}_4$  Sodium borohydride weak reducing agent



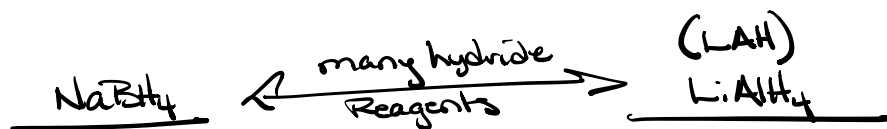
Isoelectronic with  $\text{C}^+$





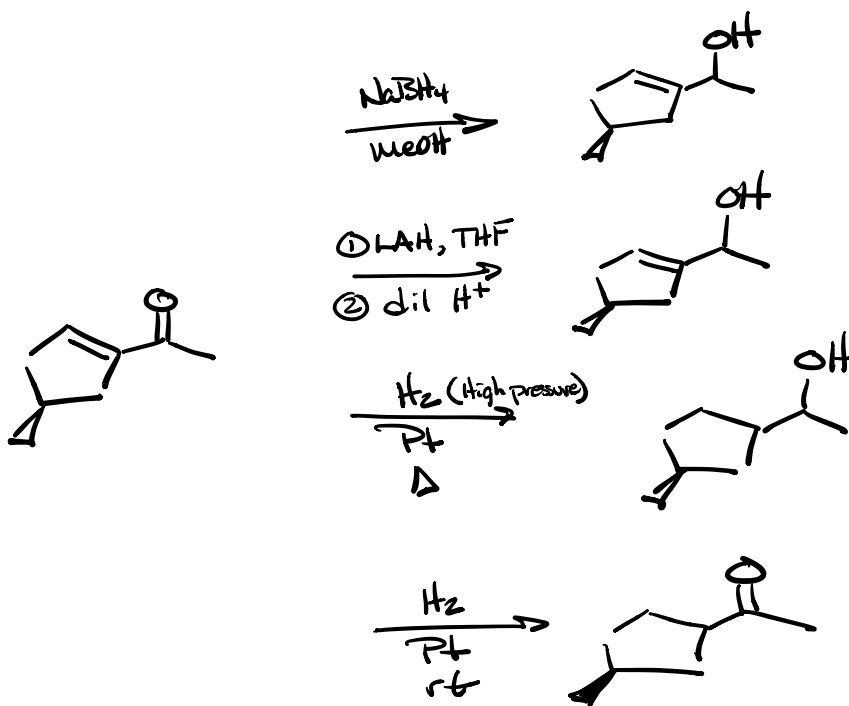
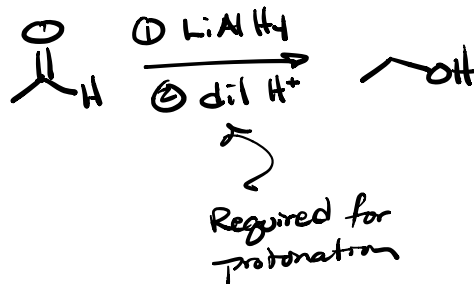
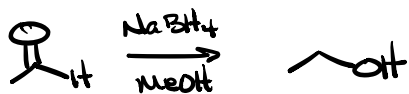
- No protic solvents!
- Must use ether solvents like THF
- Reduces aldehydes, ketones, esters, Carboxylic acids, amides, nitriles

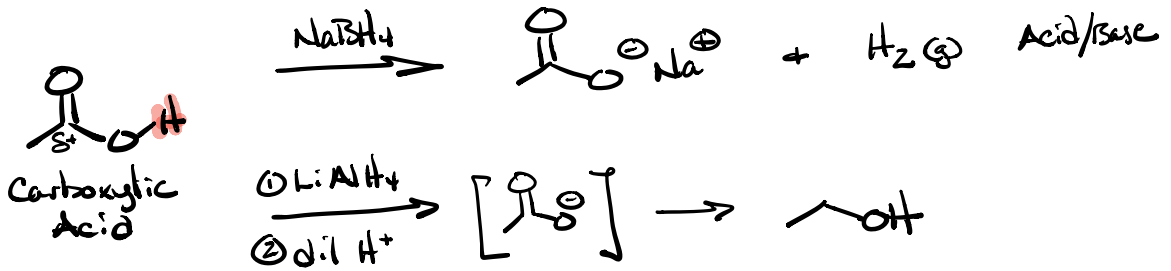
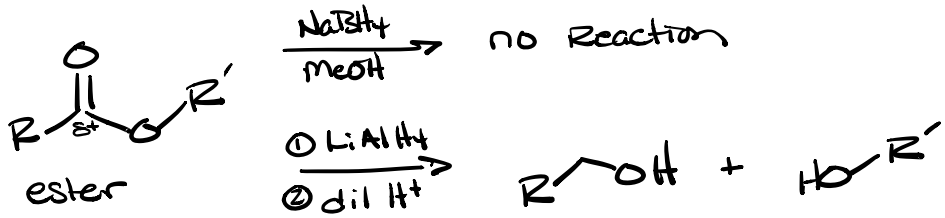




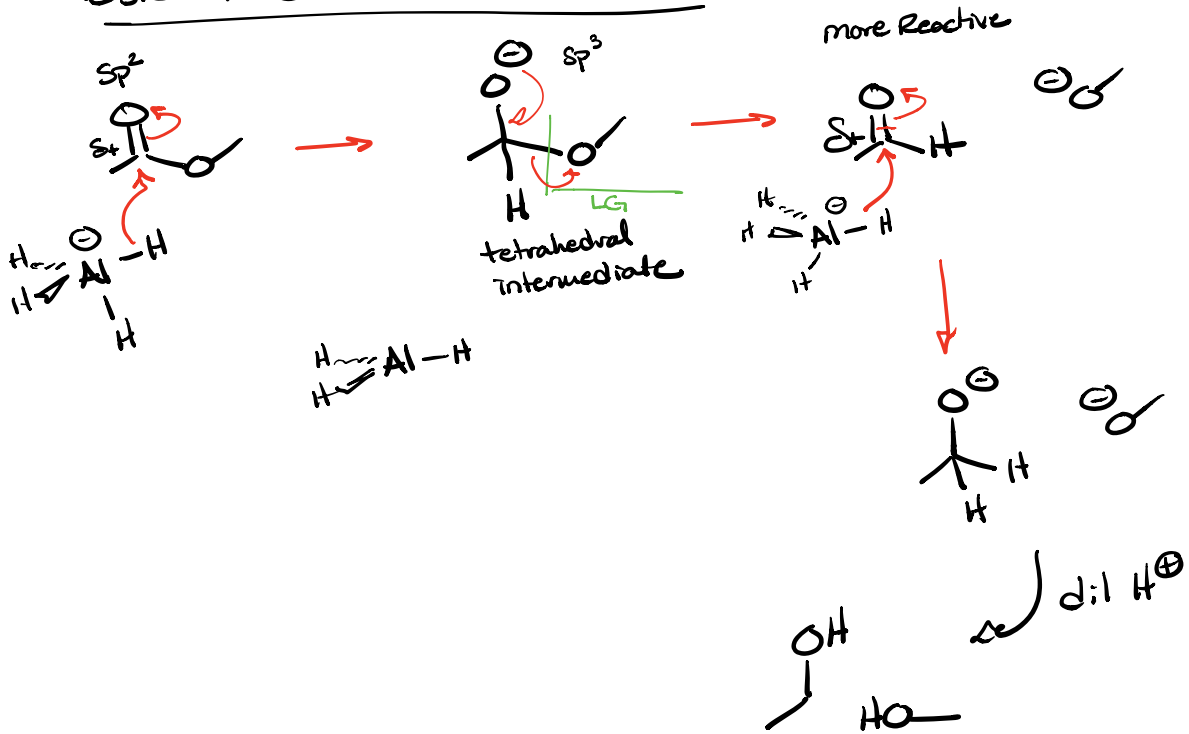
- NaBH<sub>4</sub>
- weak
  - protic Solvents OK
  - Reduces  $\text{C}=\text{O}$ ,  $\text{C}=\text{N}$  only
  - easy to work with
  - handled in air

- (LAH) LiAlH<sub>4</sub>
- Strong
  - No protic Solvents
  - Reduces many groups
  - $\text{C}=\text{O}$ ,  $\text{C}=\text{N}$ ,  $\text{C}=\text{O}(\text{OH})$ ,  $\text{C}=\text{O}$ ,  $\text{C}=\text{N}(\text{R})$
  - hard to work with
  - must be protected from air





### Ester Reduction Mechanism



ester

