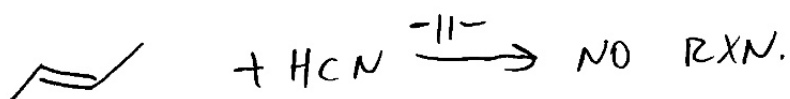
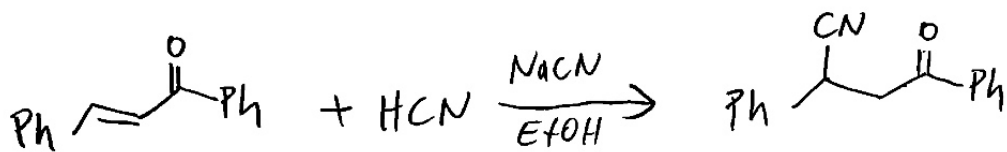
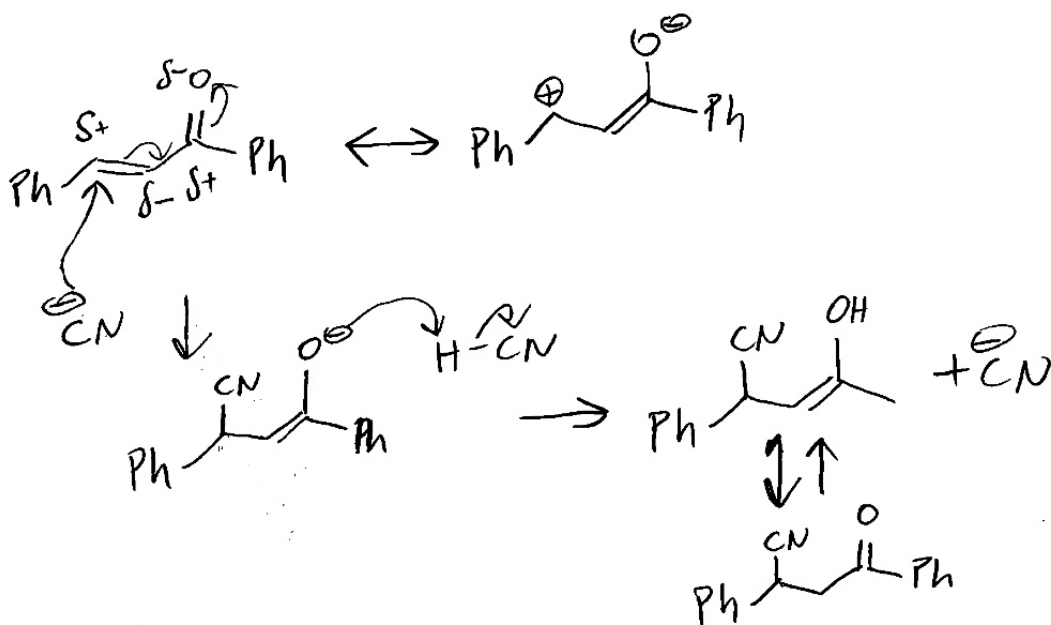


# CONJUGATE ADDITION REACTIONS

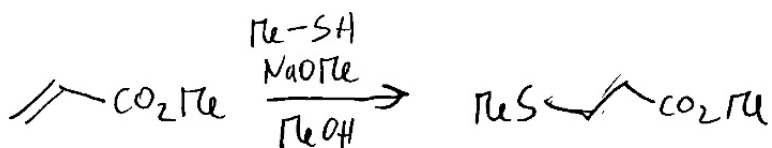
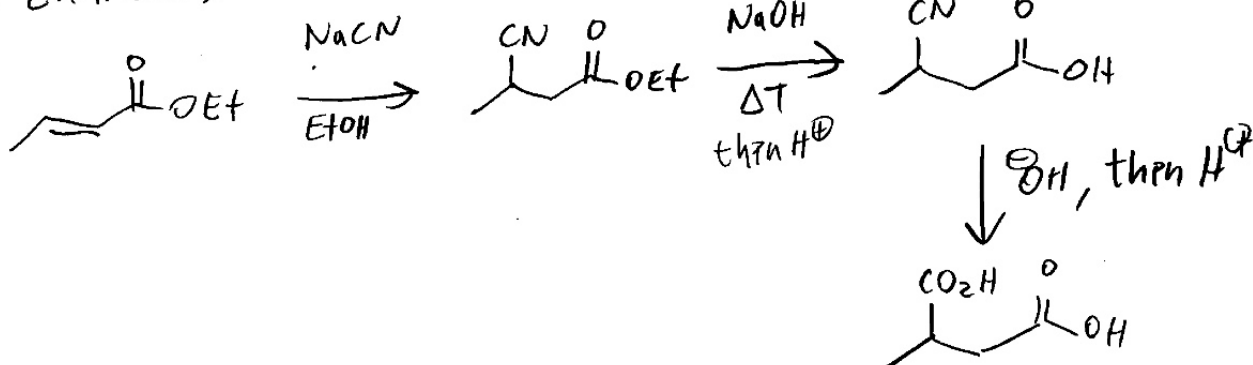
## CONJUGATE ADDITION REACTIONS TO $\alpha,\beta$ -UNSATURATED CARBONYL COMP.

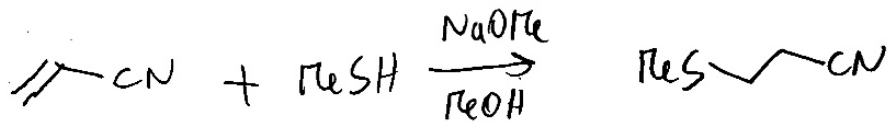
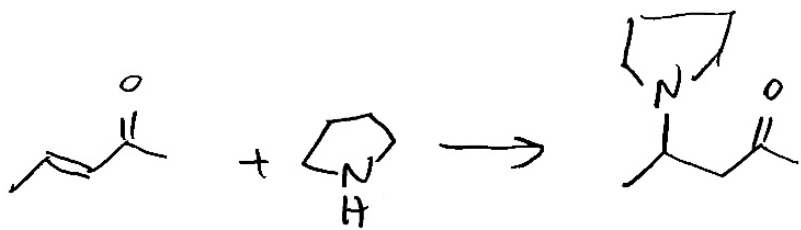


MECH:

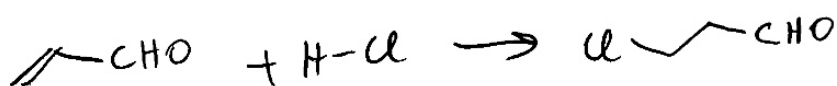
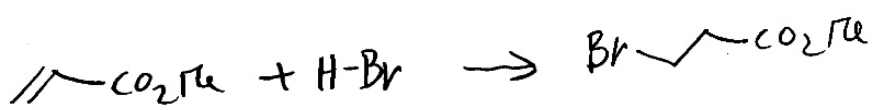


ADD. EXAMPLES:

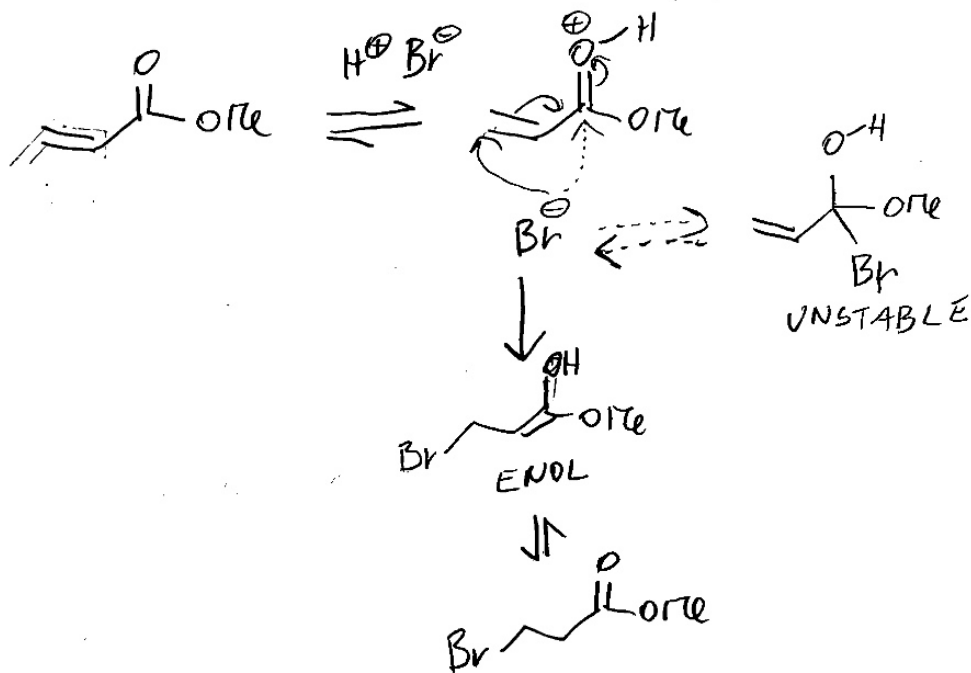




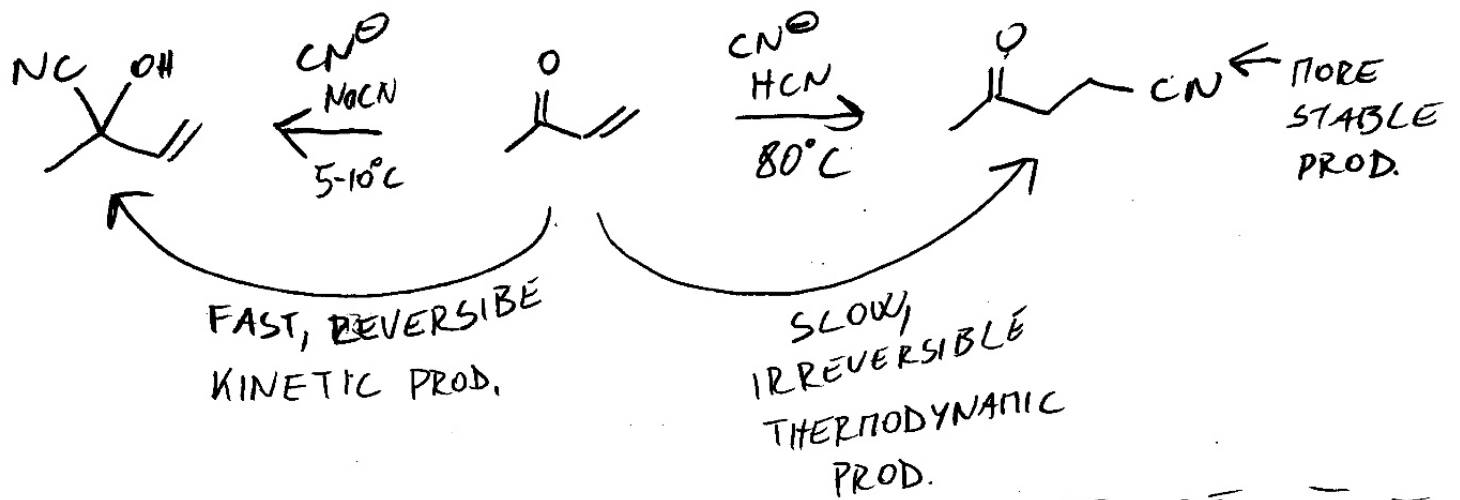
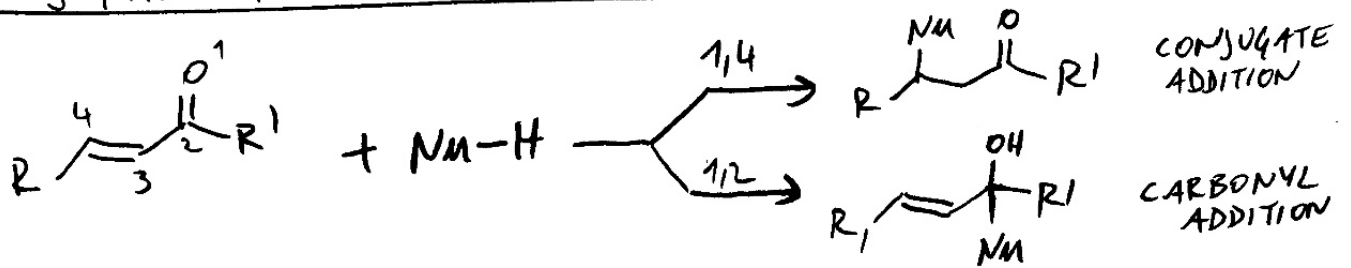
→ COULD ALSO BE ACID CAT.



MECH:



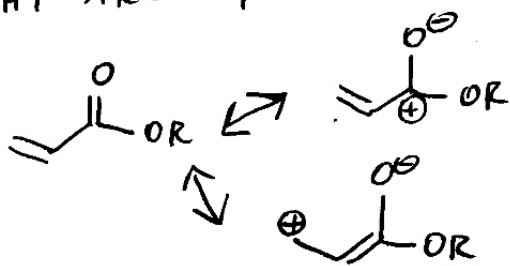
# CONJUGATE ADDITIONS VS. CARBONYL GROUP REACTIONS



WHAT ARE THE MOST IMPORTANT FACTORS THAT DETERMINE SELECTIVITY?

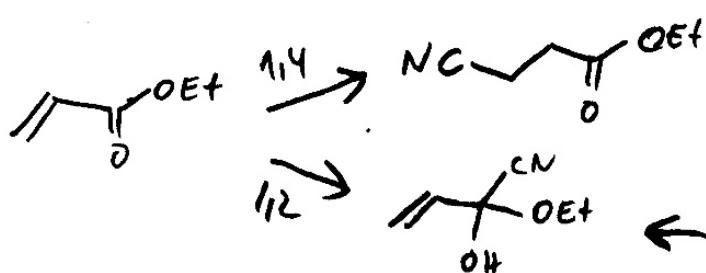
- THE REACTION CONDITIONS (KINETIC VS. THERMODYNAMIC CONTROL)
- THE NATURE OF  $\alpha, \beta$ -UNSATURATED COMP.
- THE TYPE OF NUCLEOPHILE

WHY ARE 1,2-ADDITION FASTER THAN 1,4?



POSITIVE CHARGE IS GREATER NEXT TO OXYGEN  
 SO ELECTROSTATIC INTERACTION WITH  
 NEG.-CHARGED  $\text{NU}^-$  IS GREATER → REACTION  
 IS FASTER

→ WHY IS THE 1,4-ADDITION PRODUCT MORE STABLE?

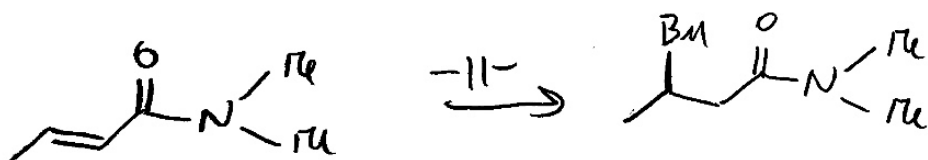
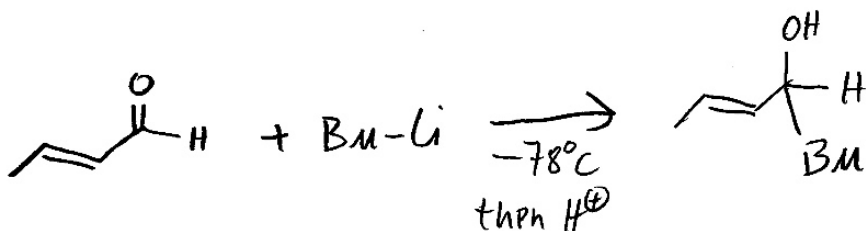


← WE GAIN  $\sigma$  C-C BOND  
LOST  $\pi$  C-C BOND  
RETAIN C=O BOND

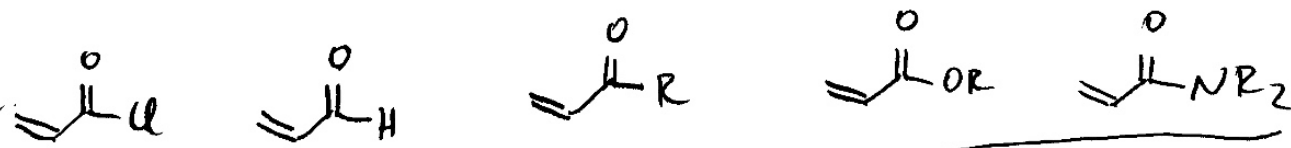
← WE GAIN  $\sigma$ -C-C BOND  
RETAIN  $\pi$  C-C BOND  
LOST  $\pi$  C=O BOND

C=O  $\pi$  BOND IS STRONGER  
THAN C=C  $\pi$  BOND

### STRUCTURAL FACTORS



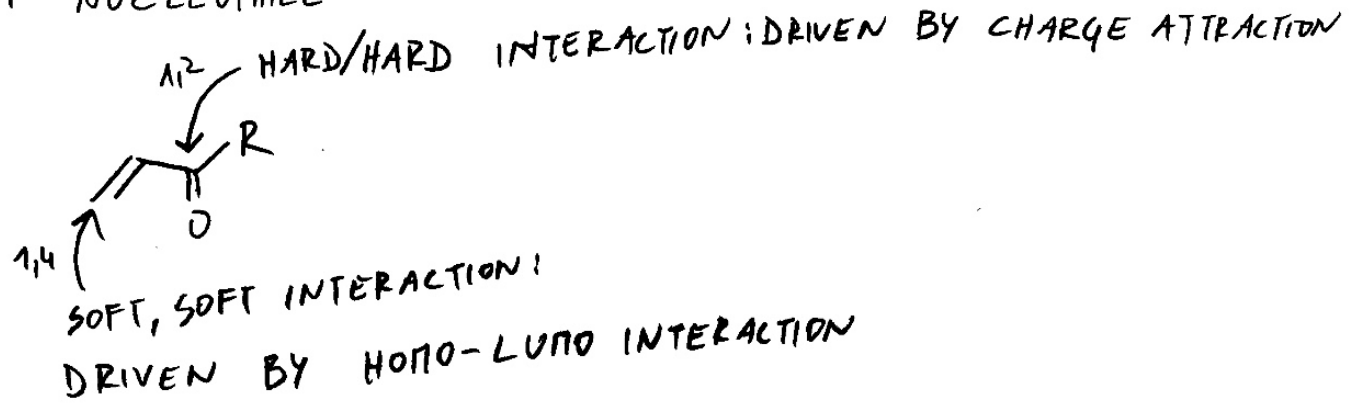
THE MORE REACTIVE IS THE CARBONYL GROUP, THE MORE  
1,2-ADDITION WE WILL OBSERVE



← REACTIVITY

← PROPORTION OF ADDITION TO CARBONYL GROUP

→ TYPE OF NUCLEOPHILE



HARD NUCLEOPHILES:  $\text{F}^\ominus$ ,  $\text{OH}^\ominus$ ,  $\text{Cl}^\ominus$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{R}-\text{MgX}$ ,  $\text{R-Li}$ ,  $\text{H}^\ominus$

BORDELINE:  $\text{N}_3^\ominus$ ,  $\text{CN}^\ominus$ ,  $\text{R-NHR}'$  (AMINES),  $\text{Br}^\ominus$

SOFT NUCLEOPHILES:  $\text{I}^\ominus$ ,  $\text{RS}^\ominus$ ,  $\text{RSP}^\ominus$ ,  $\text{RSH}$ ,  $\text{R}_2\text{-CuLiX}$

• HARD/SOFT REACTIVITY:

- REACTIONS OF HARD SPECIES ARE DOMINATED BY CHARGES AND ELECTROSTATIC EFFECTS
- REACTIONS OF SOFT SPECIES ARE DOMINATED BY ORBITAL EFFECTS
- HARD LIKES TO REACT WITH HARD
- SOFT TEND TO REACT WITH SOFT

EXAMPLE:



NOTE: THIS IS IRREVERSIBLE TRANSFORMATION