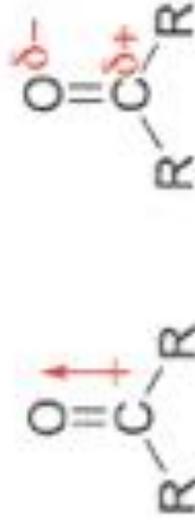


Announcements:

I will not test you on physical properties, spectroscopy or IUPAC nomenclature

Discussion start next week + *office hours*.
Quiz A in discussion next week
Bring Scantron form Apperson 20420

Lecture 2: Start Ch 20, Carbonyls!



complete

complete

no complete

♫ D'yer Maker (led zeppelin)
"Baby please don't go...."



Oxygen is more electronegative than carbon... and the pi bond between them is polarized toward oxygen. Carbon just wants oxygen to keep sharing the electrons but oxygen is pulling away...



Chapter 20: Addition of hydride and

organometallic reagents
to Carbonyls.

. First set of nucleophiles.

. How do carbonyls react?

. 1st: hydrides: Reductions

to start: Oxidation versus reduction

2

Think about oxidation state at each carbon



3 bonds to O

Highest ox state!



2 bonds to O



1 bond to O

Lowest ox state.

to decide on ox. state

more C-Z bonds Z = heteroatom

O, S, N, Br, F

= higher ox state!

more C-C or C-H

= lower ox state

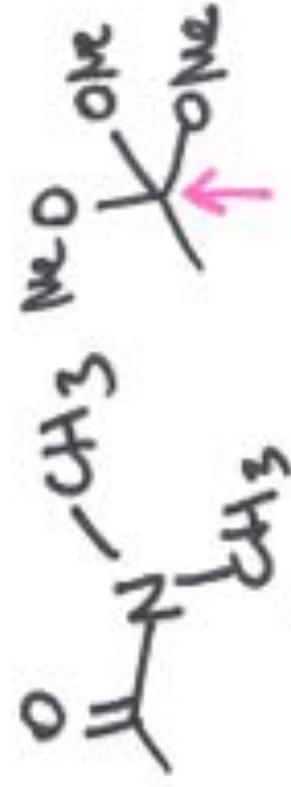
5
The "Carboxylic acid" state



3 bonds to Z



3 bonds to Z



amide
3 bonds to Z

3 bonds to O

Aldehyde oxidation state



2 bonds to Z



ketones

2 bonds to Z



2 bonds to Z



ketal

2 bonds to O

Why do we bother?

quickly assign ox state
decide do I need to reduce
or oxidize?



Carboxylic
acid
ox. state

alcohol

ox
state

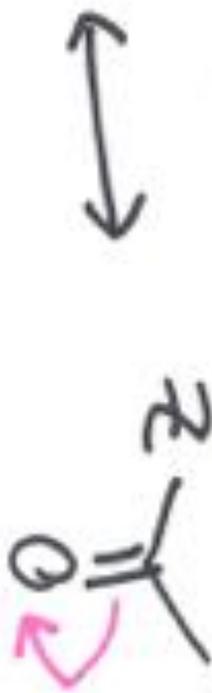
Ch
20.3

∴ Must be a reduction
somewhere

7

Reactivity of C=O

Resonance
Structures!
← resonance →
(arrows)

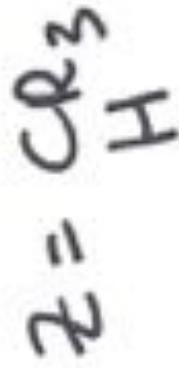
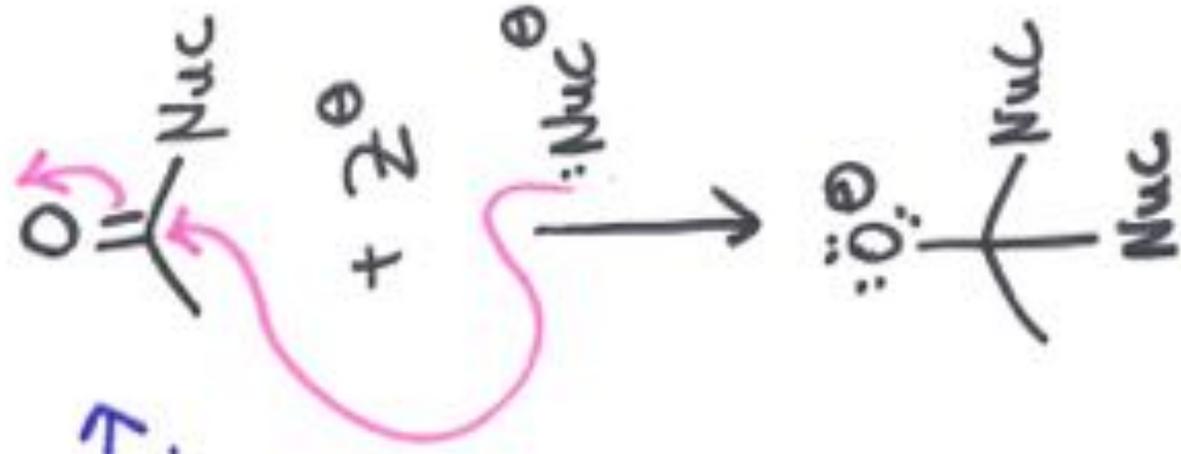
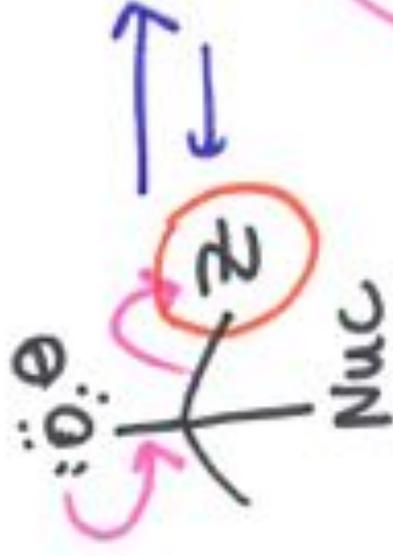
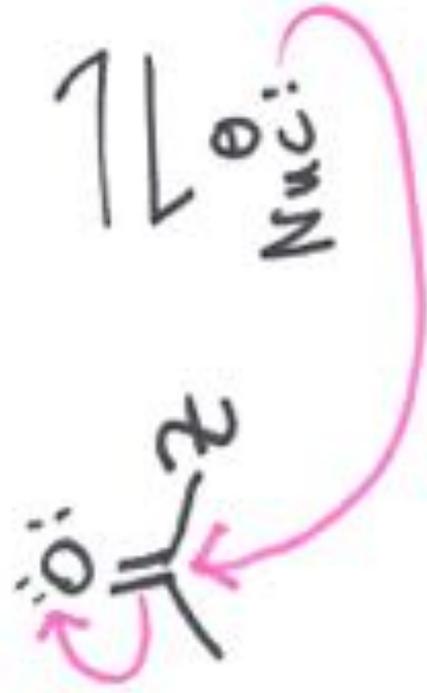


Real structure : Resonance hybrid

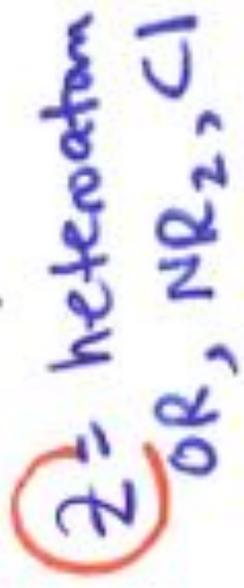
unicorn? resonance hybrid

horse ← → rhino
 Resonance structure Resonance structure.

How do they react?



Reaction
Stops.



Keep going!!

ALL
QUARTER

$z =$ many things

$Nuc^{\ominus} =$ many
things

Sort all carbonyls...

2 classes:

① \bar{z} = not a leaving group.



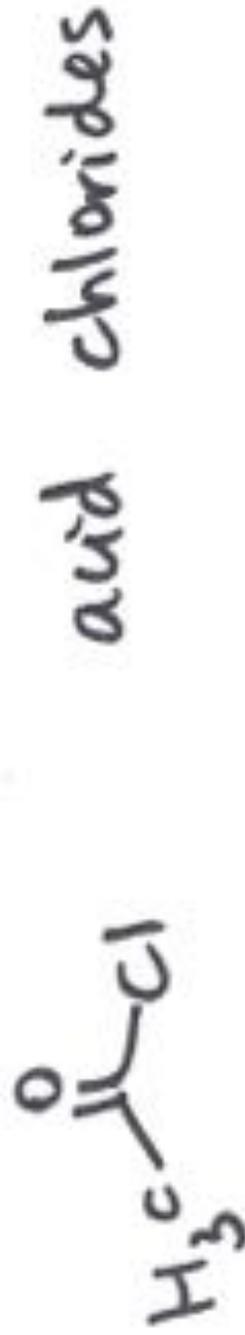
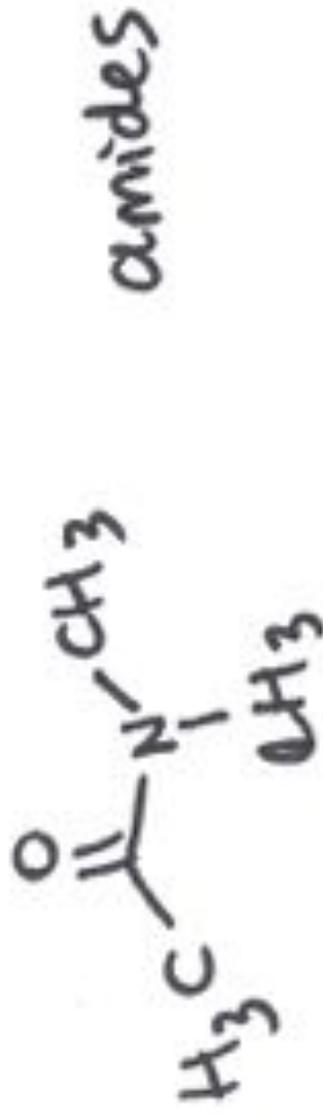
aldehyde



ketone

Nucleophiles
typically
add
once...

② $Z =$ is a leaving group



nucleophiles
Sometimes
add
twice.....

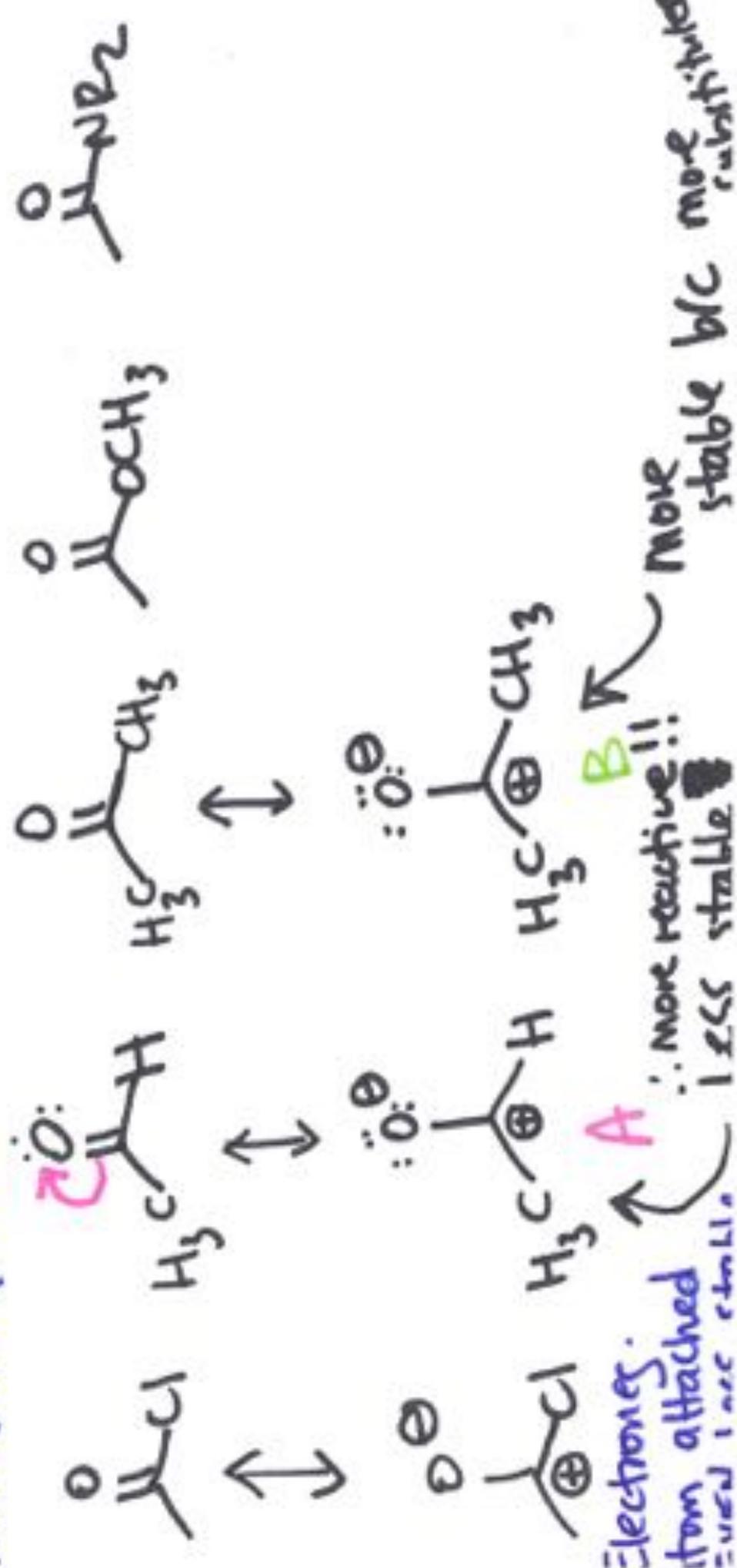
All of these functional groups

react similarly.

most ← how electron poor is the carbonyl carbon
Least

electrophilic
more electrophilic

electrophilic



LEAST reactive!!!
amide

3 resonance
structures

N is
better
donor
than
O

better
stabilizes

ester

Less
reactive
Less
electrophilic
than
ketone

Spreading charge through
resonance stabilizes the
compound.

ketone

electron
donating
groups stabilize
S+

