

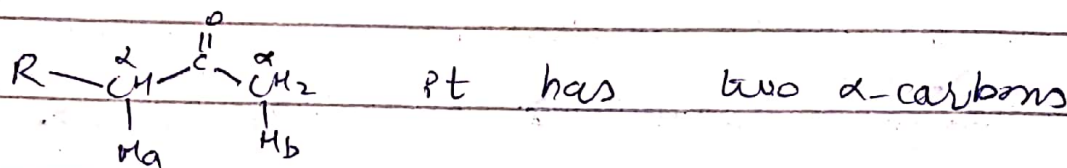
Thermodynamic & Kinetic Controlled

Symmetrical carbonyl (ketone)

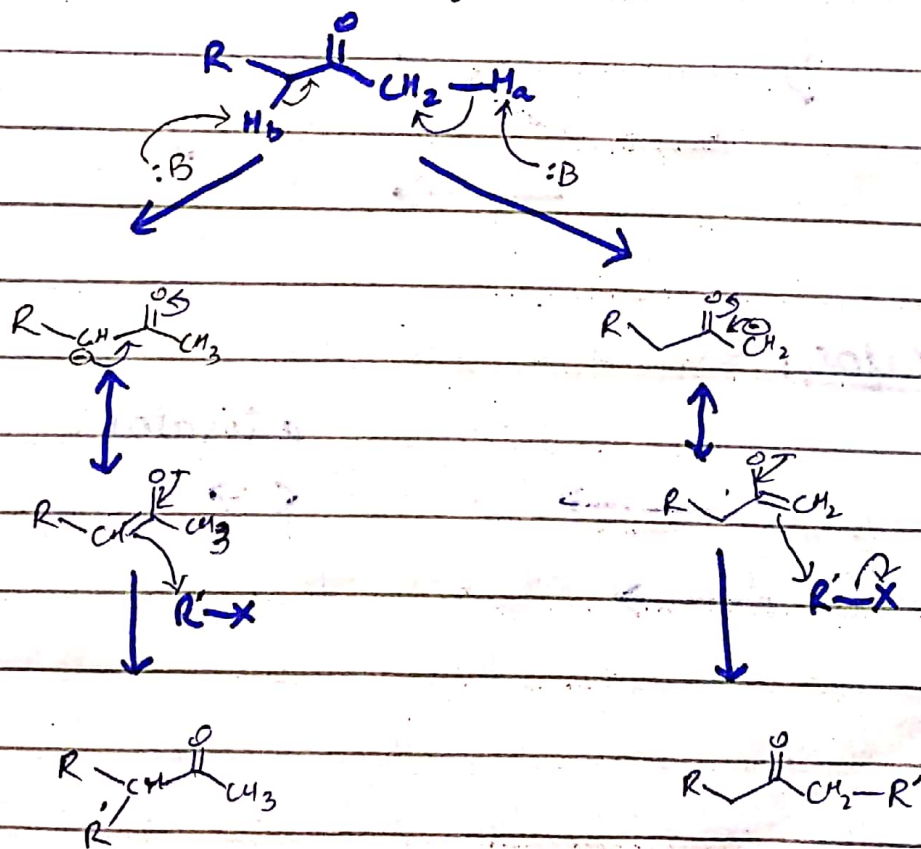
Reactions:-

In this case $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$ proton can be removed from both sides. because both are similar-

Unsymmetrical:-



but Hydrogen attach to this are not same-
It can form two types of enolate



TCP

KCP

"Thermodynamically controlled products"

"kinetically controlled products"

Both of These are Regioselective Reactions

Thermodynamically controlled

product and enolate are called thermodynamic controlled

Stability is favoured

If reaction conditions are thermodynamic than that product is formed which stable

TCP more stable

Require reversible conditions before formation.

Require medium strong Base

Small Bases like KH and NaH are used

Require more time at least over time.

Require high temperature (or room temp) at overnight.

Require protic solvent

Require soft base.

Kinetically controlled.

product and enolate are called as kinetic controlled

Rate of reaction is favoured.

If conditions are kinetic than those product are formed which is fast/easy to form. KCP formed rapidly.

Require irreversible conditions.

Require strong Base

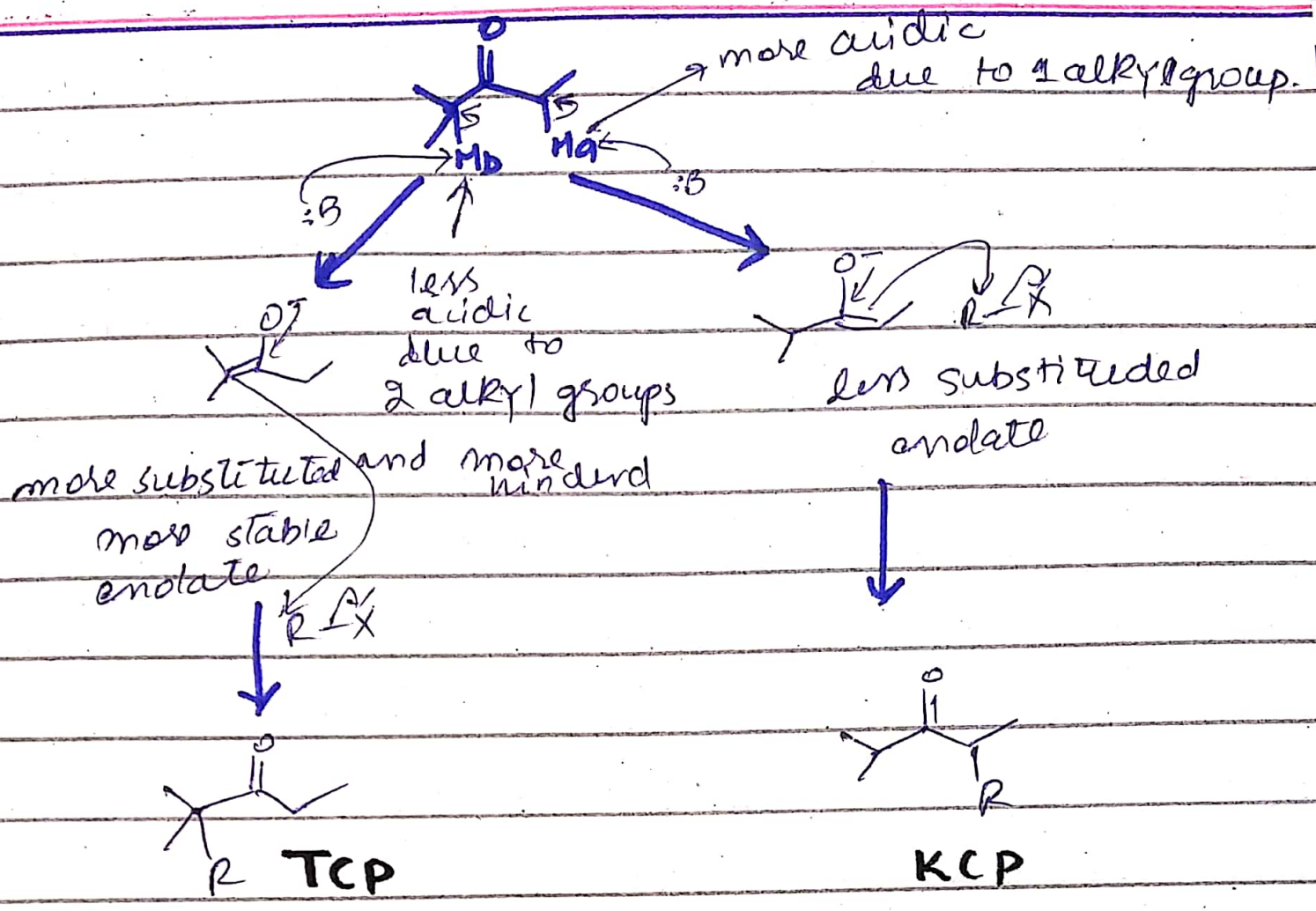
Large Bases like LDA is used.

Require less time.

Require low temp (-78 or 40°C)

Require aprotic solvent.

Require hard Base



Hard Base

oxophilic

small size

concentrated so tightly

hold e⁻

Allow irreversible reactions

less polarizing power

They are bad ~~base~~ Nu[⊖]

F[⊖]

Soft Base

large size

loosely bound e⁻

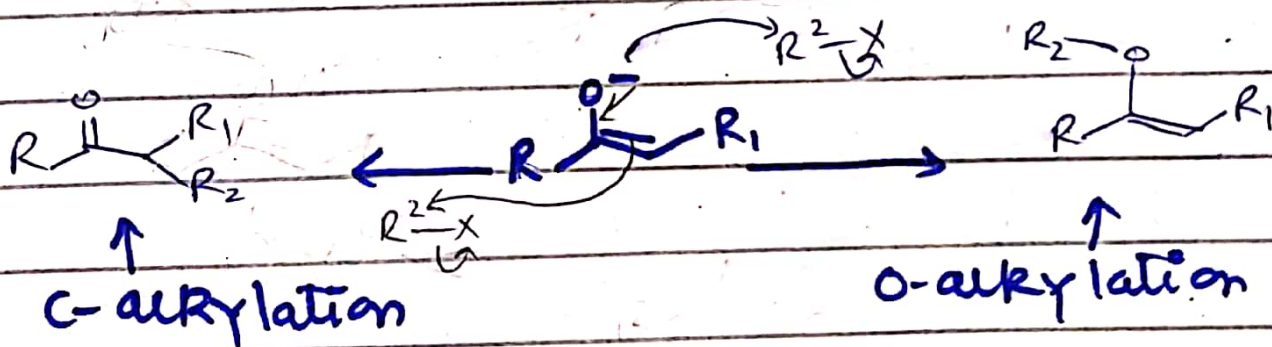
Allow reversible reaction

larger polarizing power

they are good Nu[⊖]

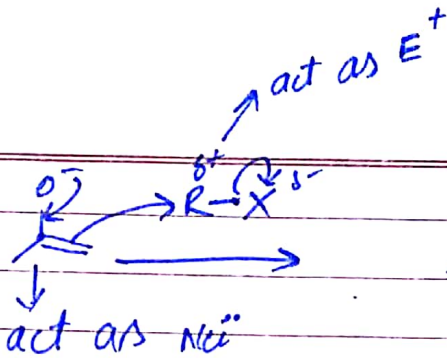
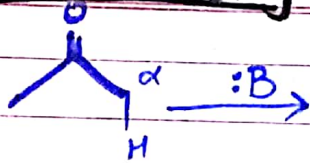
I[⊖]

O-Alkylation and C-Alkylation:

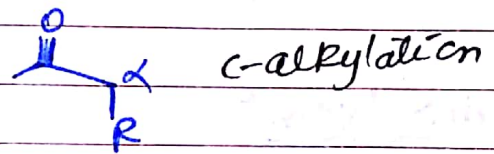


As oxygen has negative charge it can undergoes alkylation and act as nucleophile itself.

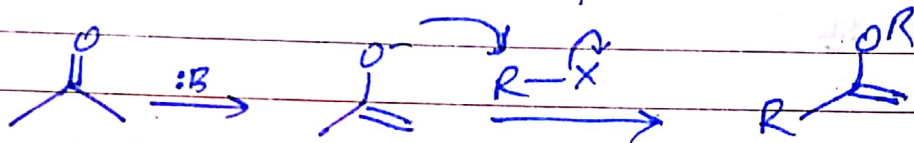
1st Possibility



M T W T F S S



2nd possibility :- Oxygen has negative charge it can itself act as nucleophile.



It is called o -alkylation - alkyl group is attach to oxygen.

In which **conditions** C -alkylated or o -alkylated products are formed?

→ **Solvent** → **medium polar** → for C -alkylation

→ **Aprotic polar** → o -alkylation

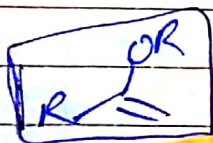
↓ used as additives (HMPA)

(HexaMethyl PhosAmide)

Which is more favoured:-

In C -alkylation $C=O$, $C-C$ bonds are formed. $BE = 1076$ kcal/mol **more bond E** ↑ more stable

In o -alkylation $C-O$, $C=C$ are formed **less stable** ↓ less stable
 $BE = 976$ kcal/mol



are called as **enol ethers**, **vinyl ethers**. They react after their formation, used as intermediates. They are less stable.

By **Hydrolysis** form enols and **enolate/carbonyl**

Date: _____

M T W T F S S

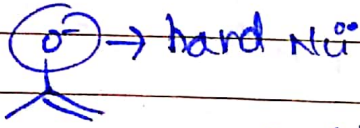
O-alkylation \Rightarrow Reversible.

(i) Solvent

OAlkylation
polar aprotic

c-alkylation
Medium polar
(THF, DEE)

(ii) Hard / soft Nu \rightarrow less charge density.



O-Alkylation
Nu- is hard

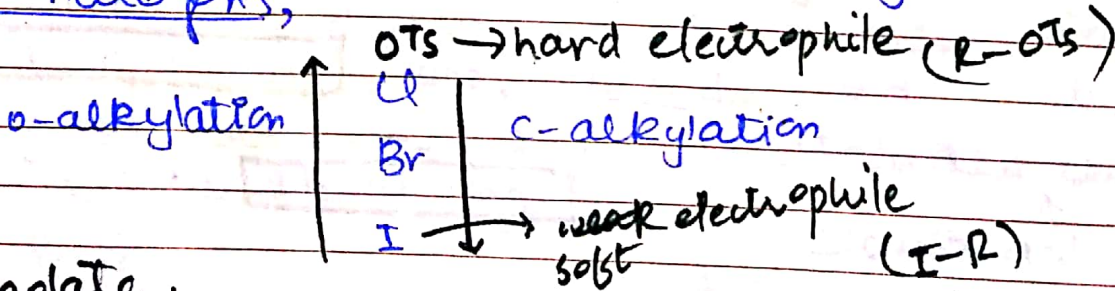
c-alkylation
Nu⁻ is soft
Enolate are soft Nu⁻

(iii) Like favour like

"Hard Nu⁻ favour removal of
Hard leaving group.
Soft Nu⁻ favour soft leaving
group"

Soft leaving group \Rightarrow c-alkylation
hard " " \Rightarrow O-alkylation.

In halogens,



Enolate:

enolates are called **ambident** nucleophile because the negative charge on enolate is delocalized by resonance over two non-equivalent atoms.

ev charge is delocalized by resonance