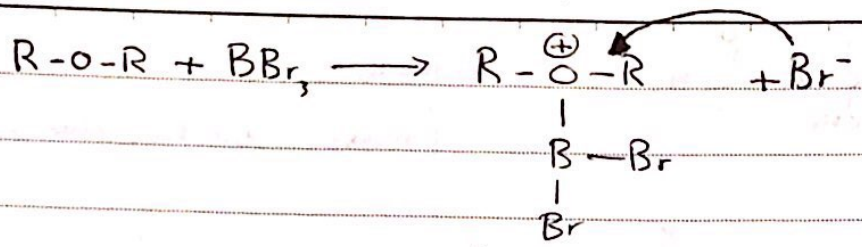
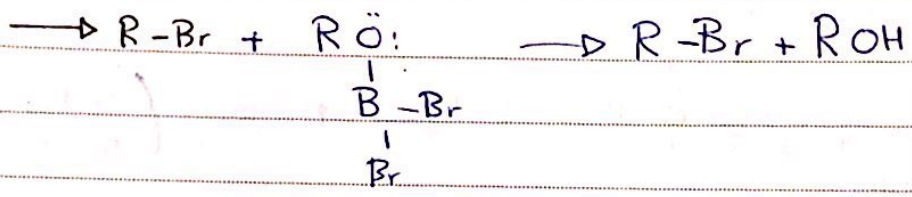
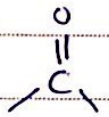
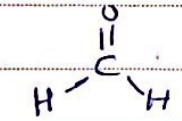
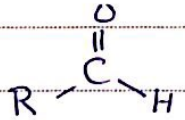


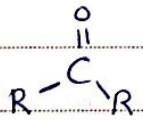


Chapter (9) : Aldehydes & Ketones

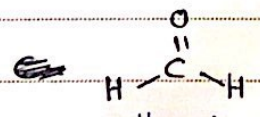

carbonyl group

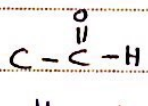

formaldehyde ← common name . methanal

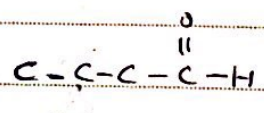

aldehyde

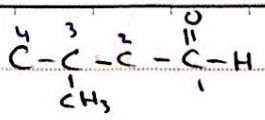

ketone

9.1) Naming aldehydes and ketones


methanal

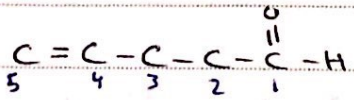

ethanal


butanal

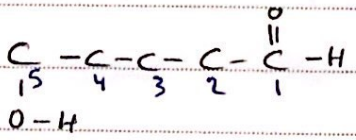


3-methyl butanal

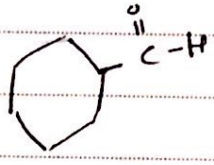
(numbering starts from carbonyl)



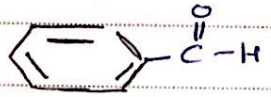
4-pentanal (carbonyl has priority)



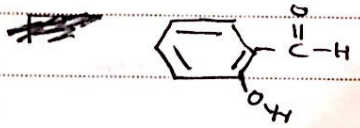
5-hydroxy pentanal (carbonyl has priority)



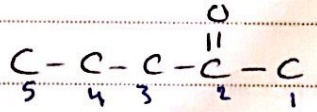
cyclo hexan carbaldehyde



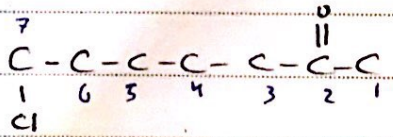
benzaldehyde



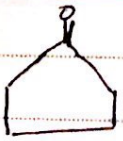
o-hydroxy benzaldehyde



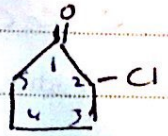
2-pentanone



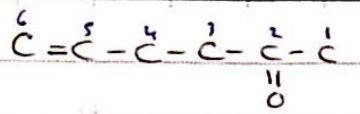
7-chloro-2-heptanone



Cyclo pentanone

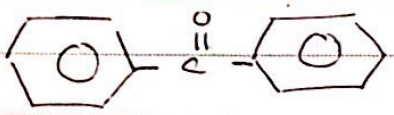


2-chloro cyclo pentanone



5-hexen-2-one

acetophenone



benzophenone

not included
just know acetone

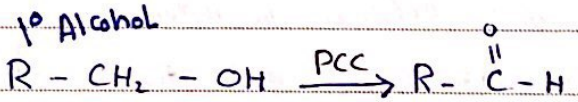
→ 9.2) Some common aldehydes and ketones

acetone is used as a solvent because it is protic.

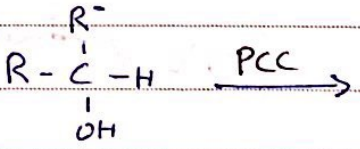
9.3) Synthesis of aldehydes and Ketones ← basically a revision of previous rxns

[1] Oxidation of alcohols

1° Alcohol

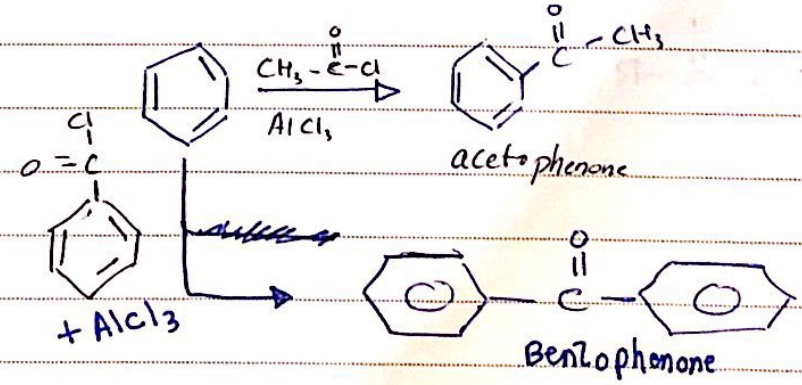


2° Alcohol



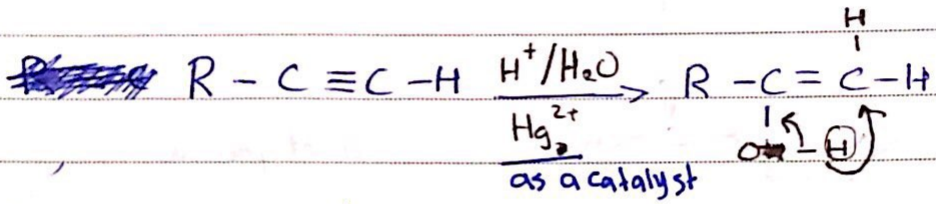
← Prime means that it could be the same or different R.

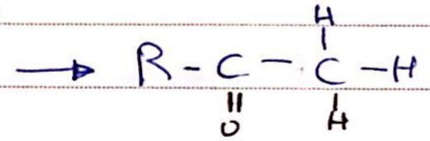
[2] Aromatic Ketones

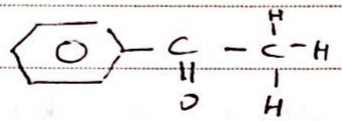


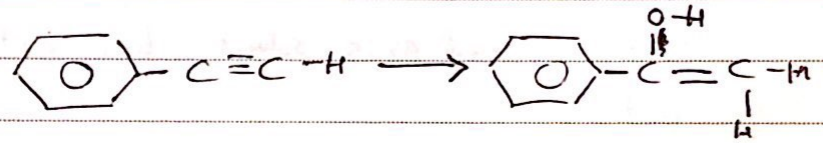
NO.

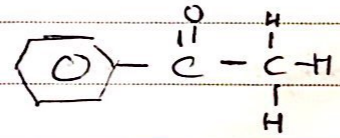
[3] Methyl Ketones





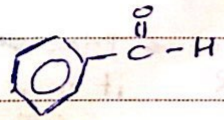
e.g. prepare  starting with an alkyne.



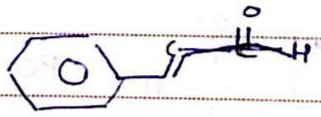


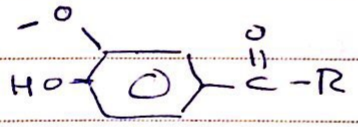
9.4] Aldehydes and Ketones in nature

Know the names and structures of the examples.



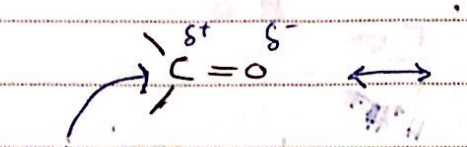
benzaldehyde



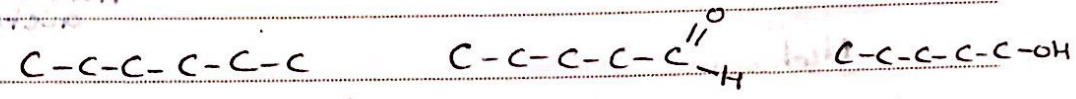


NO.

9.5) The carbonyl group

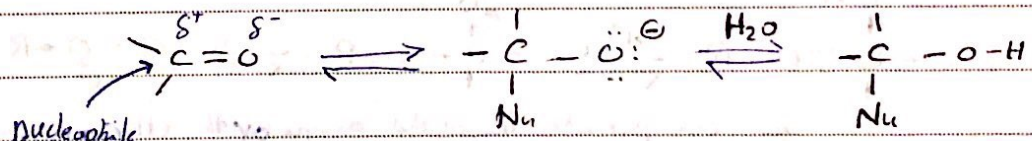


Nucleophile



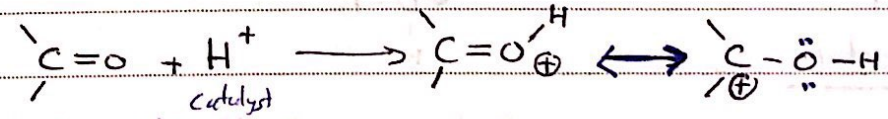
b.p.	69	102	118
	1) dipole-dipole		H-bonding
~~Alcohol can make one hydrogen bond with another alcohol molecule~~	2) can hydrogen bond with water		

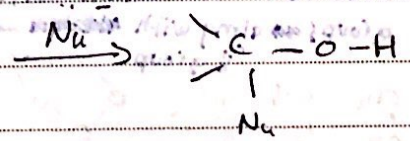
9.6) Nucleophilic addition to carbonyl groups



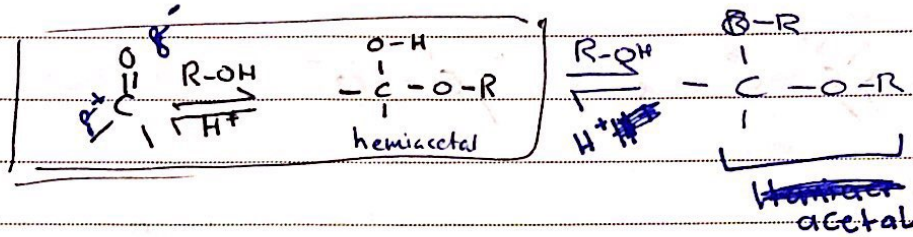
Nucleophile
Nu:⁻

Nucleophilic addition ra



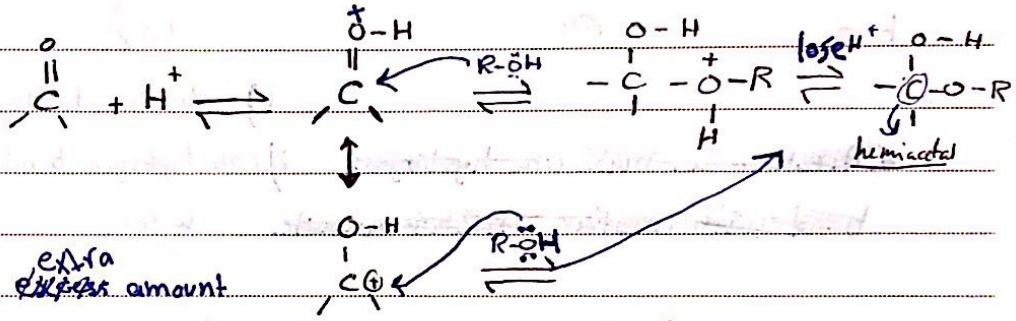


9.7) Formation of alcohols : formation of hemiacetals and acetals

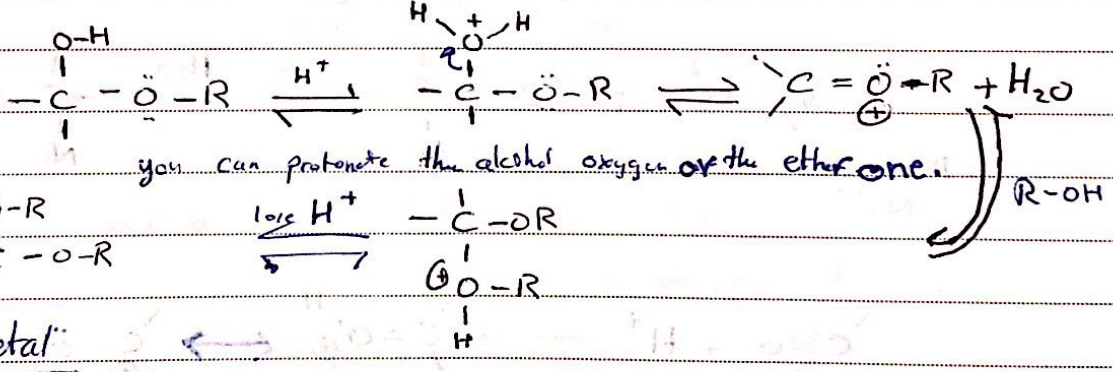


Mechanism:

hemiacetal: compound has C connected to an alcohol and an ether oxygen

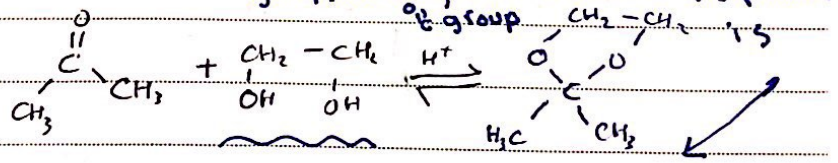


- Note:- when we have extra amount of Alcohol, hemiacetal compounds will complete reaction to form acetal compounds.



acetal: Compound has C connected to 2 ethers.

when there is a reactant with 2 OH groups along with the product

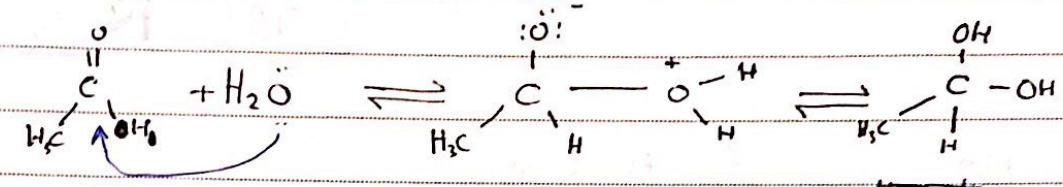


cyclic acetal

THIS IS THE THE CHEMISTRY OF SUGARS

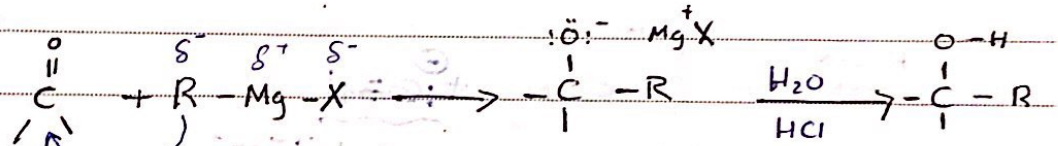
NO.

9.8) Addition of water

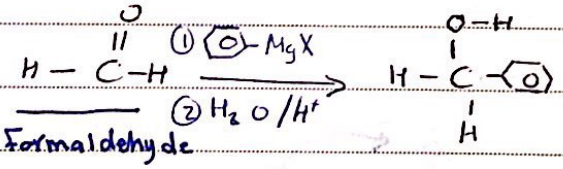


- Hydrate is very reactive molecule in oxidation of Alcohols. Hydrate to aldehydes.

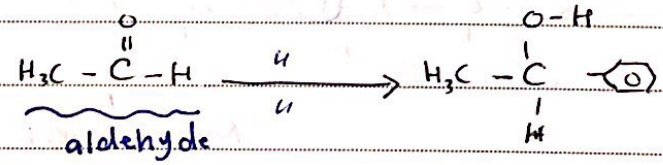
9.9) Addition of $R-MgX$ and $R-C\equiv C^{\ominus}$



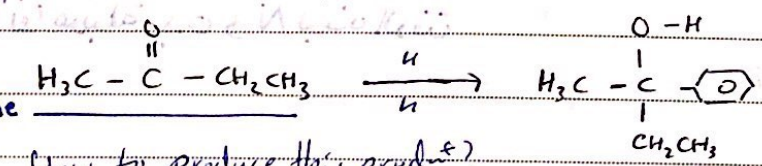
Methods of preparing alcohols:- (A) Addition of R-MgX



Formaldehyde — 1° alcohol

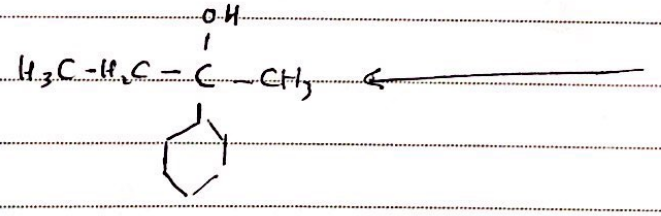


aldehyde — 2° alcohol



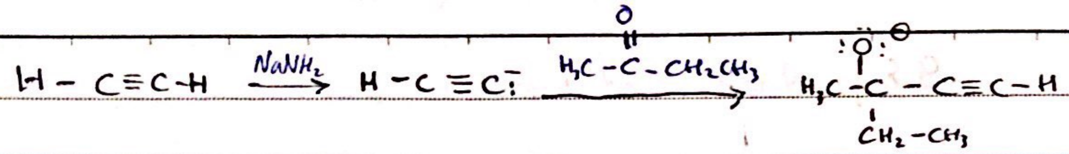
Ketone — 3° alcohol

How to produce this product?



we can use the CH_3, CH_2CH_3, as the grignard therefore, we have 3 combinations to get the product

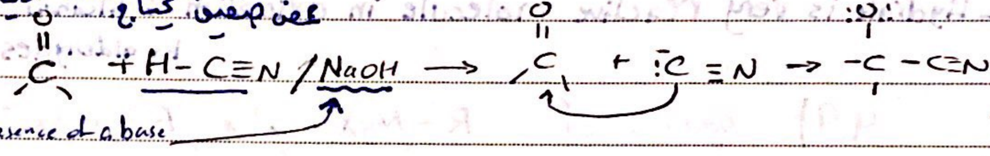
NO.



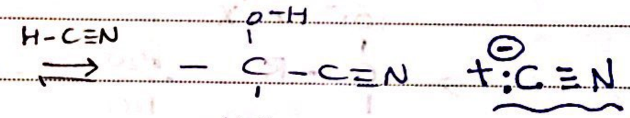
CHAPTER 3

9.10) Addition of H − C≡N

عن ضعيف بحتاج قاعدة قوية



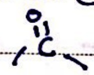
presence of a base



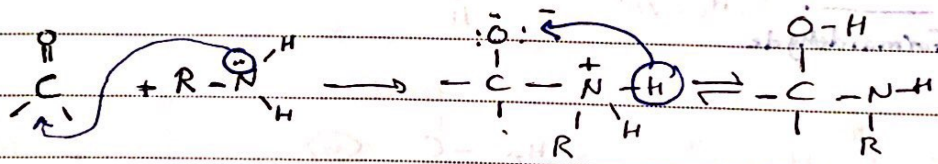
nitrile

رح ترجع تتفاعل مع

"cyanohydrin"



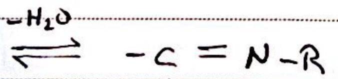
9.11) Addition of nitrogen nucleophile



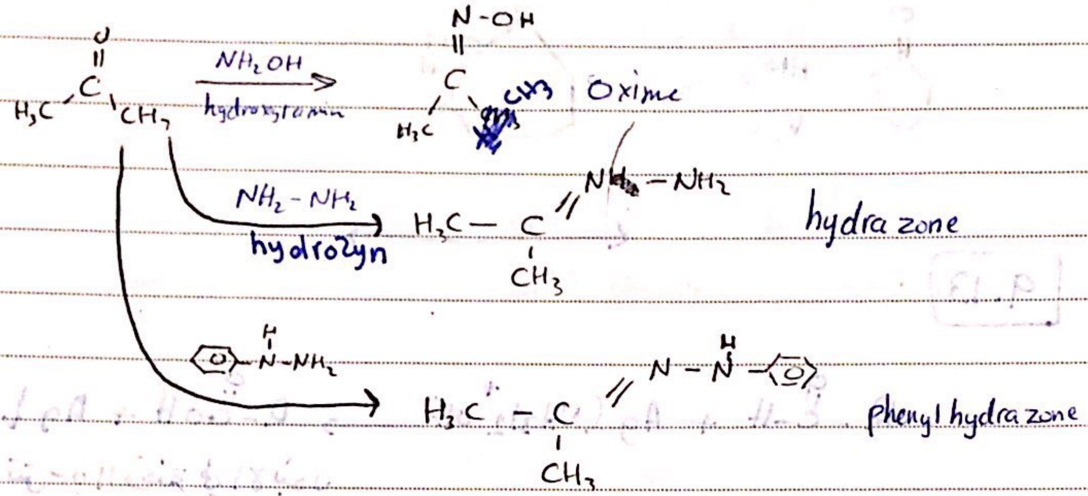
aminal

NOT STABLE

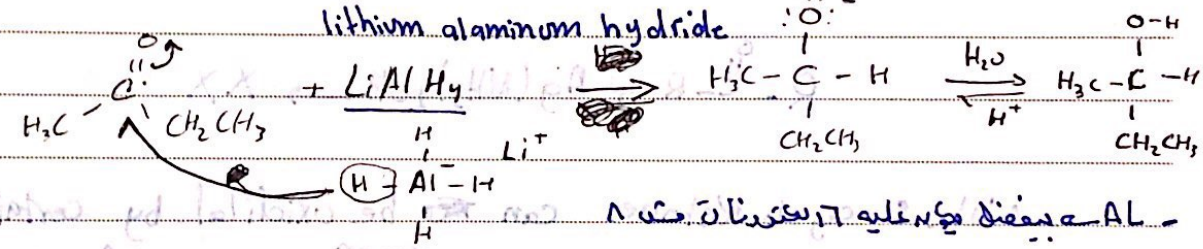
لأنها مرتبطة بـ O و N بنفس الوقت



imine

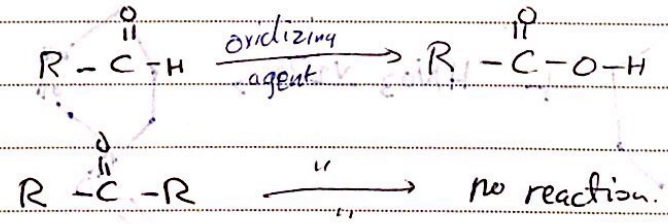


9.12) Reduction of carbonyl compounds

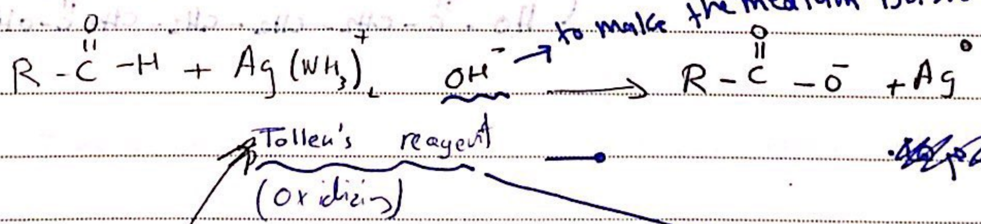


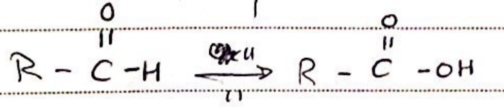
- AL بيفقد فيصير عليه 6 الكترونات بدل 8
بيتبرع بذرة H مع الكتروناتها

9.13) Oxidation of carbonyl compounds



Used to distinguish aldehydes from ketones





* نستخدمه عشان التمييز بين الألديهايد والكيتون.

NO.

Chapter 9

9.9

(B) - Addition of $H-C\equiv C^{\ominus}$

- $H-C\equiv C-H \xrightarrow{NaNH_2} H-C\equiv C^{\ominus}:Na^{\oplus} \xrightarrow{CH_3-\overset{\overset{O}{\|}}{C}-CH_3}$

$H-C\equiv C-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3 \xleftarrow{H_2O/H^+} H-C\equiv C-\underset{\underset{CH_3}{|}}{\overset{\overset{:\ddot{O}:^{\ominus}}{|}}{C}}-CH_3$

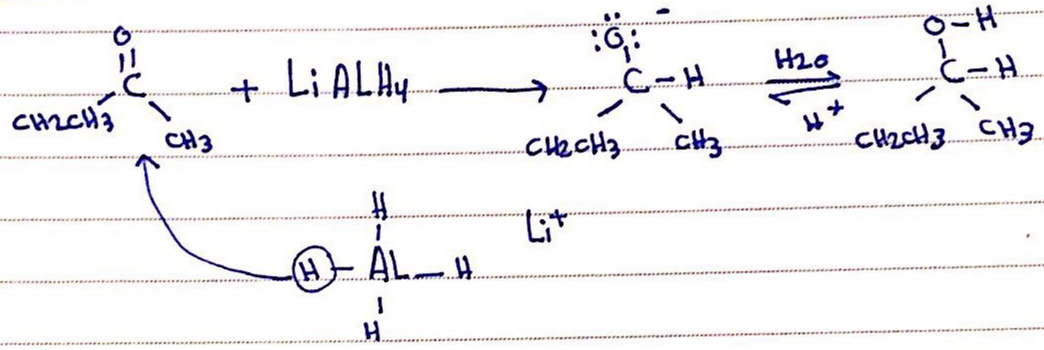
this Compound can be involved in the rxns of Alkyne.

$H-C\equiv C-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

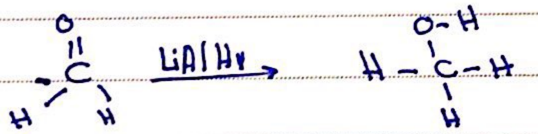
- $\xrightarrow{2H_2 / Pt}$ $CH_3-CH_2-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$
- $\xrightarrow{H_2/\text{lindlar catalyst}}$ $CH_2=CH-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$
- $\xrightarrow[H^+/Hg_2^+]{H_2O}$ $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3$

Chapter 9

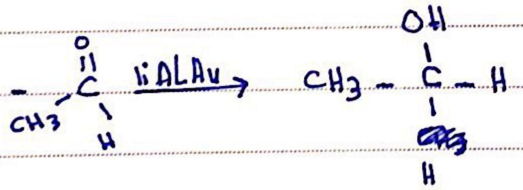
9.12 Reduction of Carbonyl Compounds



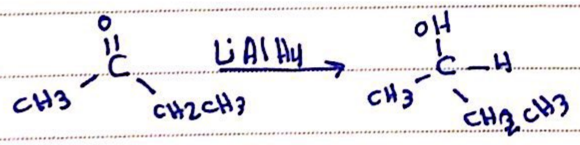
* ذرة الألمنيوم تفضل يكون حوليها ٦ إلكترونات مش ٨ ــ راح تتبرع بذرة H مع إلكتروناتها للأكسجين.



methanol



Ethanol 1° alcohol



2° Alcohol

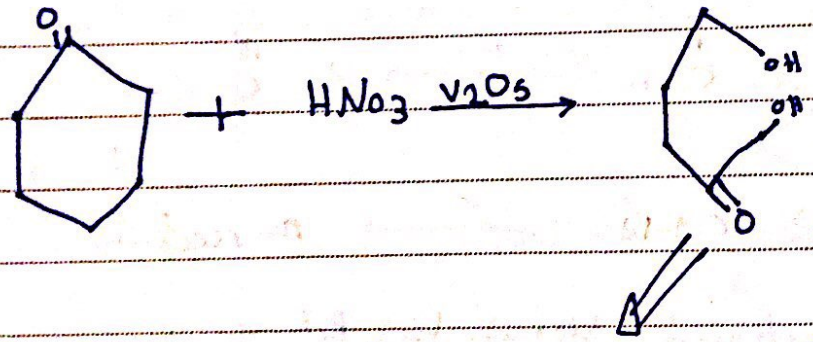
9.13

$$R-\overset{O}{\overset{\|}{C}}-H + Ag(NH_3)_2^+ OH^- \longrightarrow R-\overset{O}{\overset{\|}{C}}OH + Ag\downarrow$$

مع تترسب الفضة في الانبوب على شكل مرآة.

$$R-\overset{O}{\overset{\|}{C}}-R + Ag(NH_3)_2OH \longrightarrow XX$$

- Note: cyclo Ketones can be oxidized by certain oxidizing agent → as we need it in many artificial aspects in our lives.



$$\left(HO-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_2-CH_2-\overset{O}{\overset{\|}{C}}-OH\right)$$