



Handwritten Notes
On
Reduction



LearningMantrasOfficial



LearningMantras

Reduction !

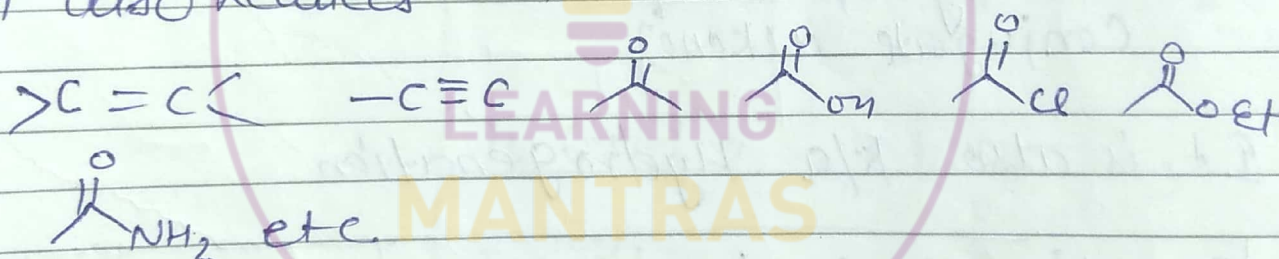
* Reduction :

- Addition Hydrogen
- Removal of oxygen
- (+)ve charge ↓ (≠)
- (-)ve " ↑

* Reduction by H_2 / cat ! (Ni or Pt or Pd)

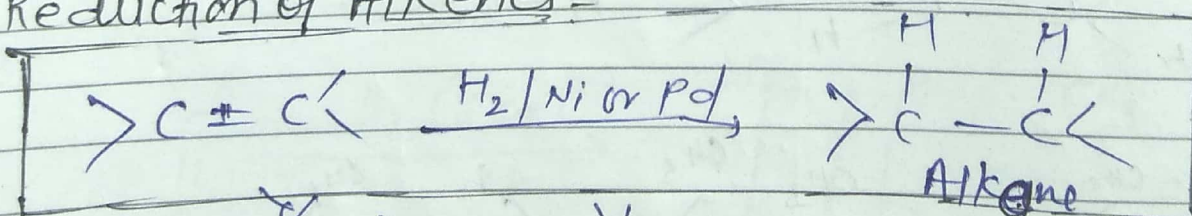
It Reduces all those group which have π Bonds

It also Reduces $R-X$.

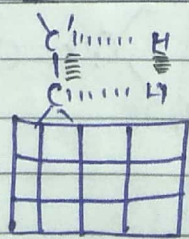
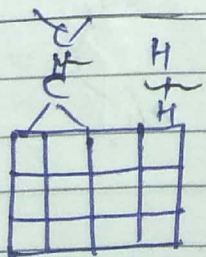


* Reduction of Alkene and Alkynes !

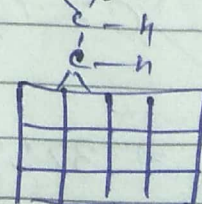
* Reduction of Alkenes :



Mech^m :

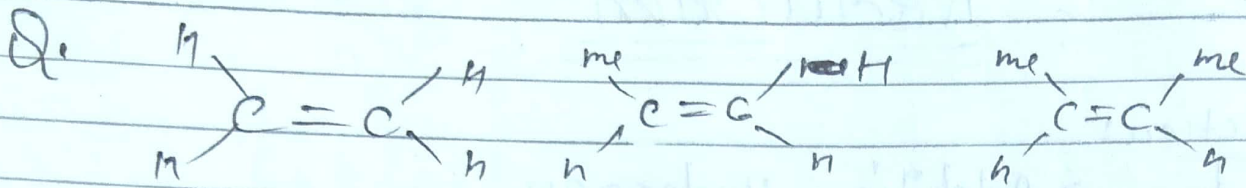


4 m c TS ✓

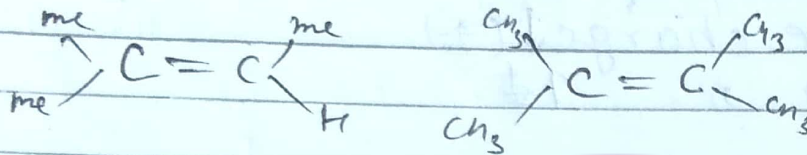


orb-electrophilic

Its adsorption phenomenon



R.O of above alkene



1 > 2 > 3 > 4 > 5

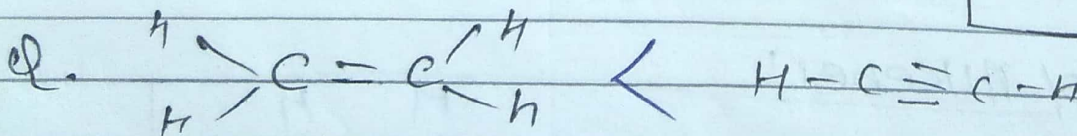
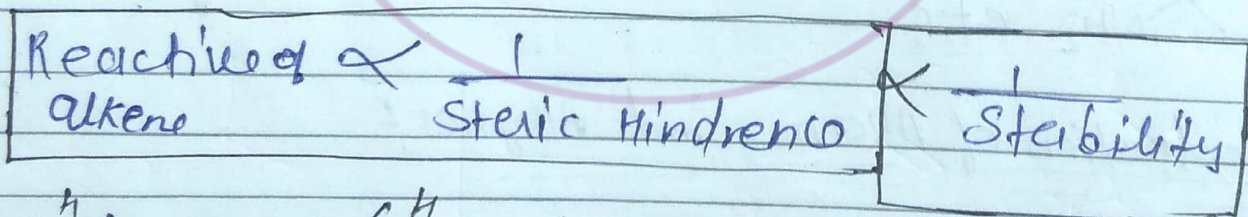
* Its Syn addition Process (SAP)

Cis-alkene \rightarrow Erthro
Trans-Alkene \rightarrow Threo

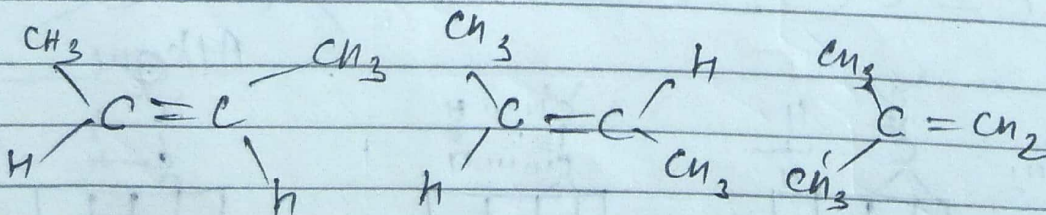
* It occur by formⁿ of γ -m.c.T.S (for Non Conjugate alkene)

* It is also k/a Hydrogenation

*



Ques!



SO \Rightarrow 3 > 2 > 1

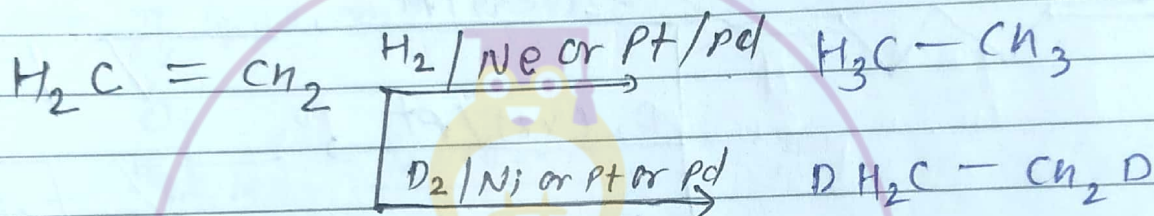
R.O = 1 > 2 > 3

H.O.H = 1 > 2 > 3.

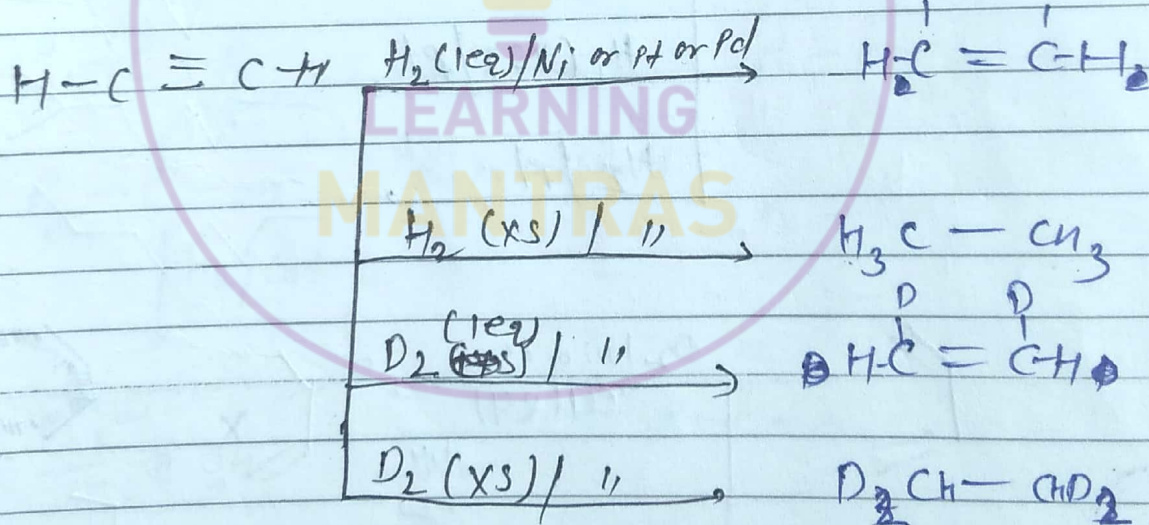
In this Rxⁿ Heat evolve which is known as Heat of Hydrogenation (H_{OH}) (in kcal)

* Similar Reduction can also of alkyne can also be done 1 mole of Hydrogen converted alkyne to alkene, 2 mol of H converted alkyne to alkane

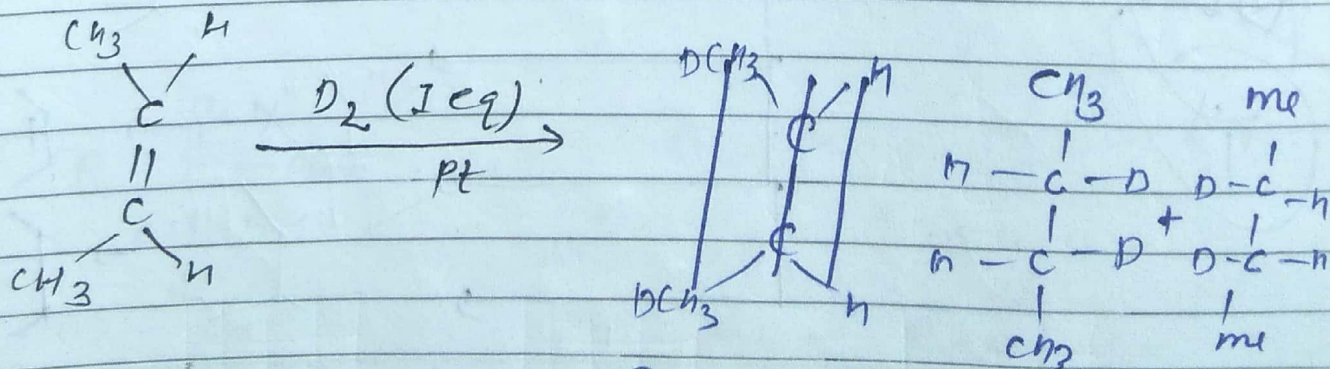
Q.1



(2)

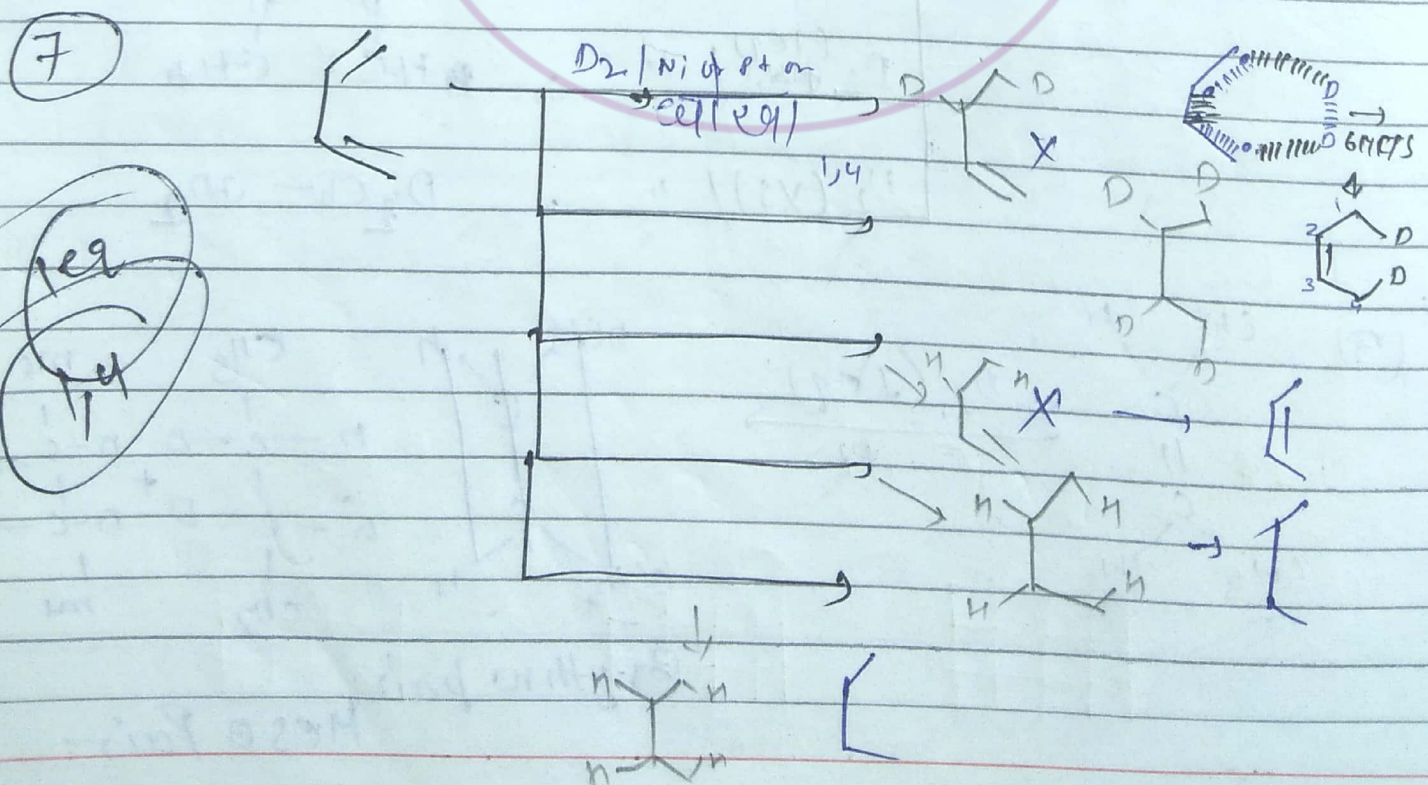
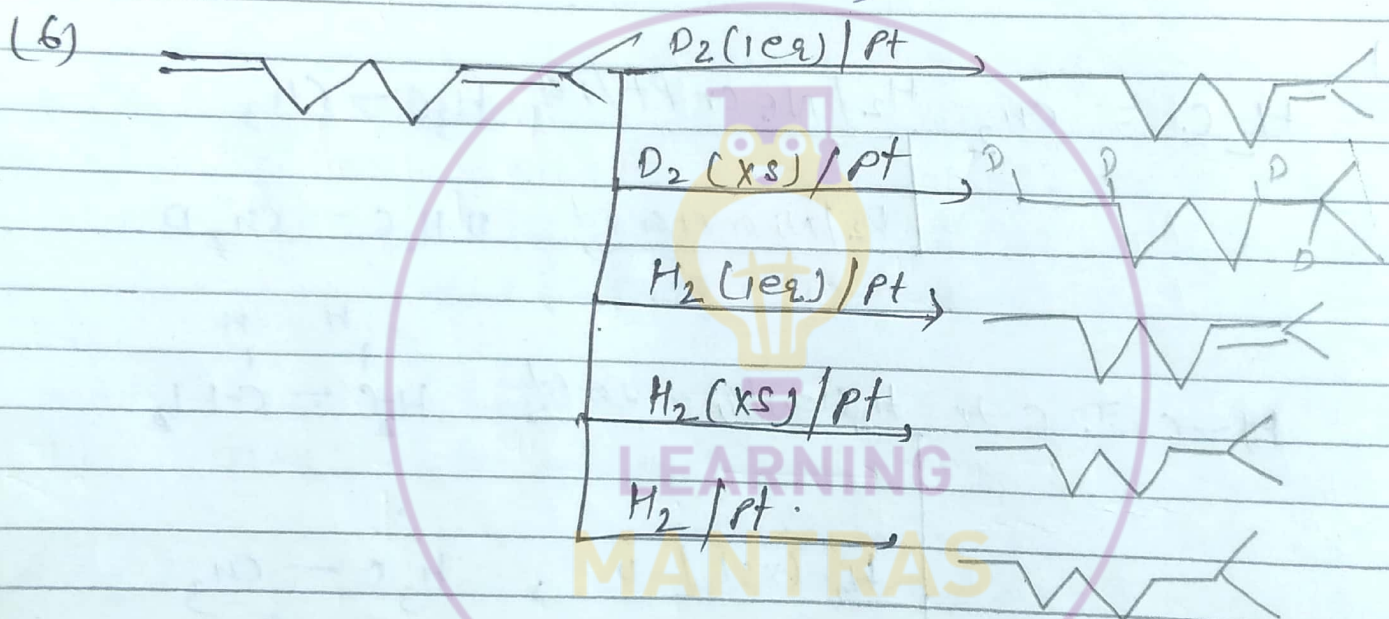
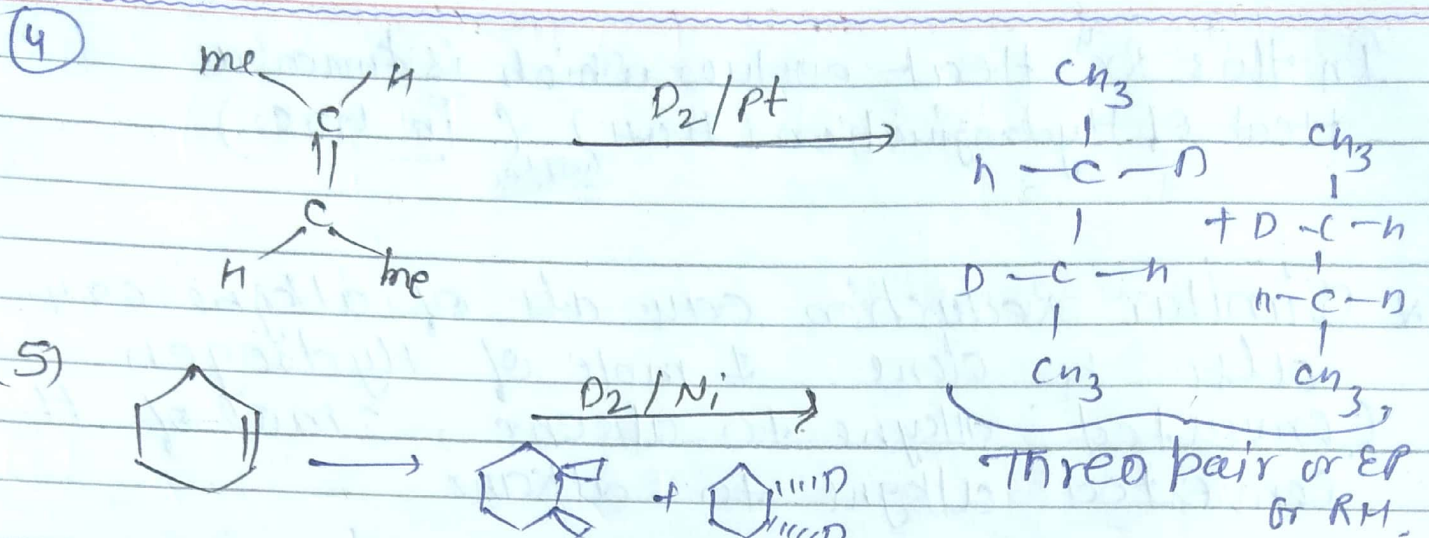


(3)



Erythro pair

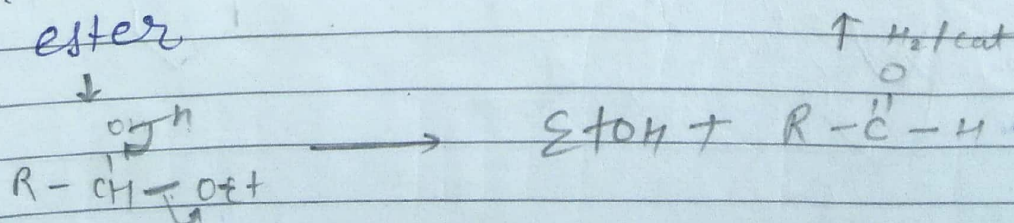
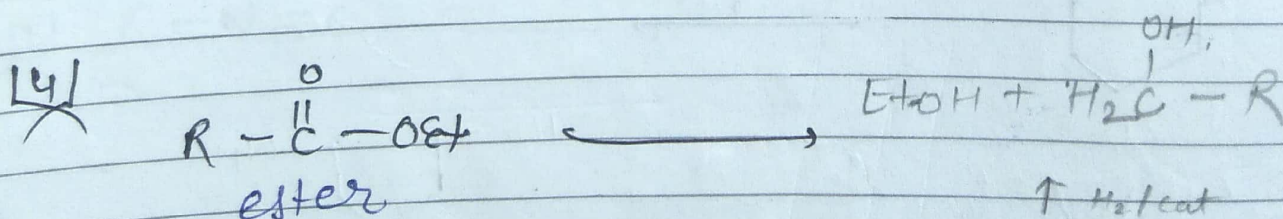
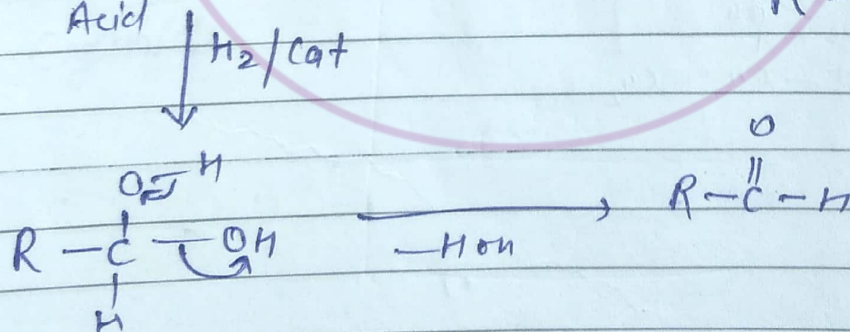
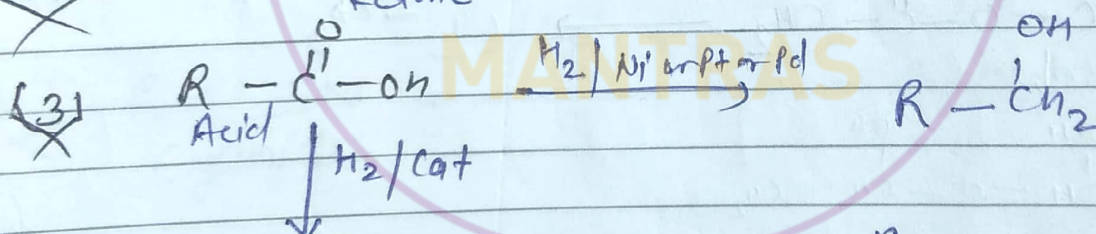
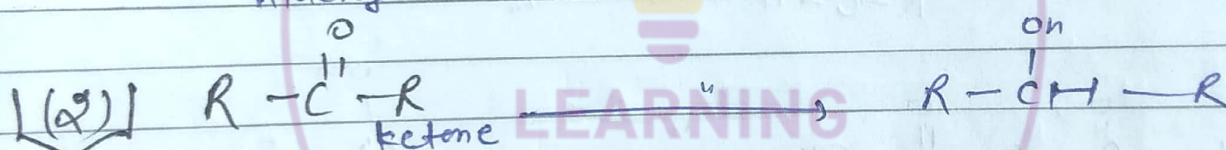
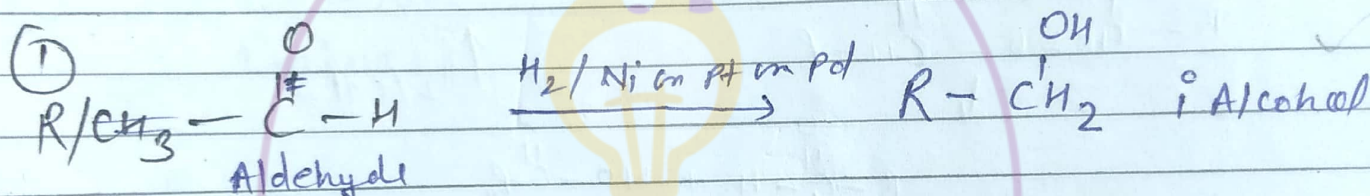
Meso Pair

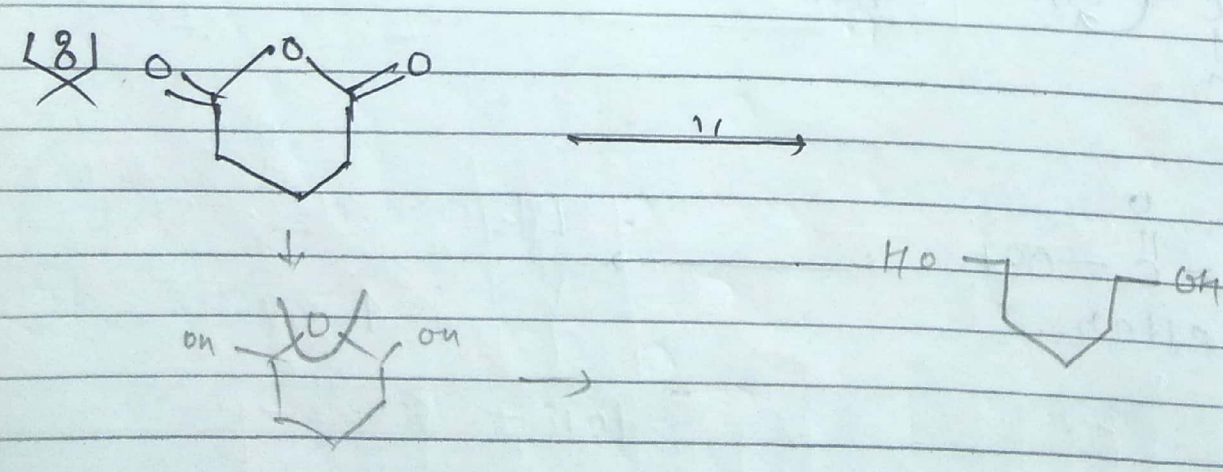
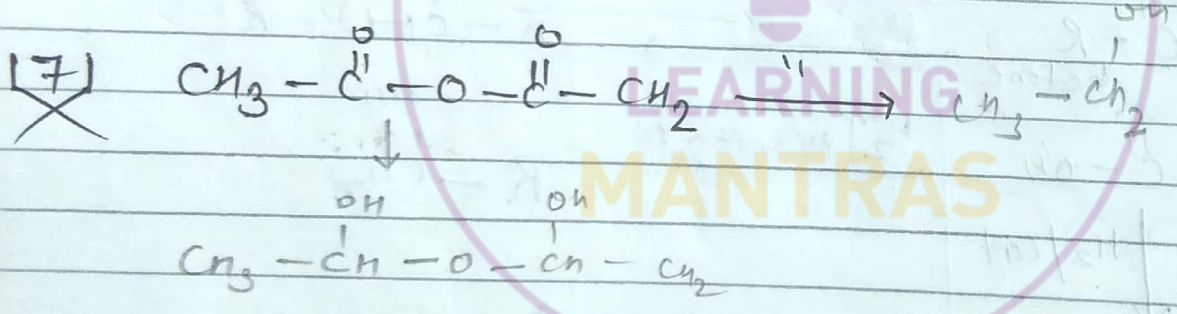
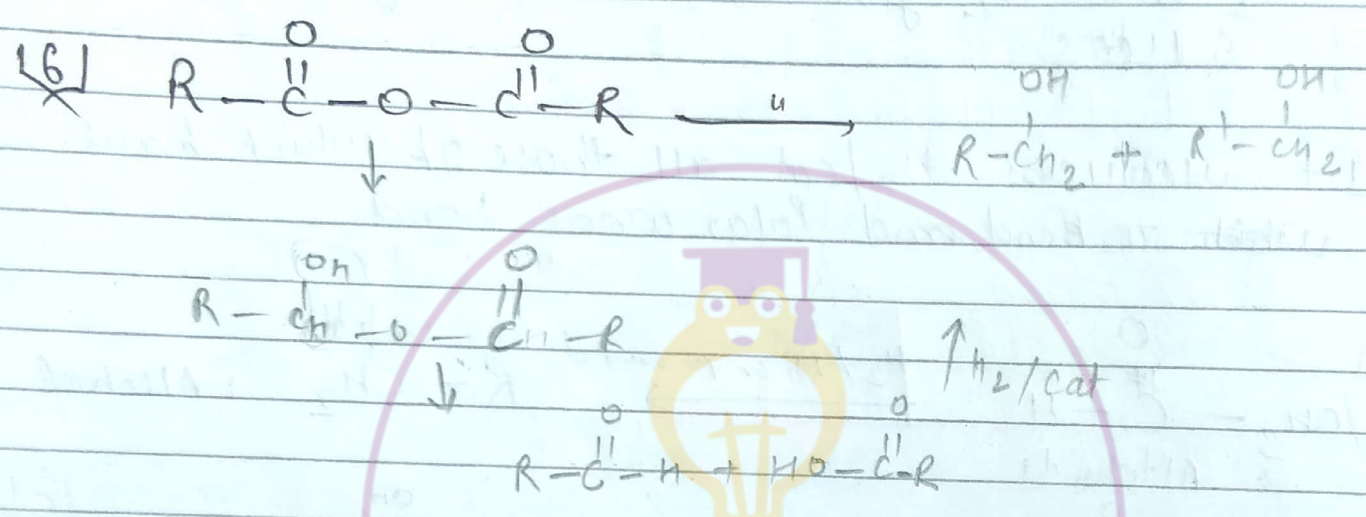
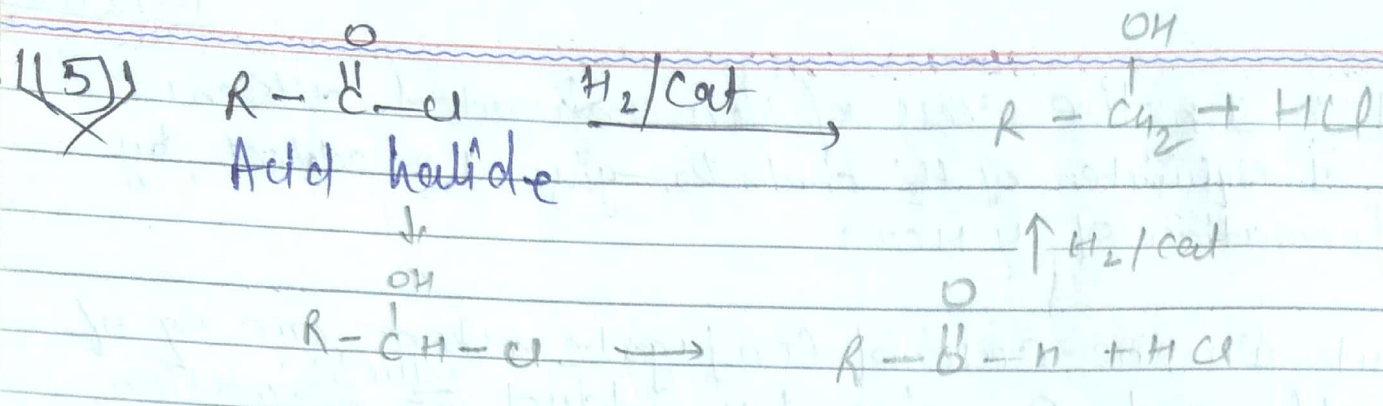


Note - In the case of Non-conjugated alkene
 1 equivalent of H_2 and D_2 give 1,2 adduct by
 formation of 4 MCTS

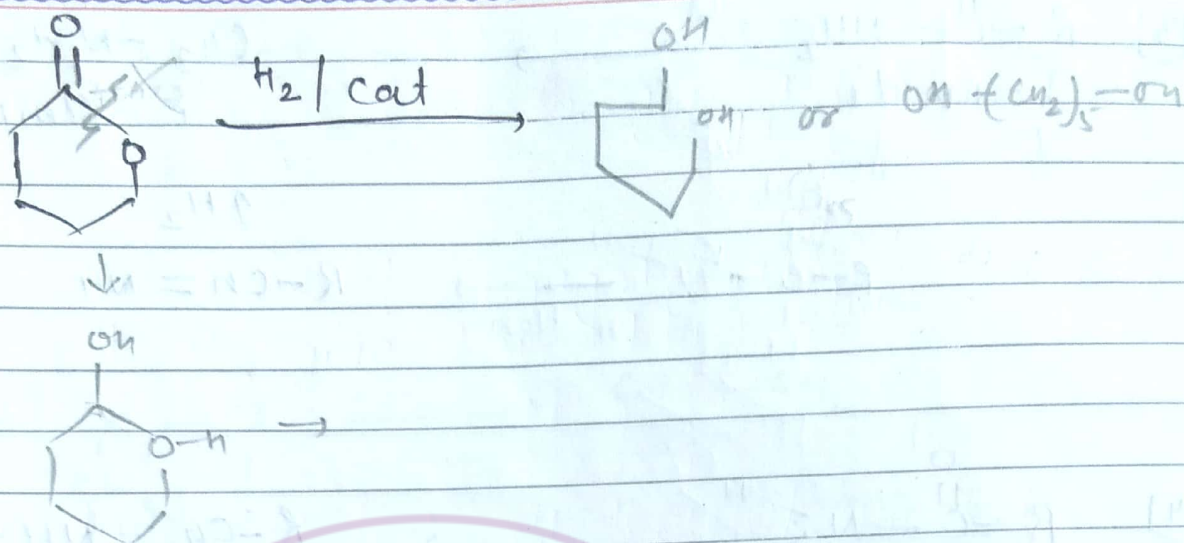
But In the case of Conjugate alkene one eq of
 H_2 and D_2 give 1,4 adduct ^{due to} formation
 of 6 MCTS

It reduces H_2 /cat all those gp which have
~~weak~~ π bond and polar weak bond.

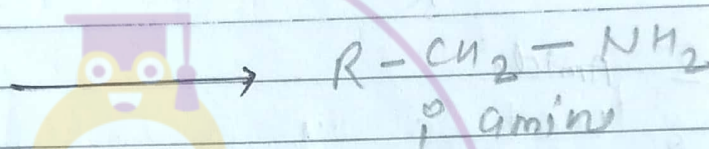
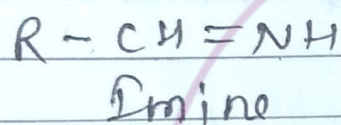




19]

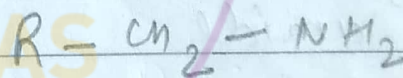
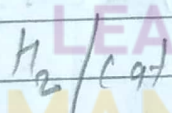
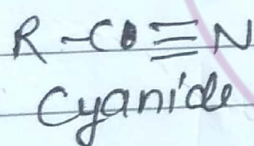


110]

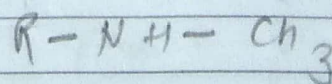
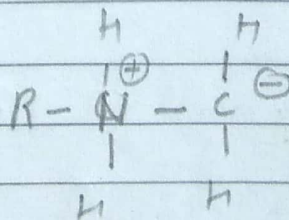
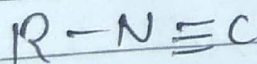


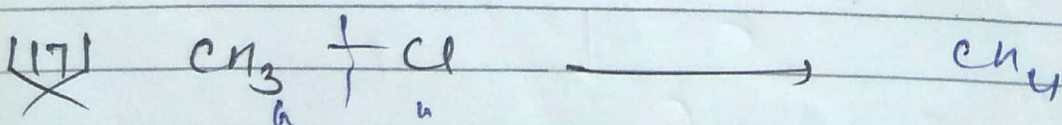
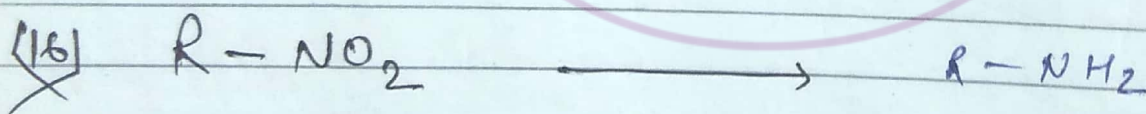
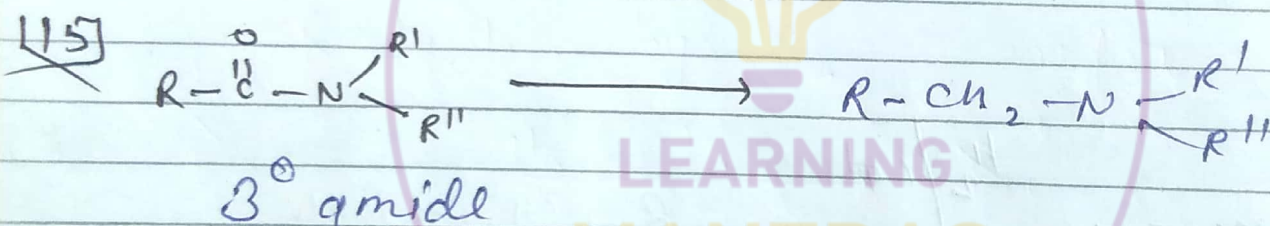
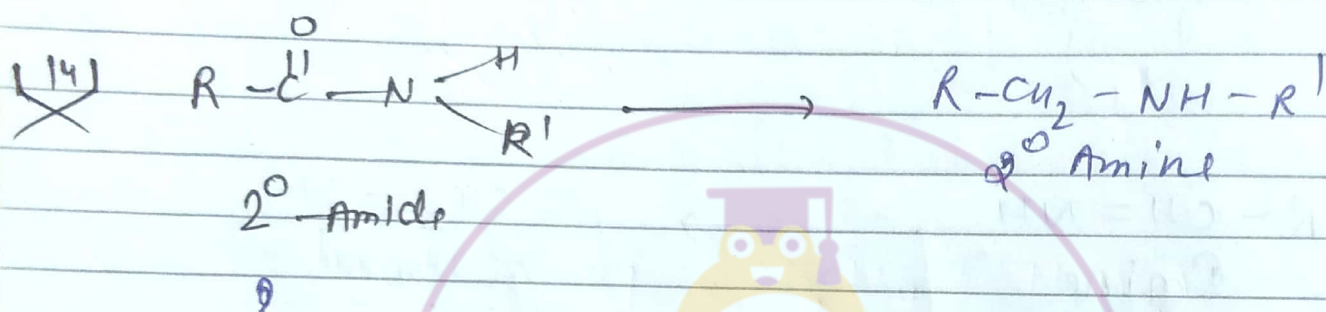
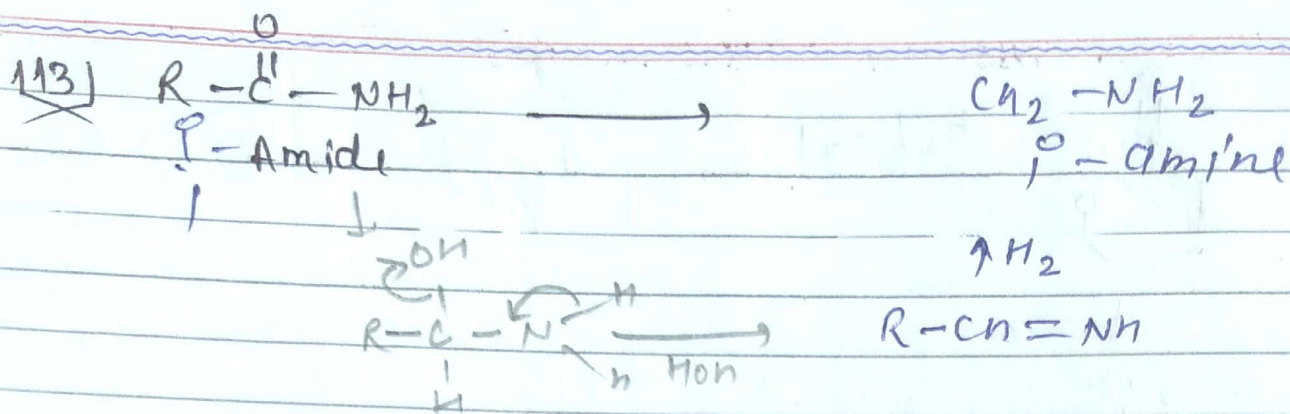
R-

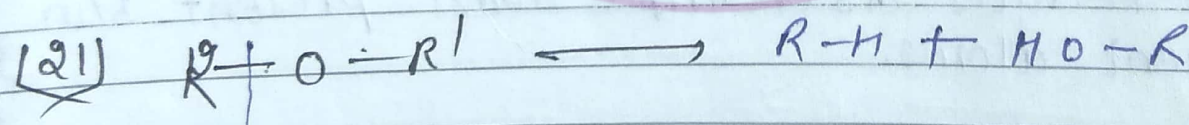
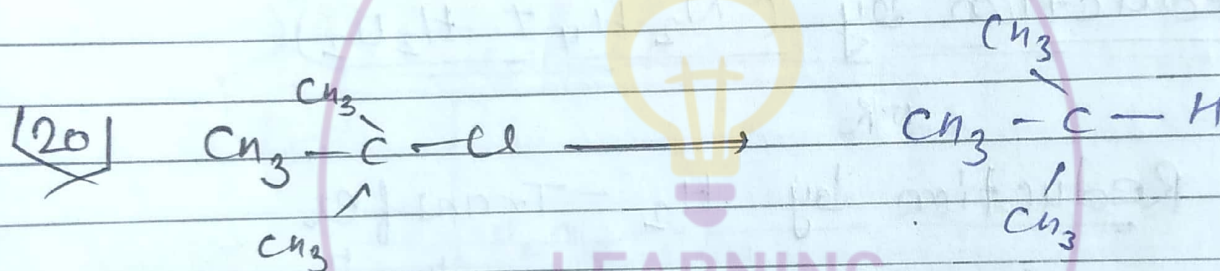
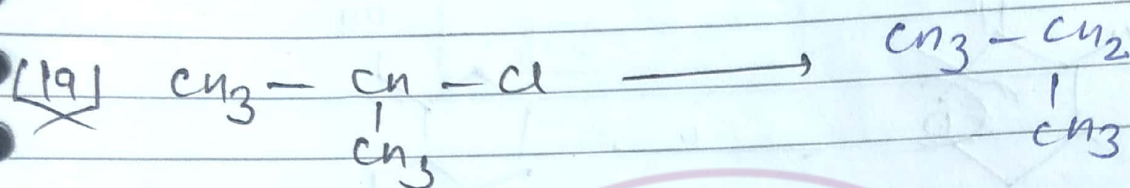
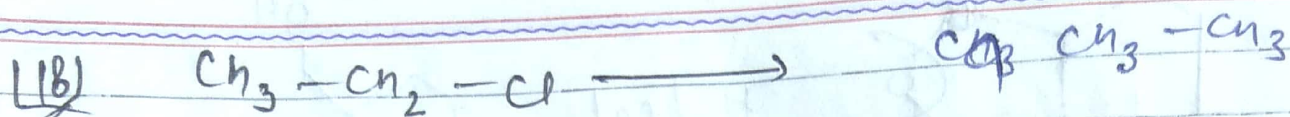
111]



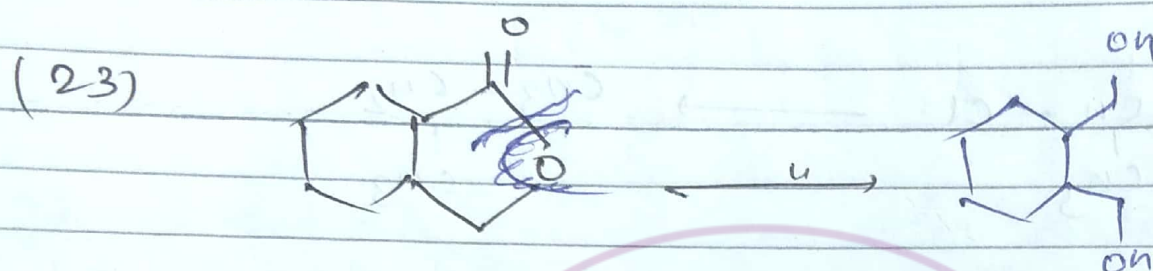
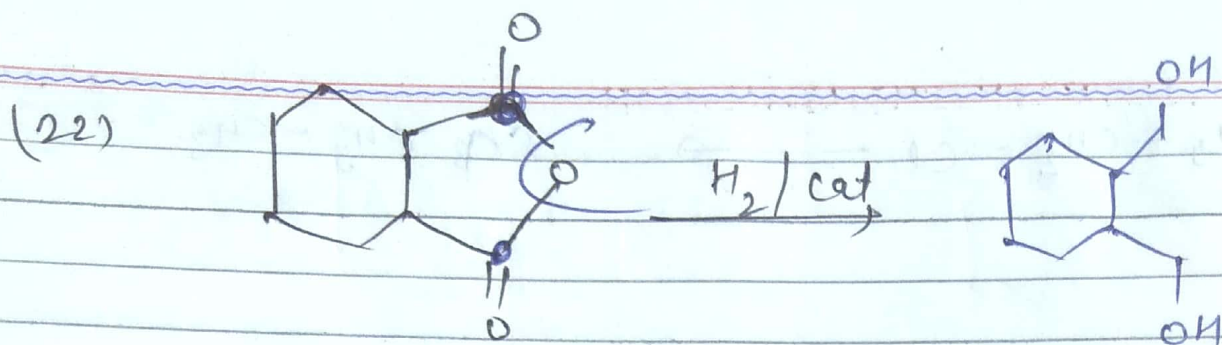
112]







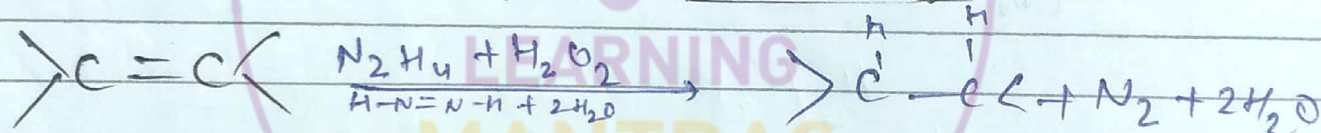
→ Jis 'C' Pe 'O' Ho to Hua alcohol 😊
 → " " " 'N' " " " Amine >1<
 → " " " 'Dono' " " " "



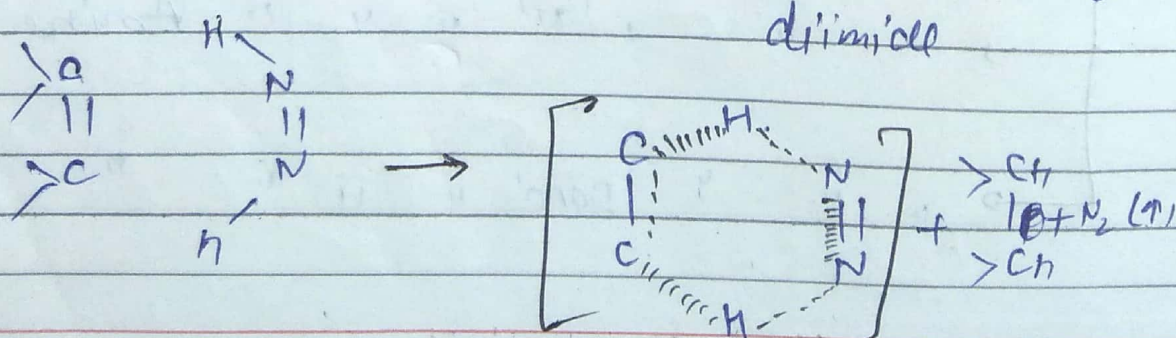
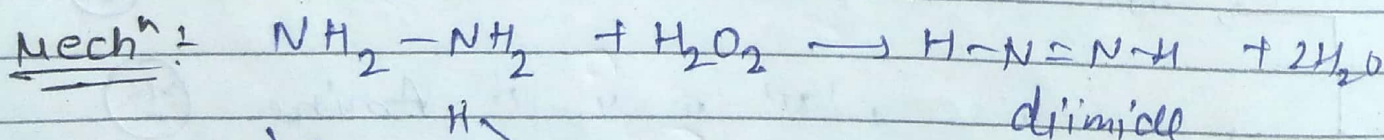
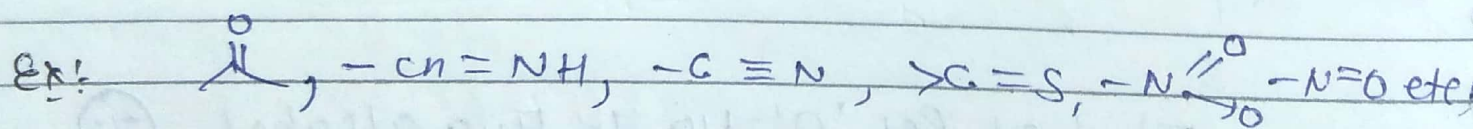
* Reduction by $(N_2H_4 + H_2O_2)$

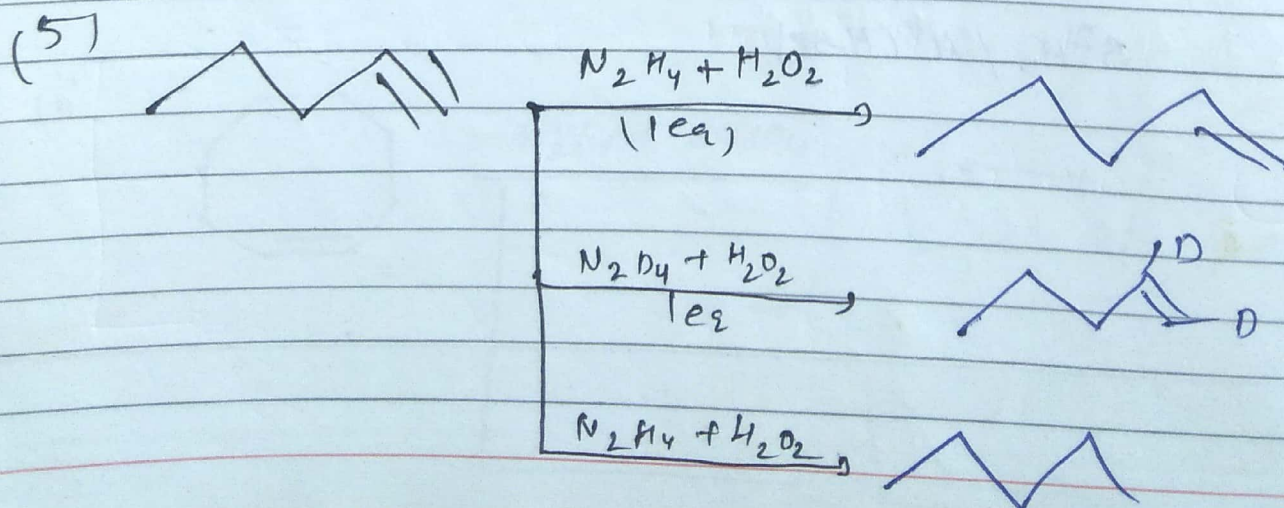
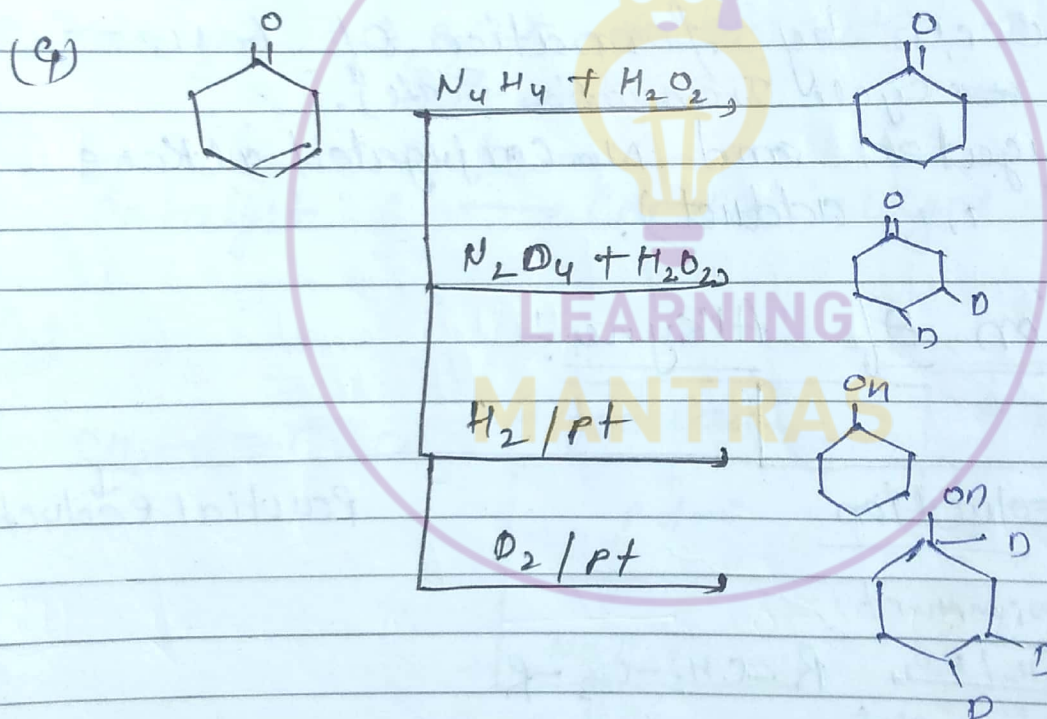
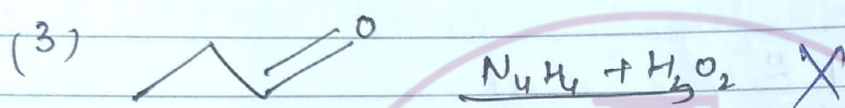
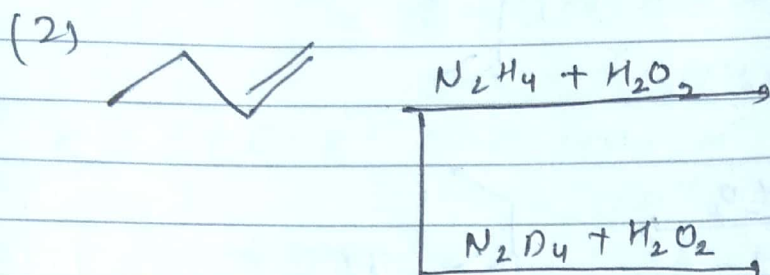
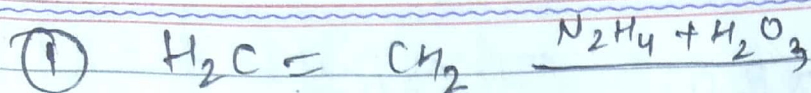
OR

Reduction by H_2 - Transfer

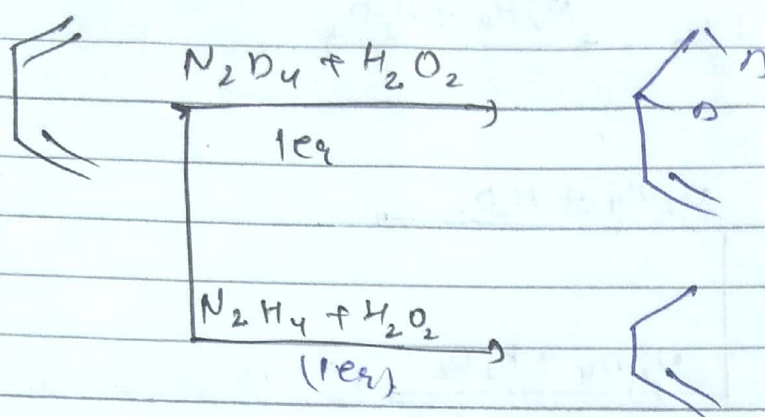


- It Reduces double bond and triple bond present in alkene / Alkyne.
- It not Reduces db or triple bond present b/w different atoms.





6

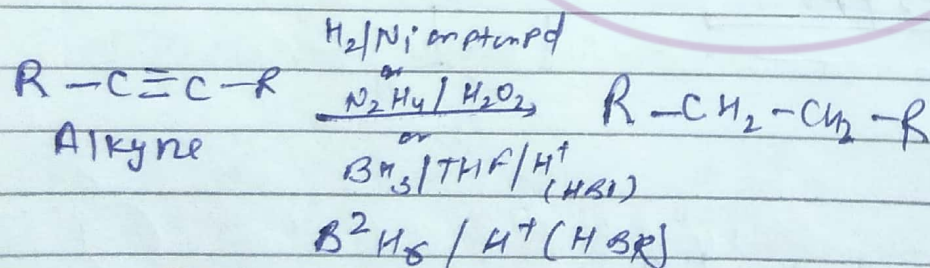


* Important point

- * This Rxⁿ occurs by formation of 6 M.E.T.S (6 member ~~cycle~~ Transition State).
- * With conjugated and non-conjugated alkene it forms 1,2 adduct.

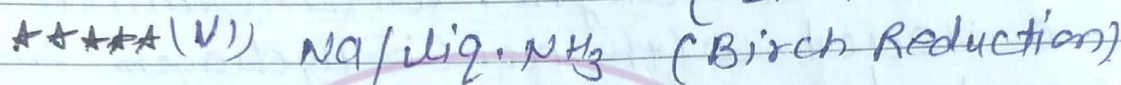
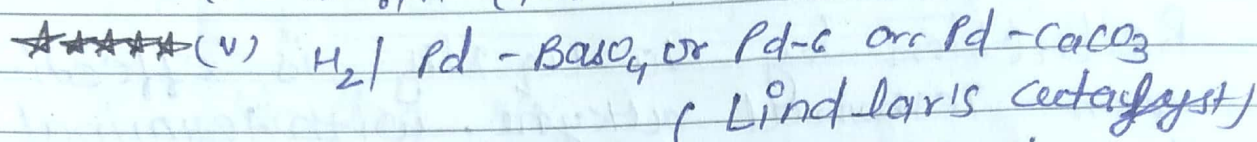
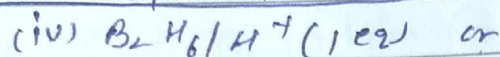
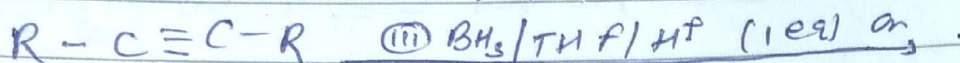
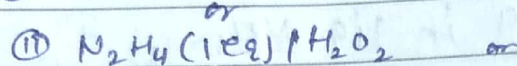
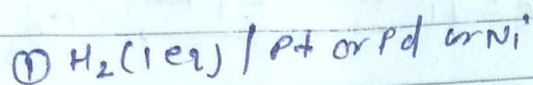
* Reduction of Alkynes

1) Complete Reduction



Partial Reduction

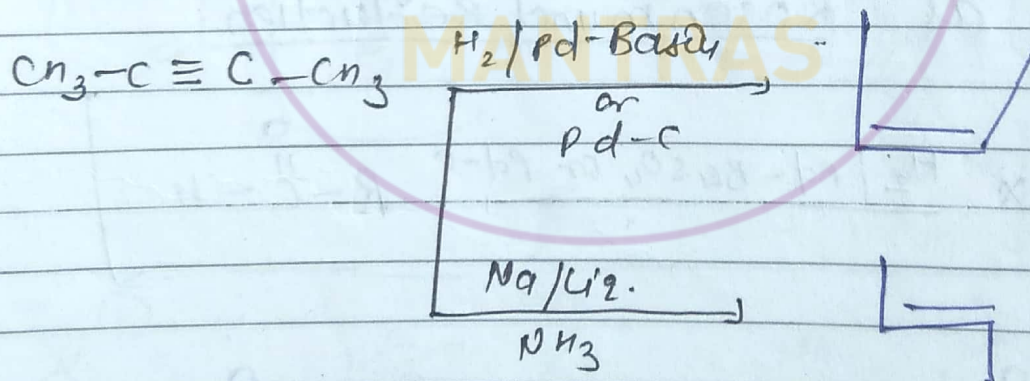
Partial Reduction:



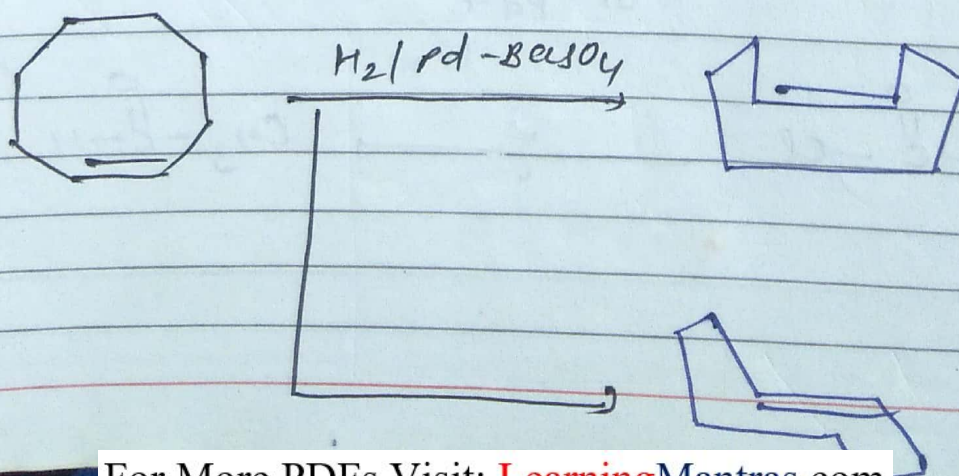
* Catalyst 1, 2, 3, 4, 5 \rightarrow Converted alkyne to cis-alkene

catalyst 6 \rightarrow Convert alkyne to trans alkene

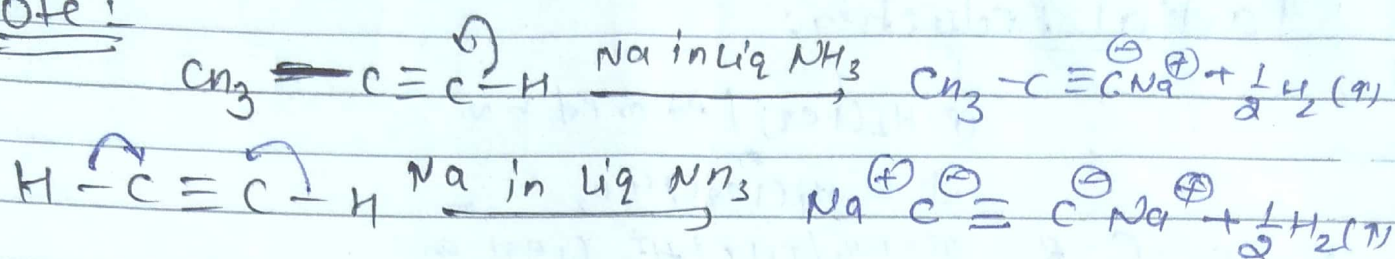
Q.1



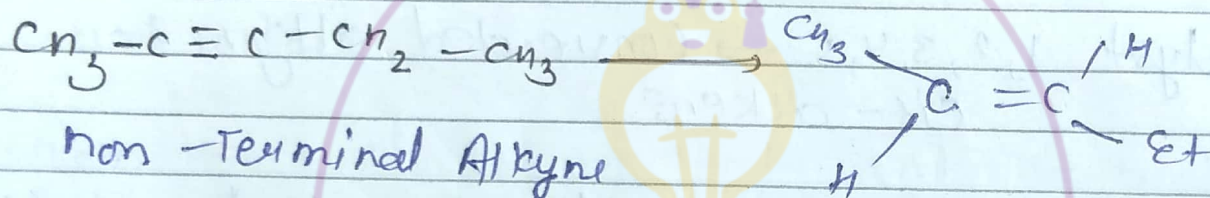
(ii)



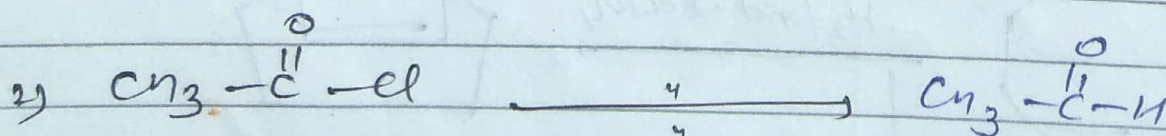
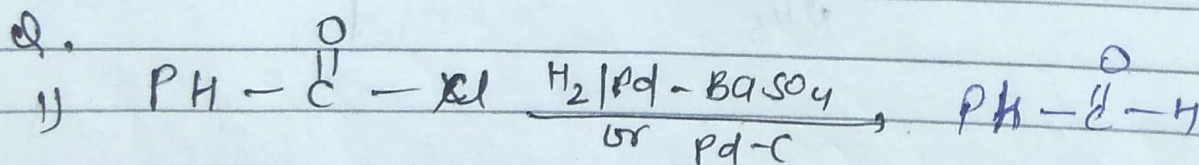
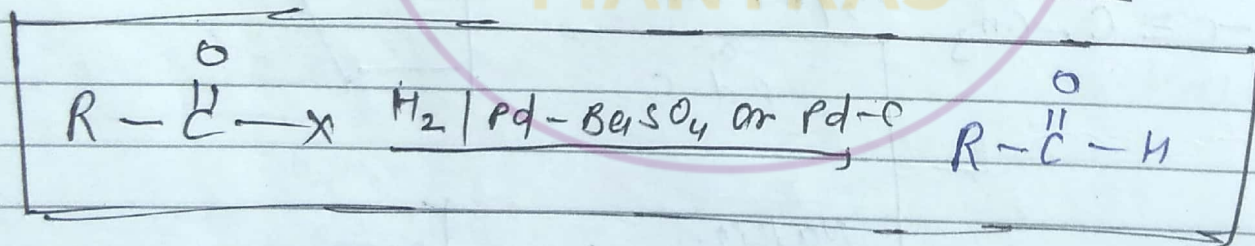
Note:

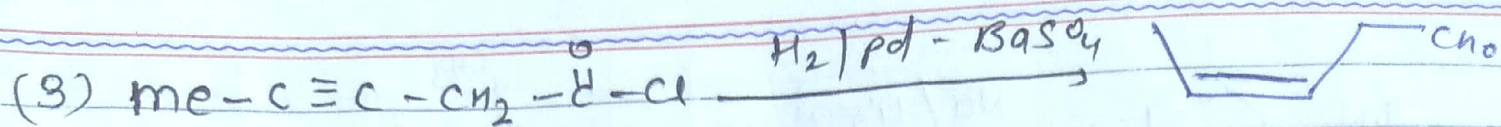


Reduction by Na Liq NH₃ is effective with non-terminal alkyne. With terminal alkyne Na reacts with acidic hydrogen and converted to salt of alkyne.



* Lindlar Catalyst (H₂ / Pd-BaSO₄ or Pb-C) also reduces Acid halide partially and reduction is known as Rosenmund Reduction.



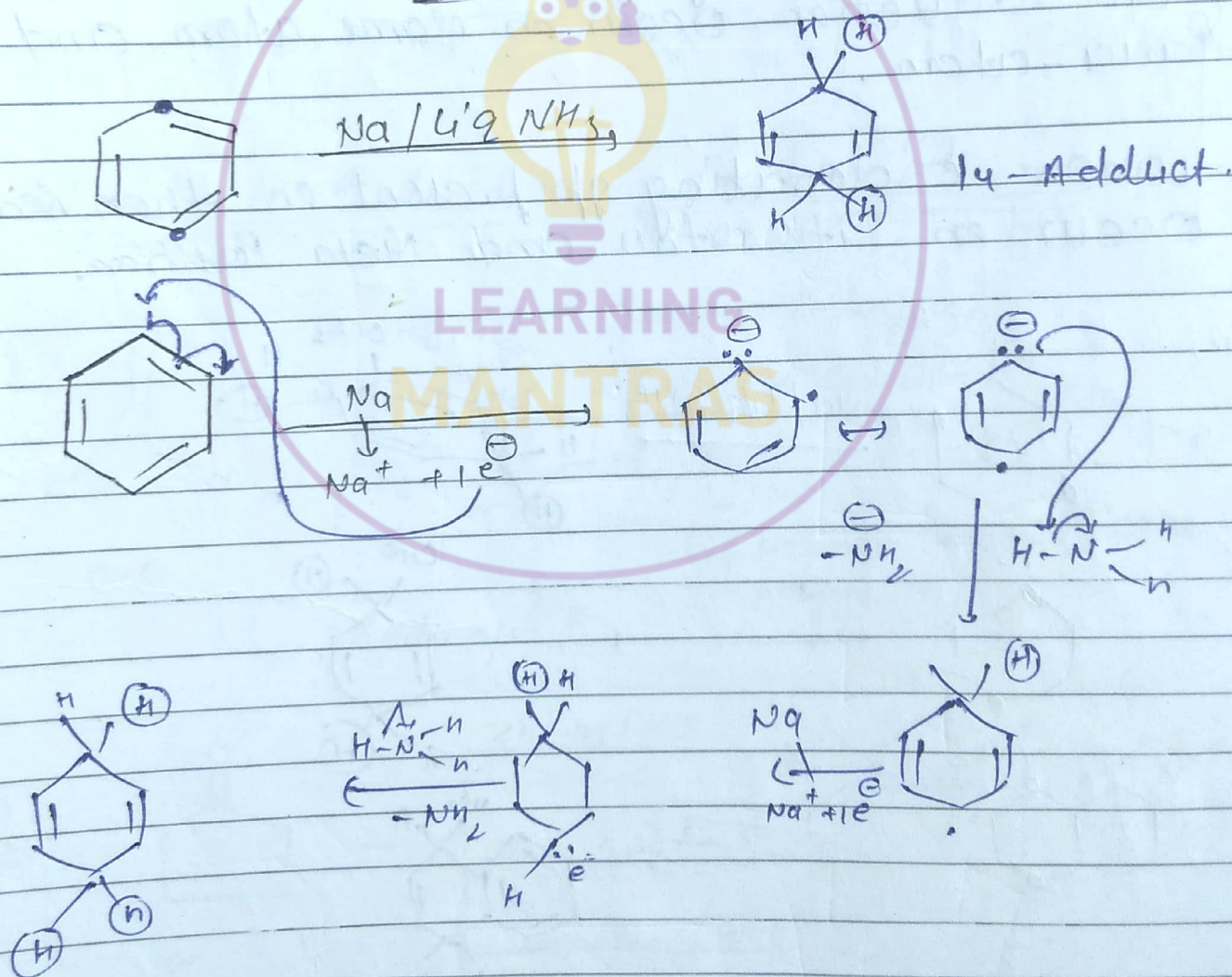


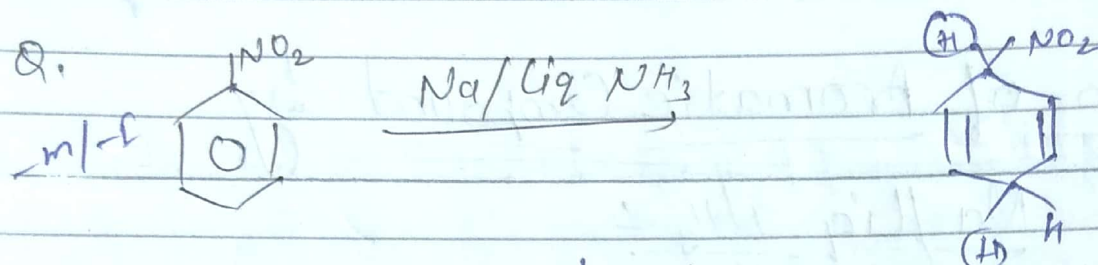
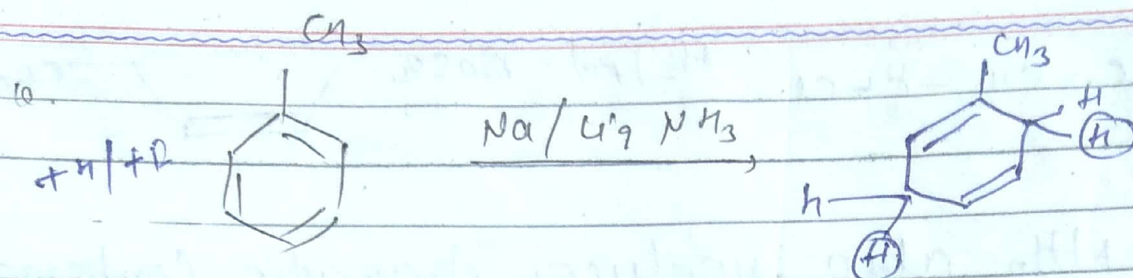
* Na/Liq. NH_3 also reduces Aromatic Compounds

* Reduction of Aromatic Compound by

Na/Liq. NH_3 :

or Birch Reduction :

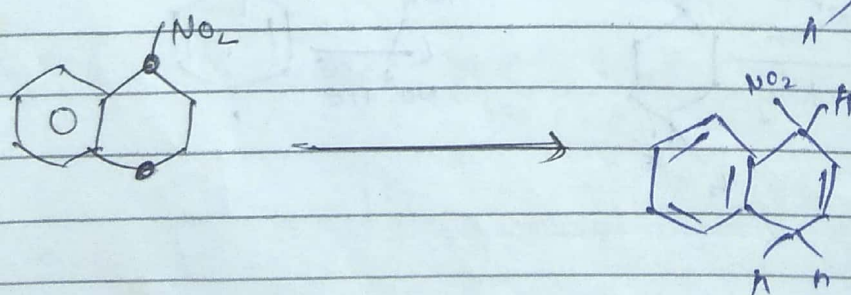
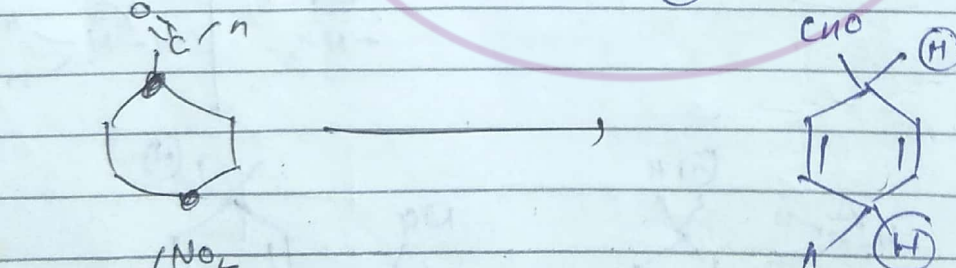
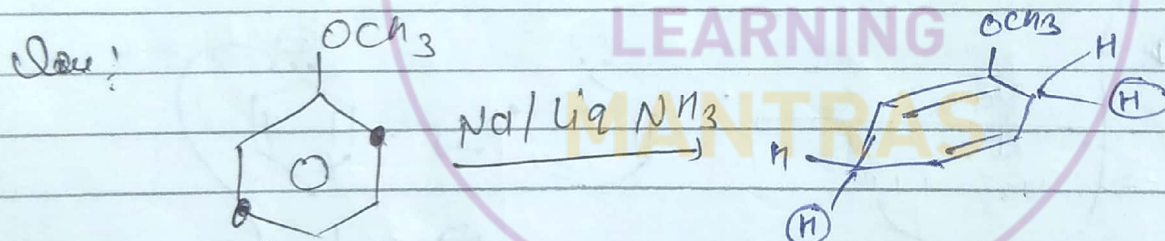




withdrawing.

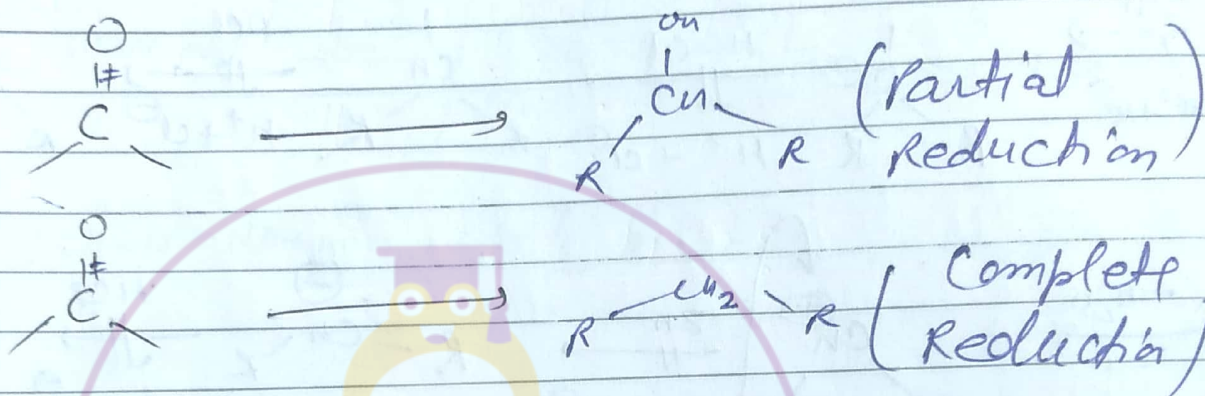
* When \ominus withdrawing gp present on Benzene Ring then Reduction occur on same atom and Para-atom.

* When \oplus donating gp present on then Reduction occur on its ortho and Meta Position.

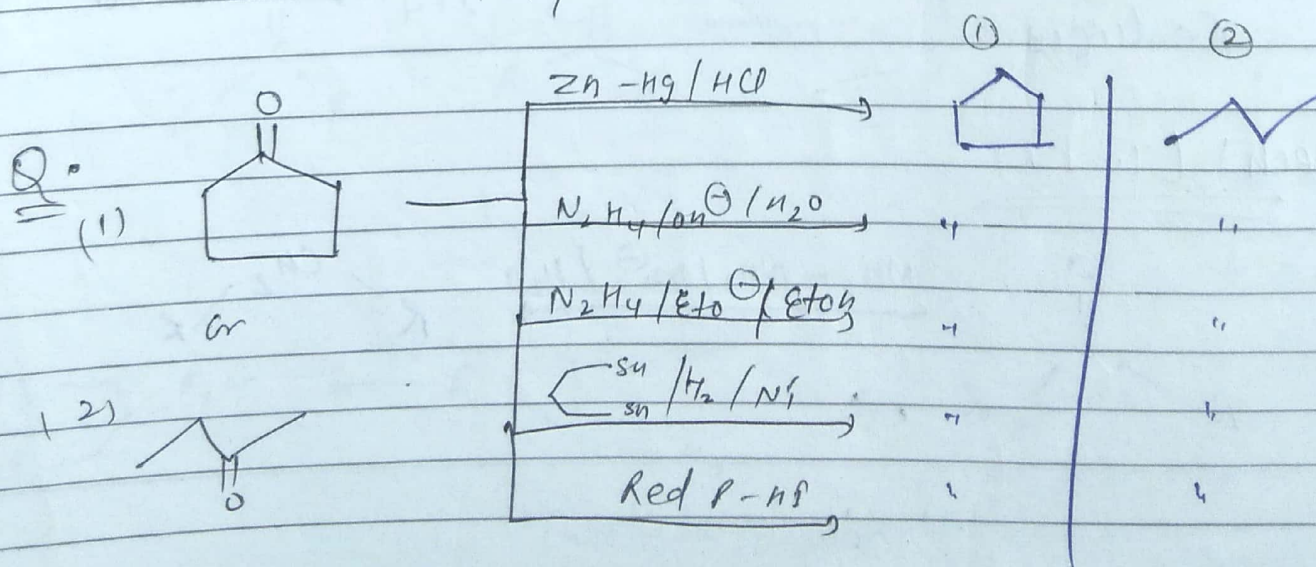
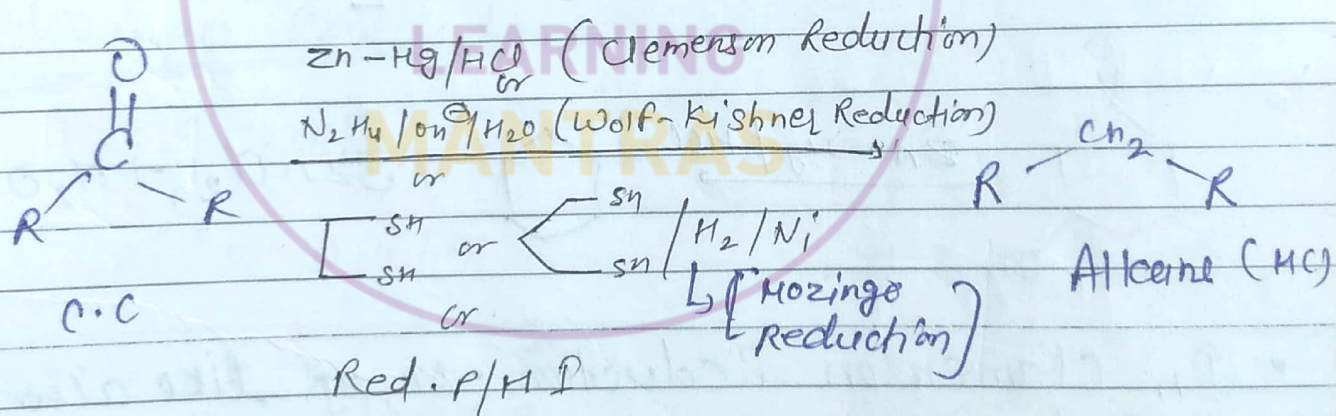


* Reduction by Li-Al-Hydride :

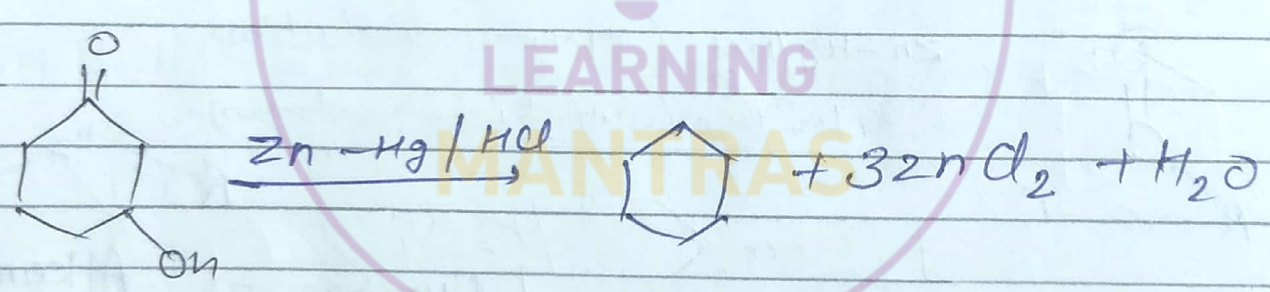
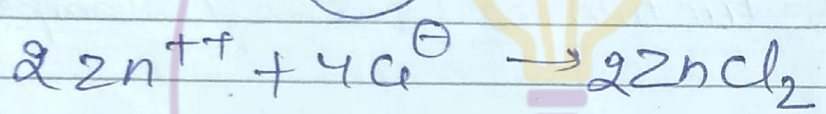
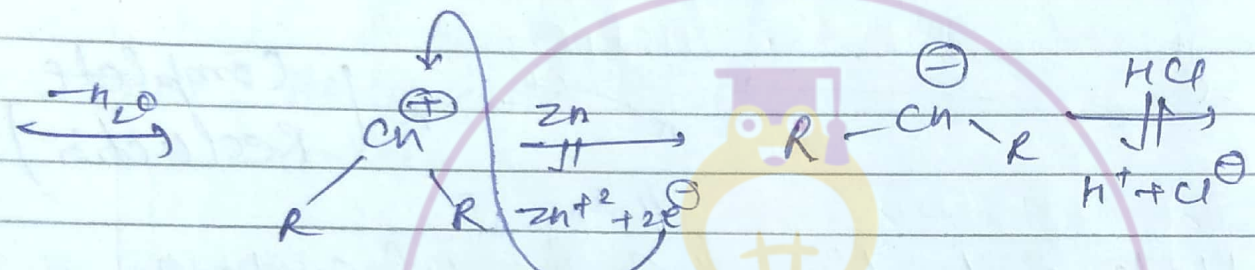
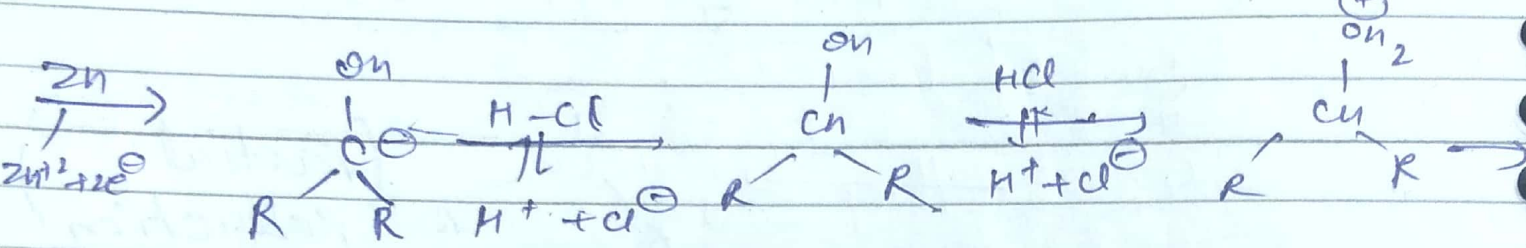
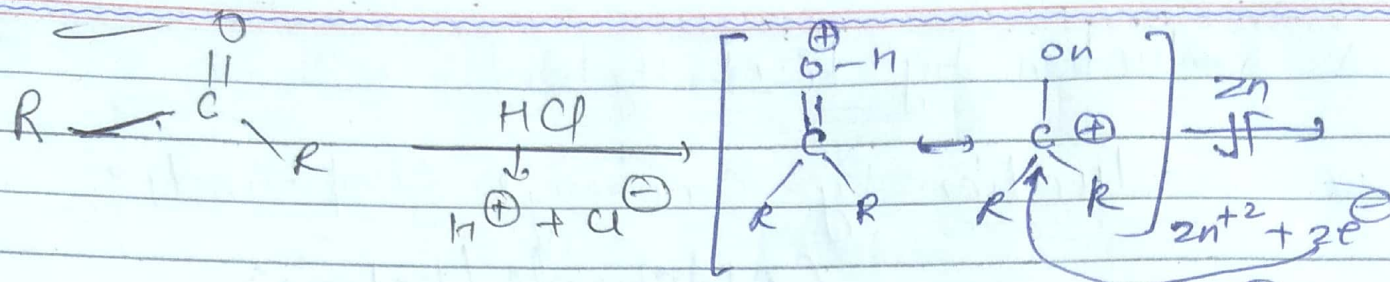
* Reduction by Carbonyl Compounds :
(Aldehyde / ketone)



* Complete Reduction of Carbonyl Comp. :

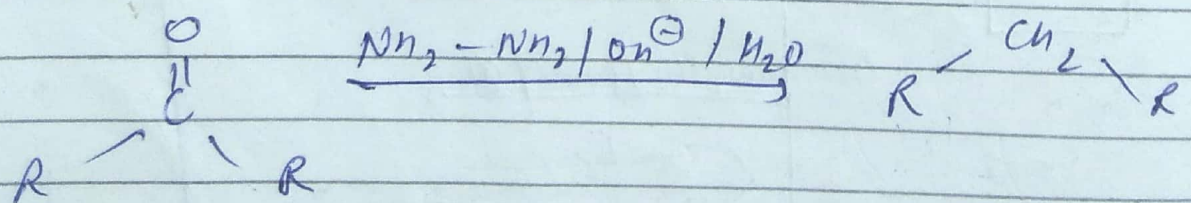


Mechⁿ!

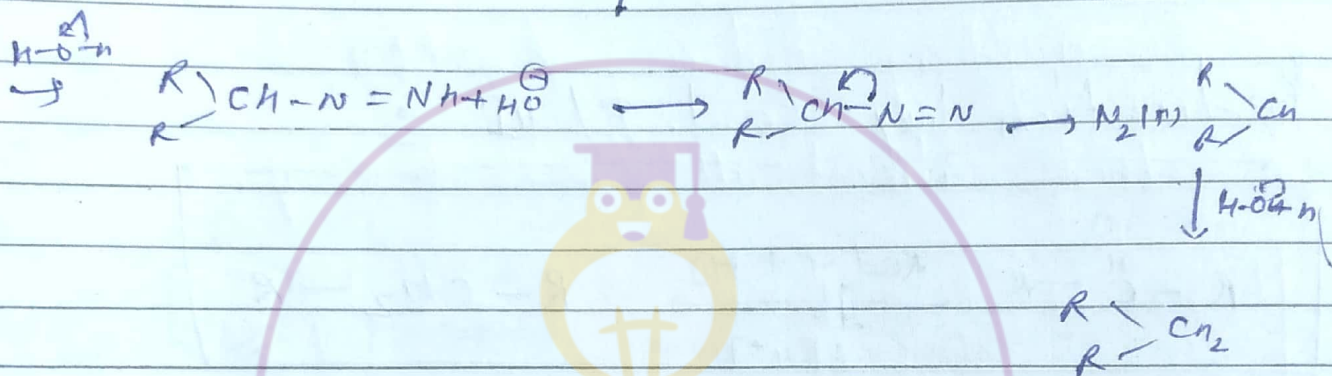
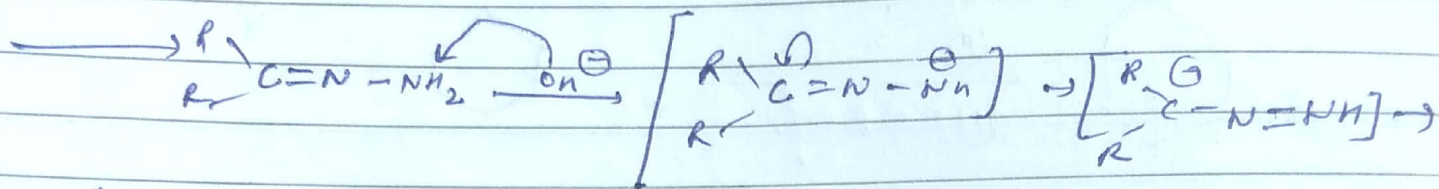
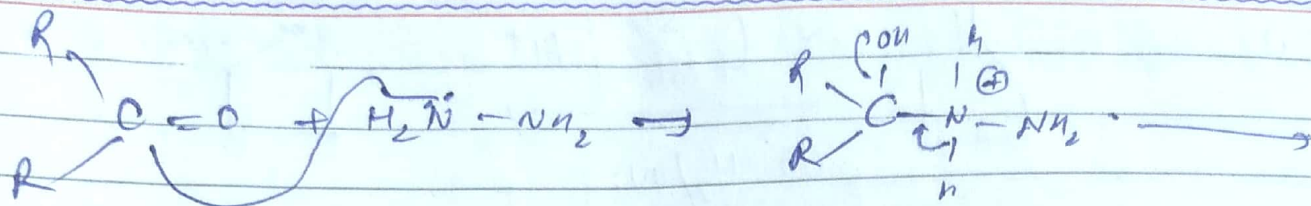


• In Clemenson Reduction -OH, OR like also Reduces.

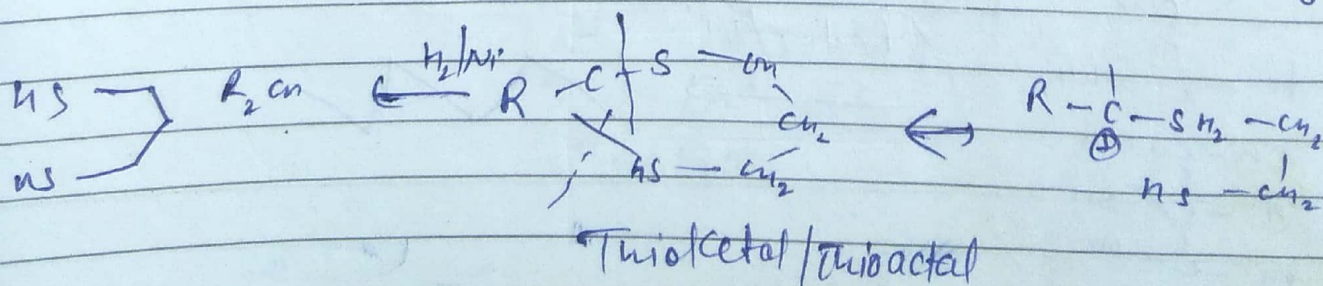
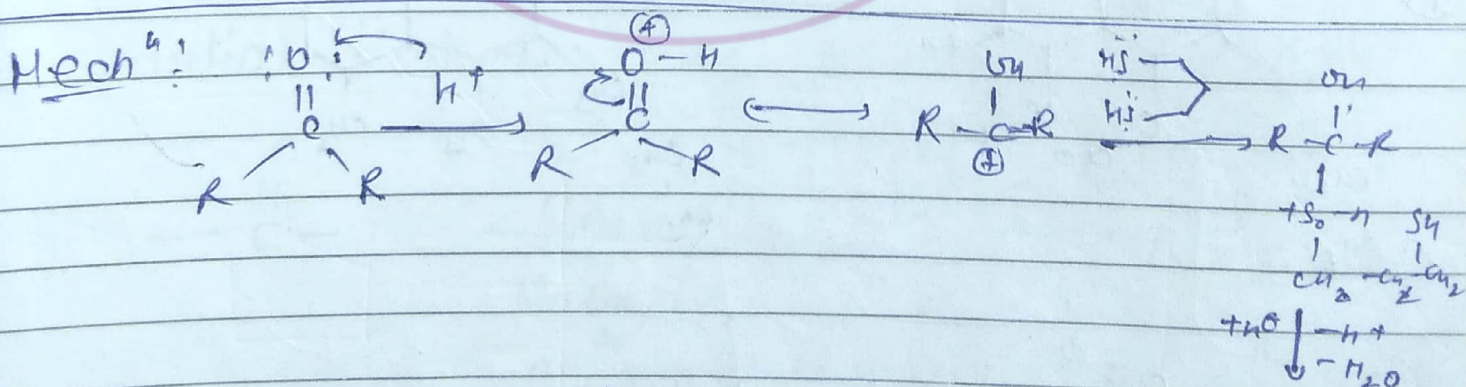
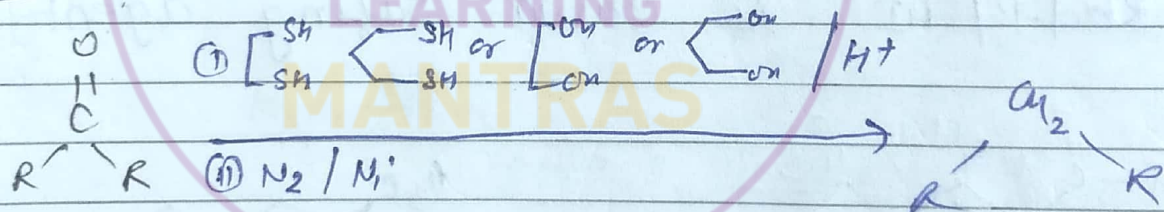
Mechⁿ! (WKR)

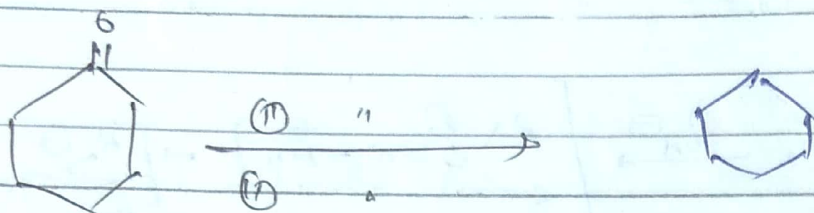
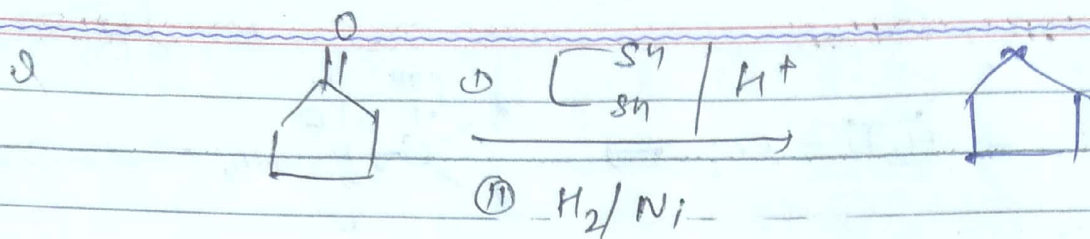


20/09/17

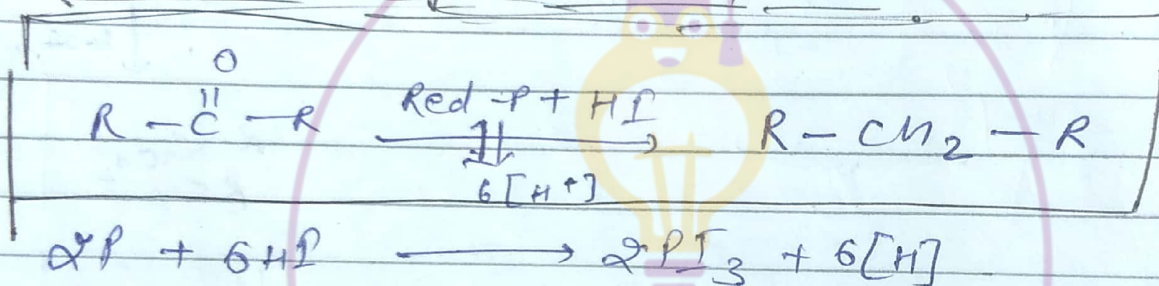


* Meringo Reduction:

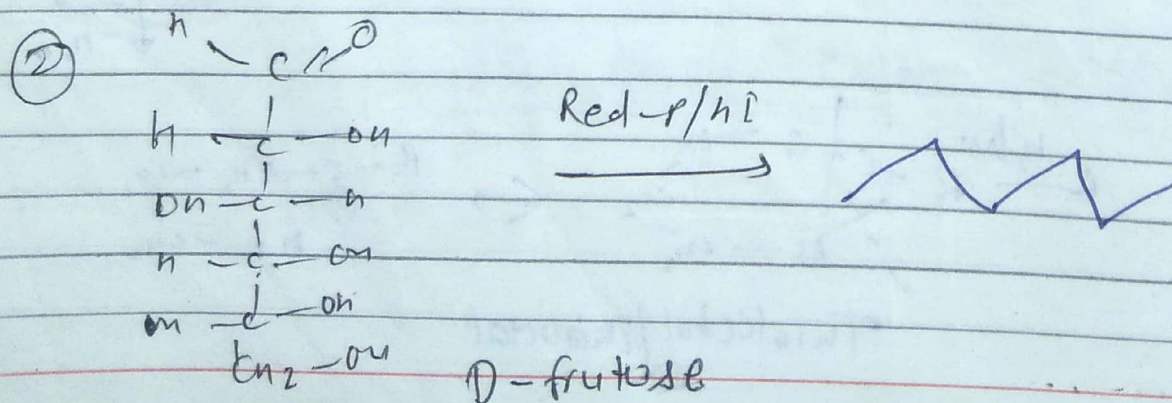
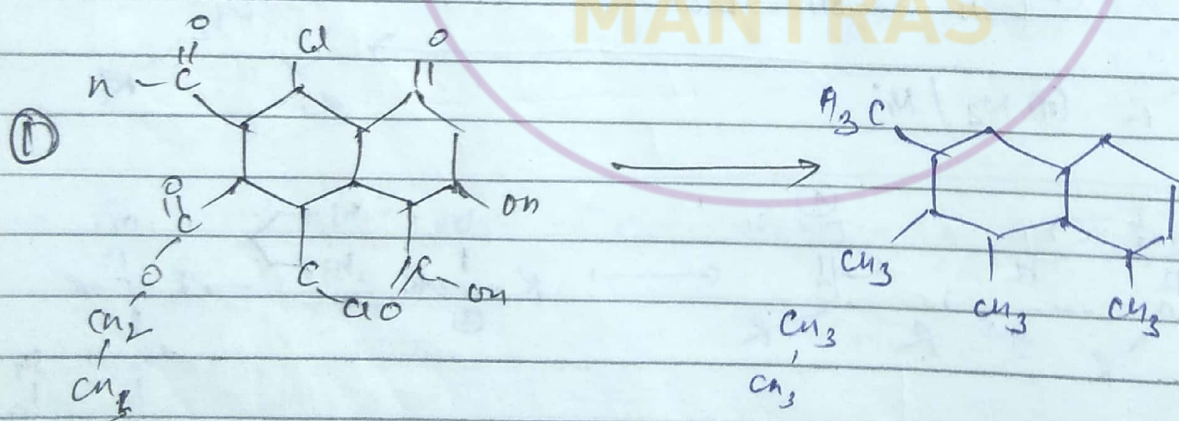


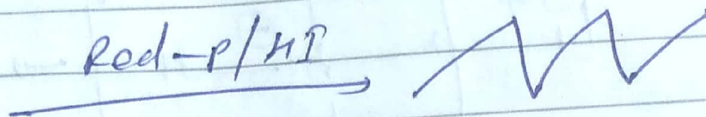
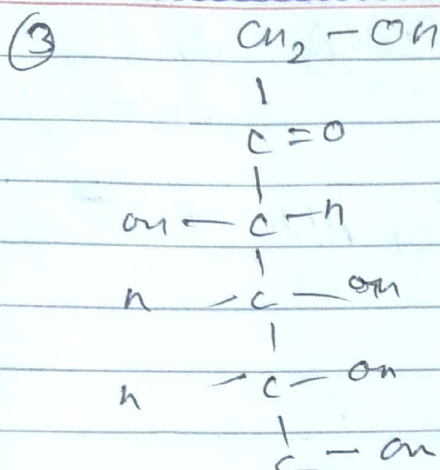


* Reduction by Red. P / HI :



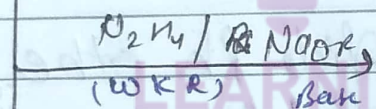
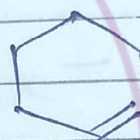
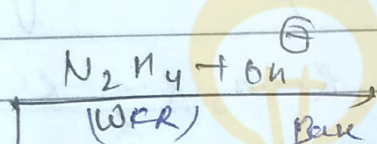
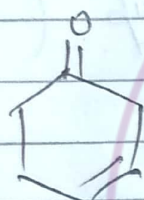
* Red-P/HI is sawa safing agent.



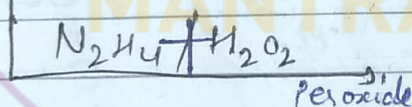


D-fructose

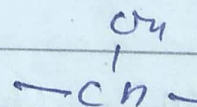
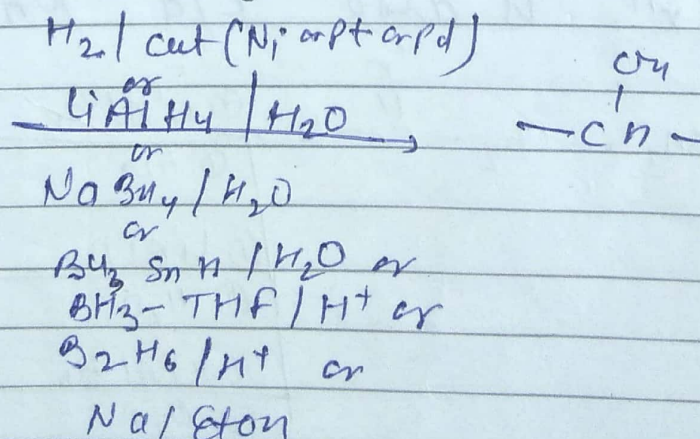
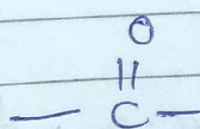
Q



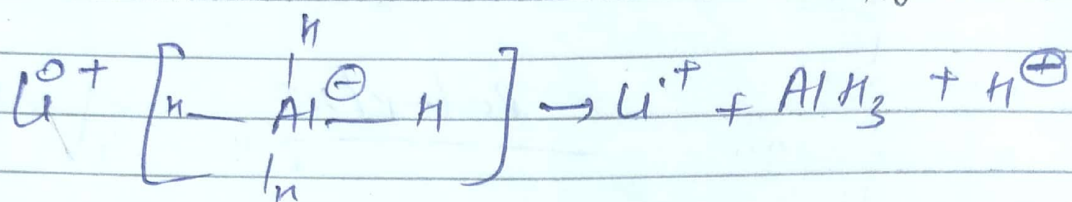
"



* Partial Reduction of aldehyde or ketone:



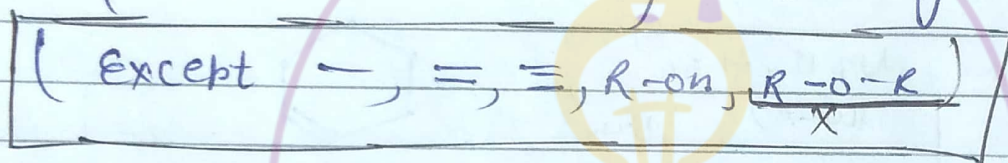
* Reduction by $\text{LiAlH}_4/\text{H}_2\text{O}$ (LAH) - Lithium aluminium hydride



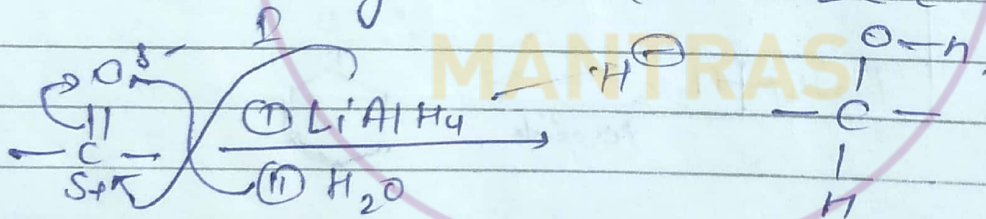
• LiAlH_4 is source of H^-

• It is a strong Reducing Agent (Work as Rmg X)

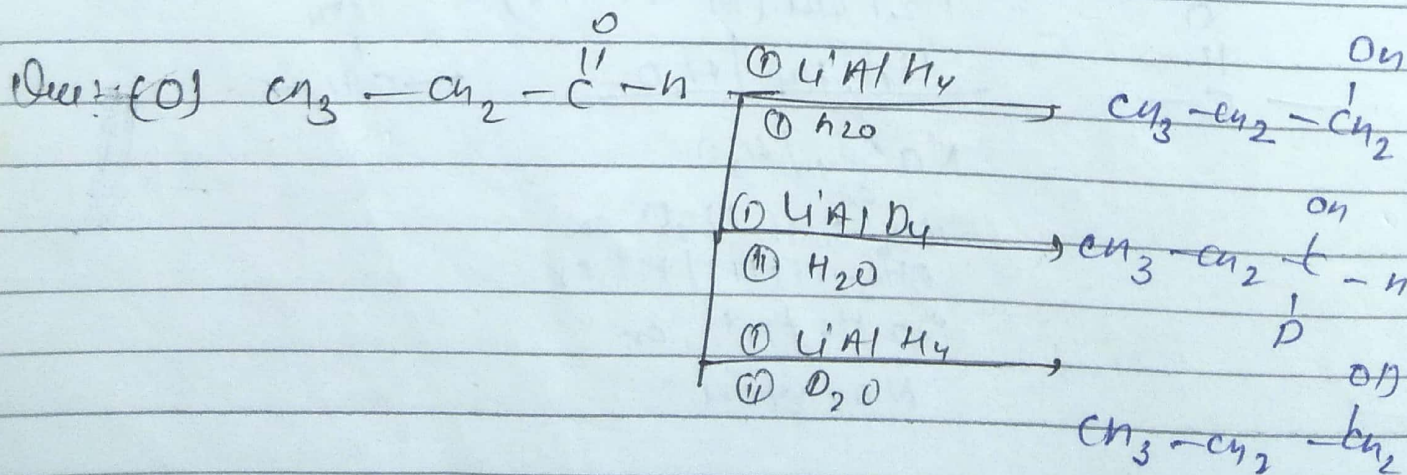
• It reduces almost all functional group (



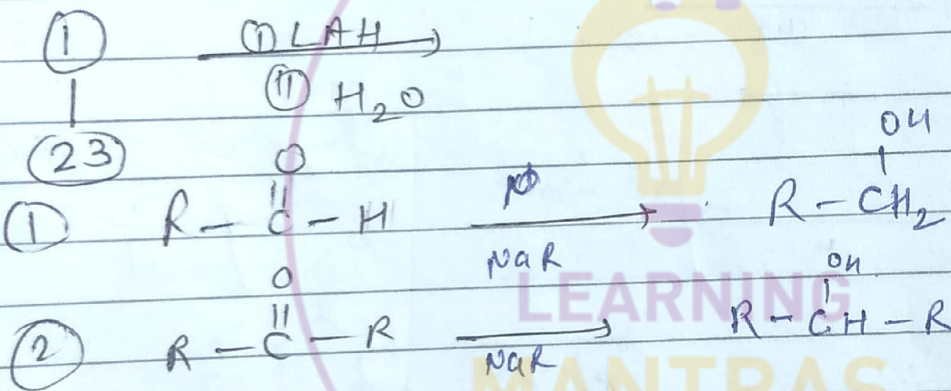
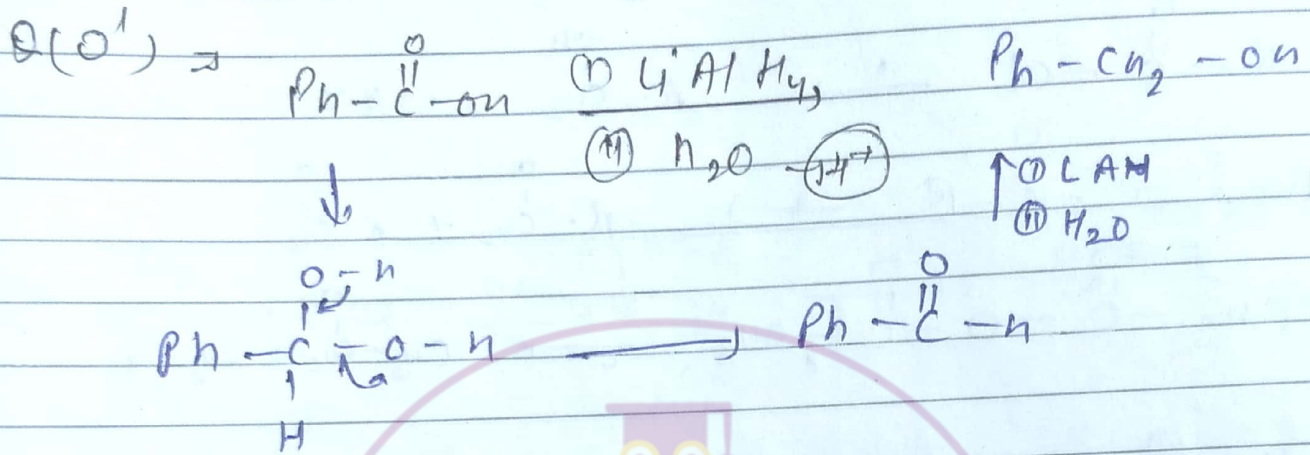
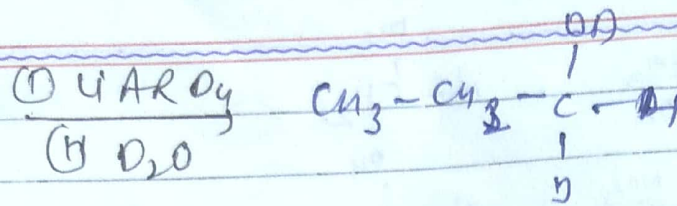
• db or atb with one side ph other side -mgp also reduced by LAH ($\text{Ph-C}\equiv\text{C-C(=O)H}$).

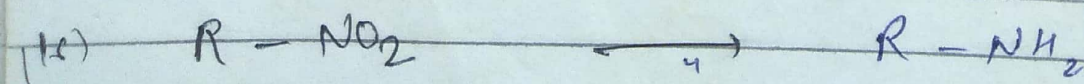
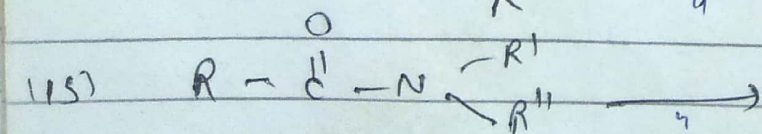
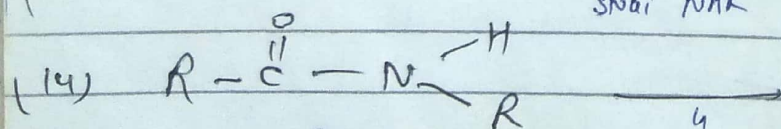
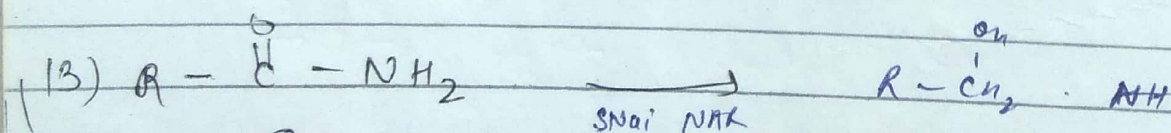
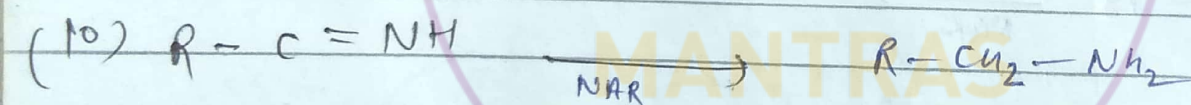
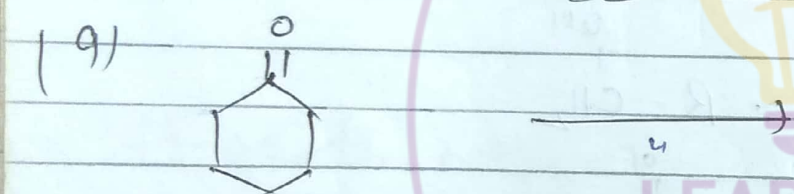
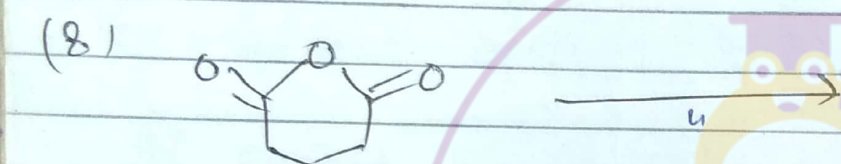
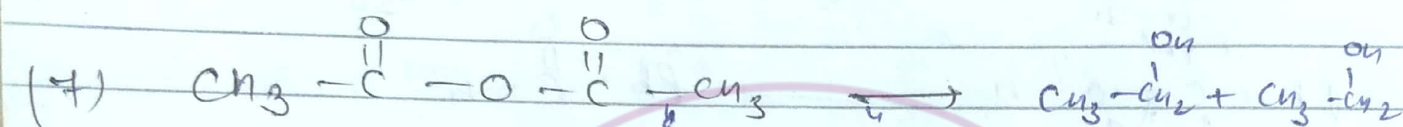
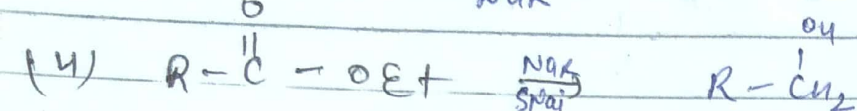
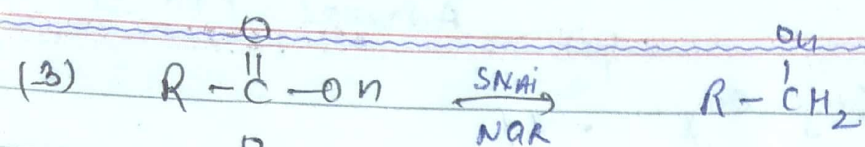


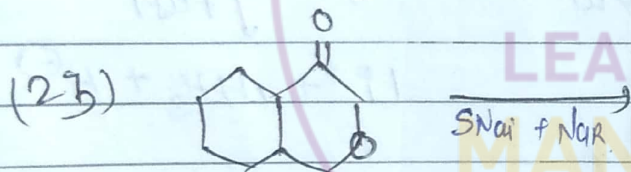
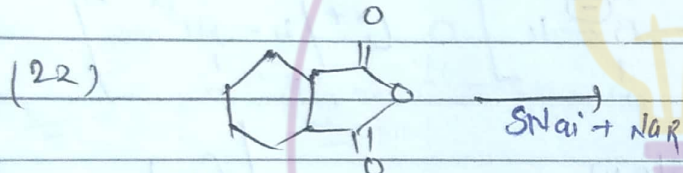
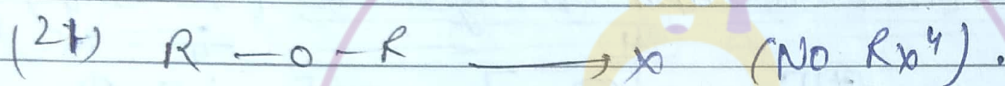
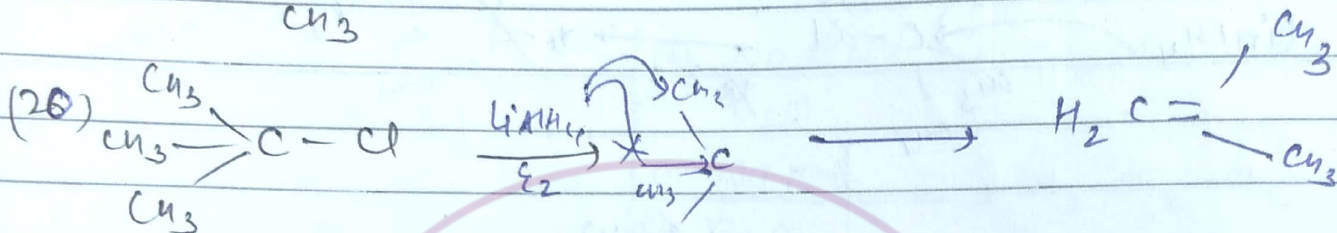
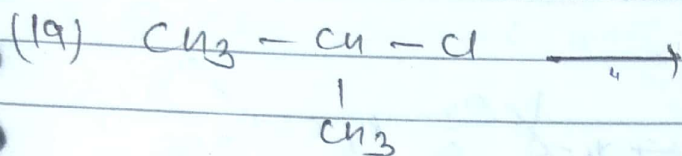
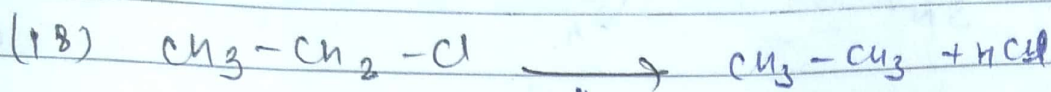
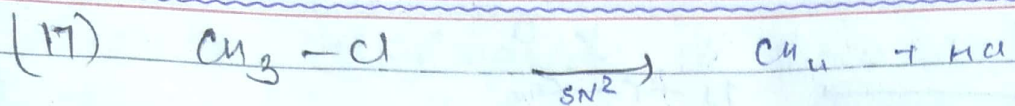
• This Rxn is also k/a NAR



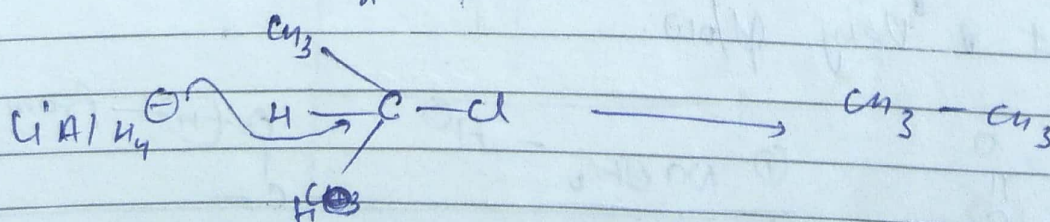
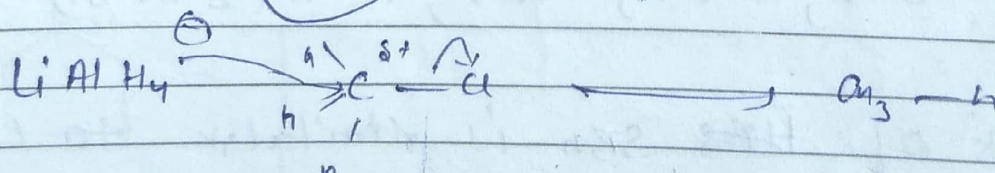
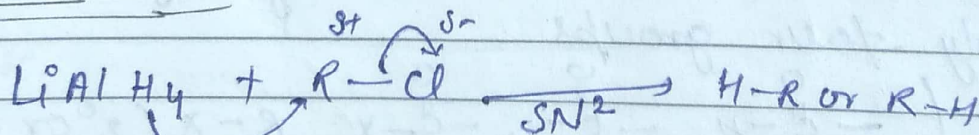
[Race 19] X
 J.M. 1 to 14 ✓
 Advanced = 1 to 22 ✓

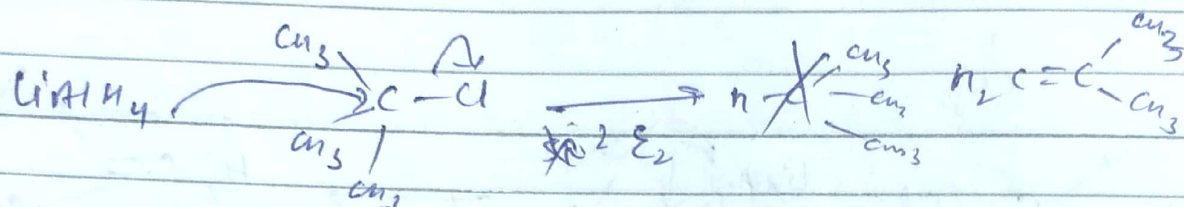
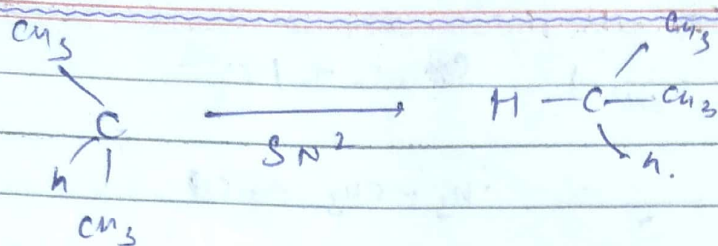




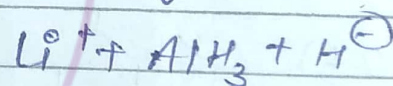
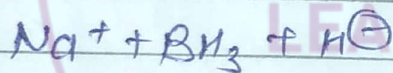
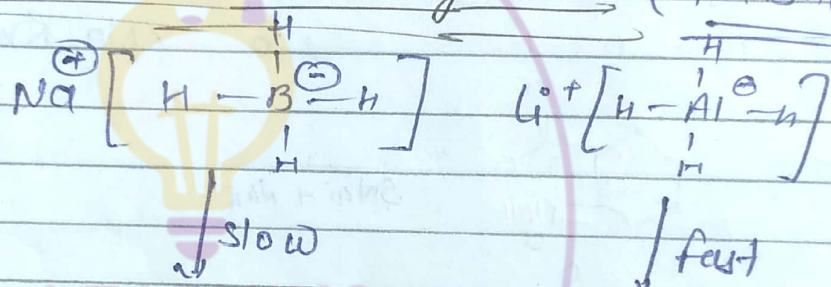


* Important Note:





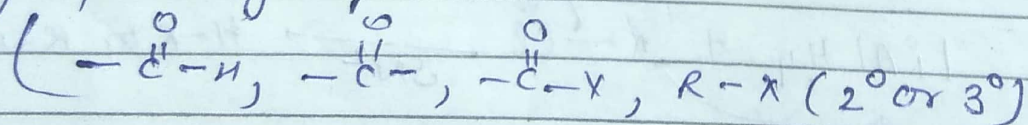
* Reduction with Sodium Borohydride (SBH) / (NaBH₄)



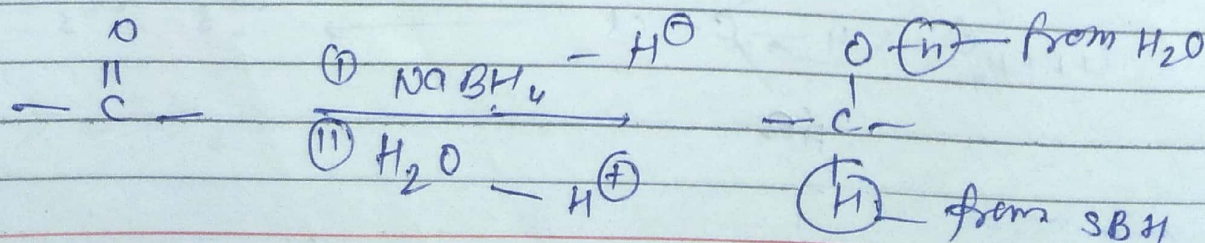
(1) SBH is a weak source of H⁻

(2) LAH is a strong source of H⁻

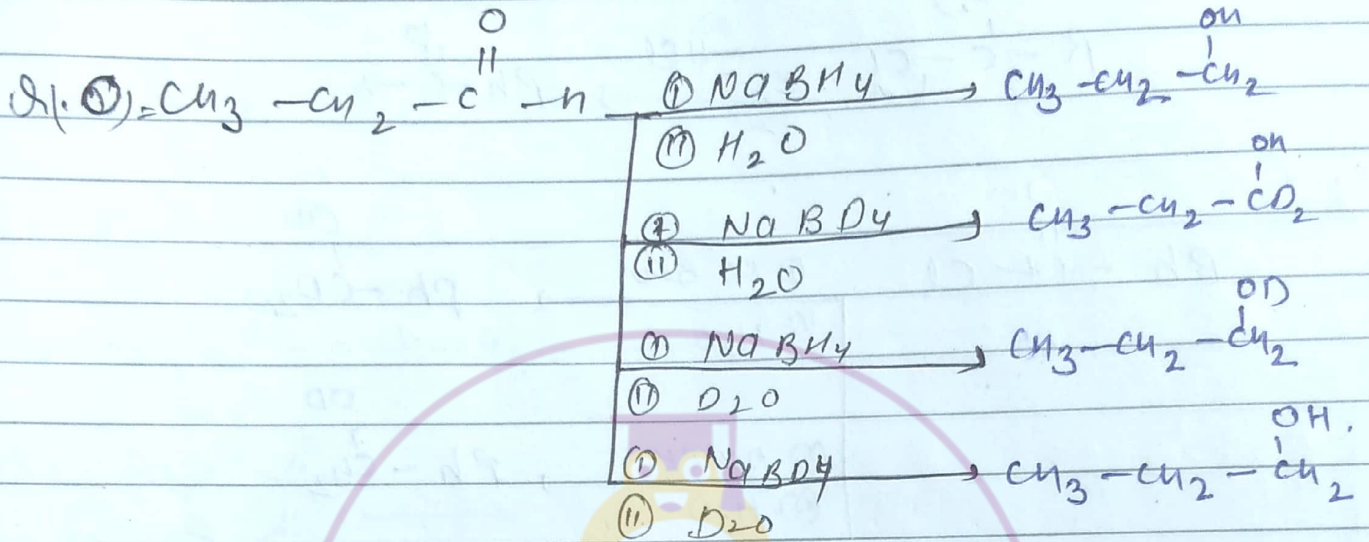
* SBH is a weak reducing Agent and reduces only four groups



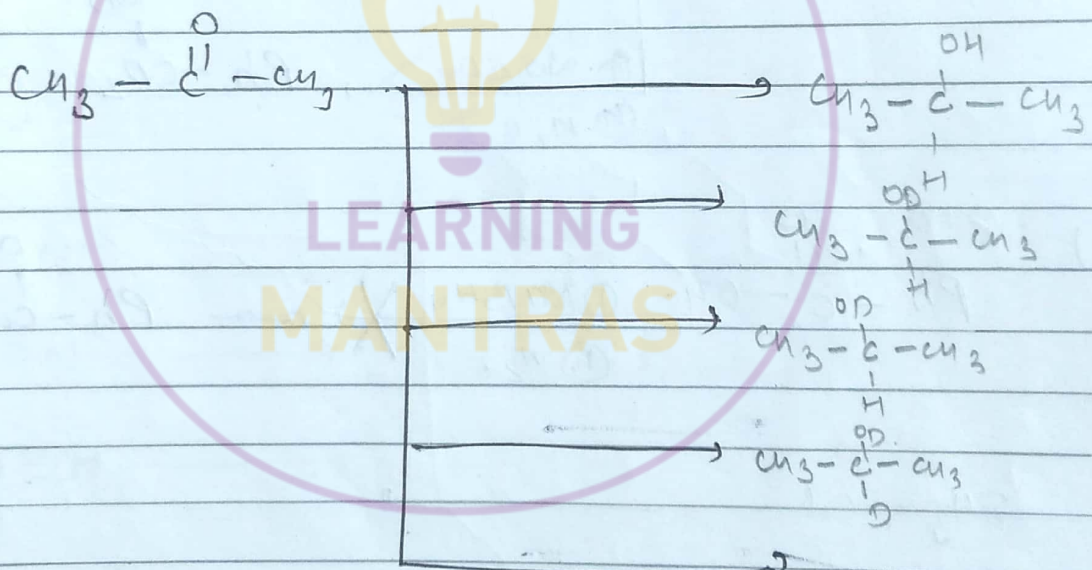
* Work of ~~HB~~ SBH is similar to LAH but a very y/lw.



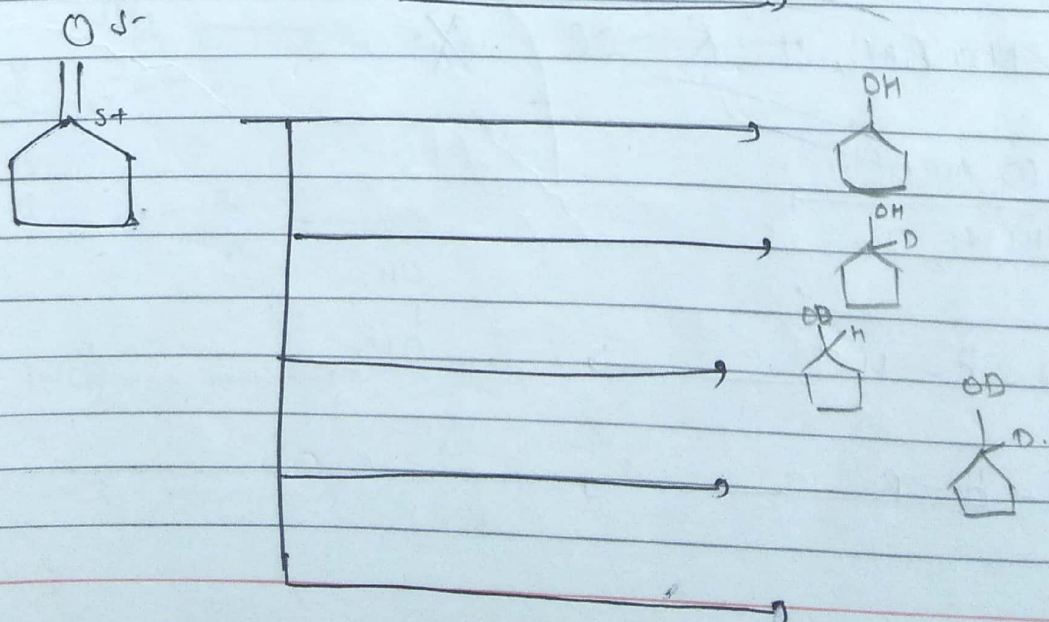
* with alkyl halide it show S_N1 Mechⁿ.
Therefore it react with 2° and 3° halide only

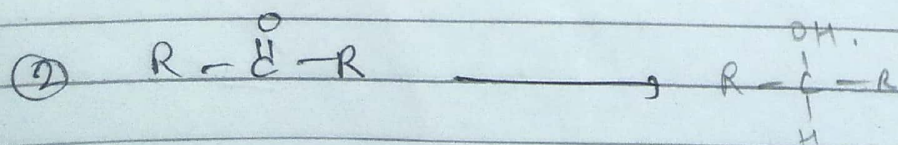
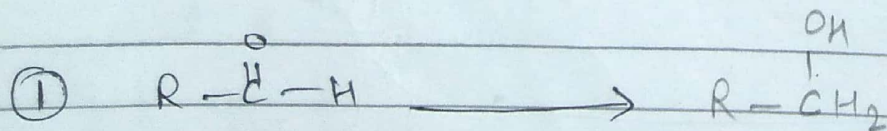
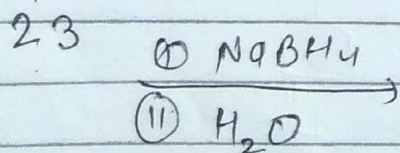
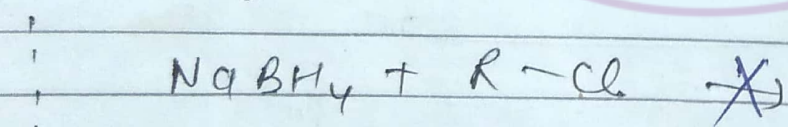
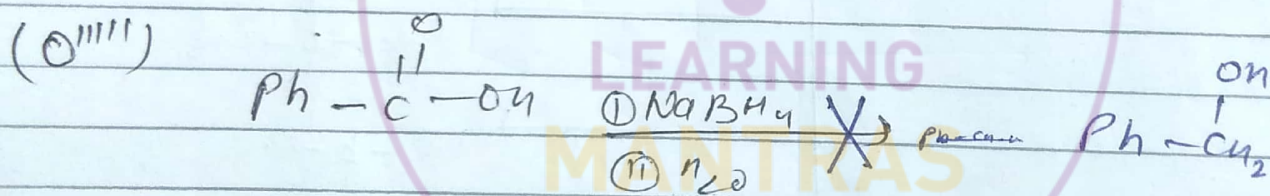
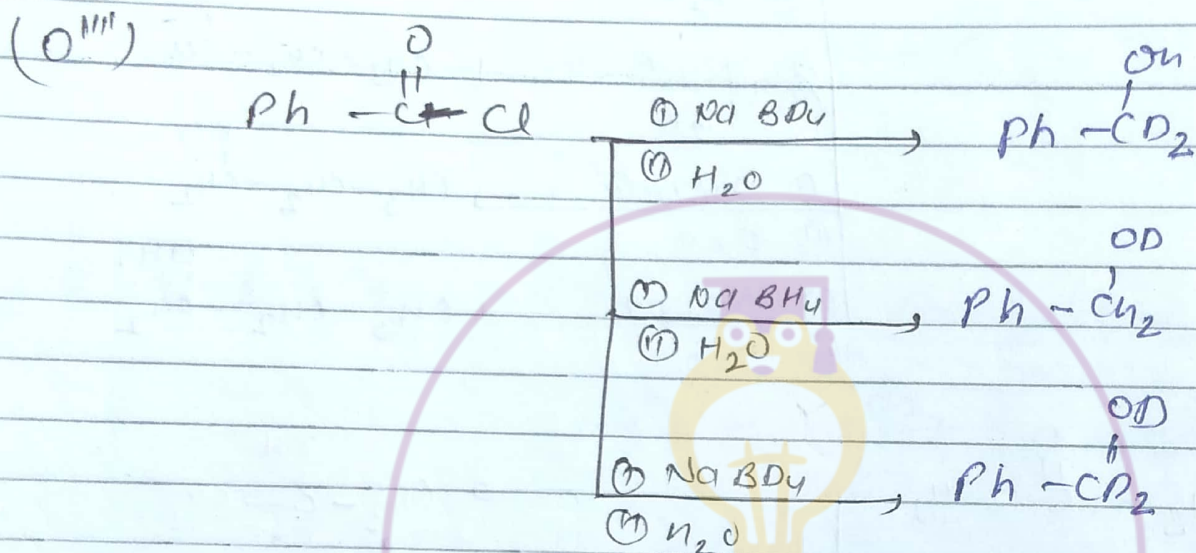
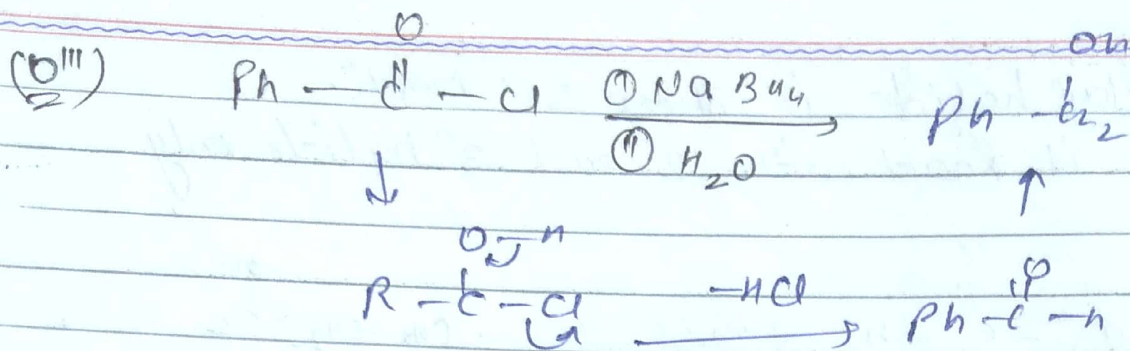


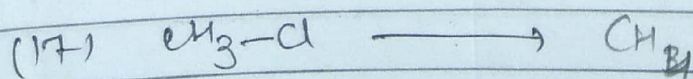
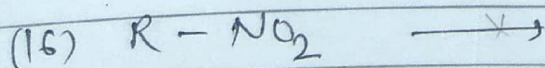
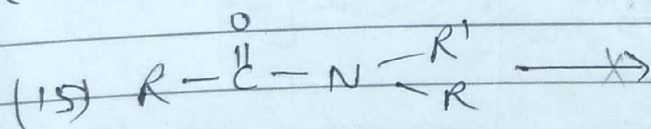
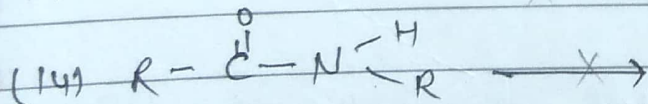
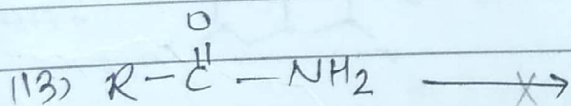
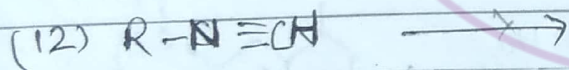
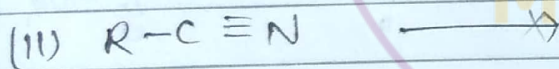
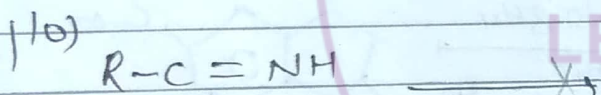
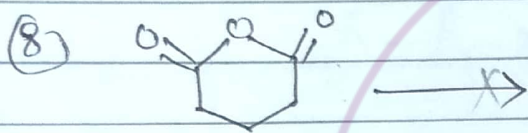
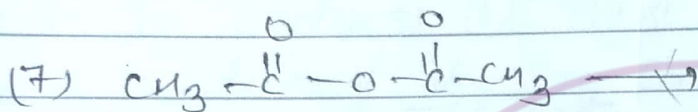
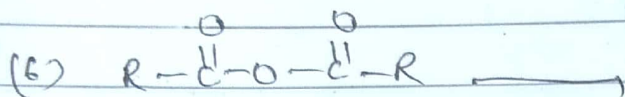
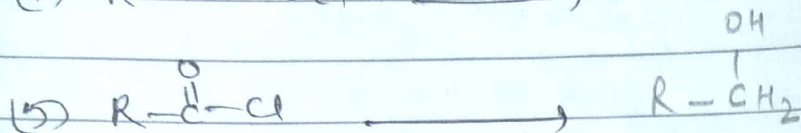
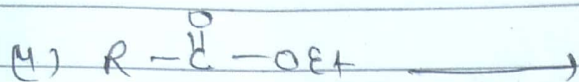
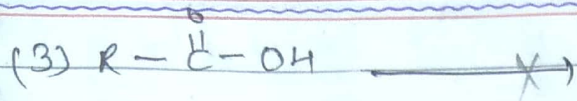
Q. (ii)

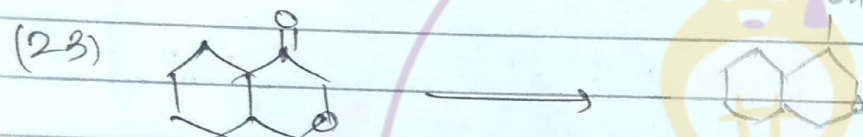
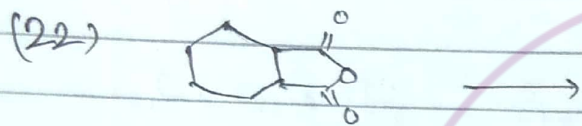
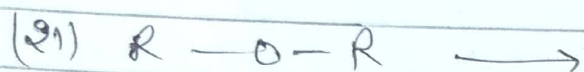
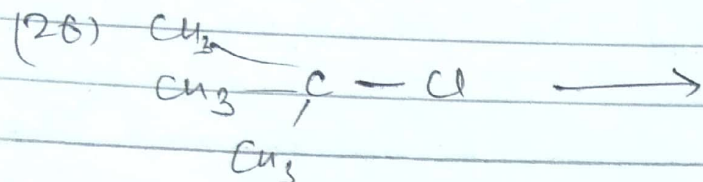
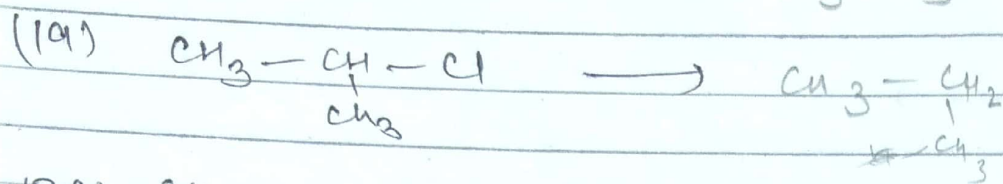
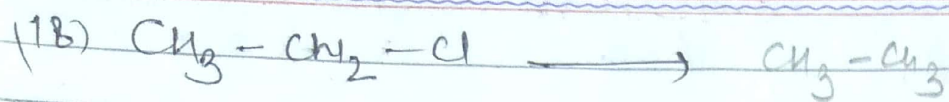


Q. (iii)

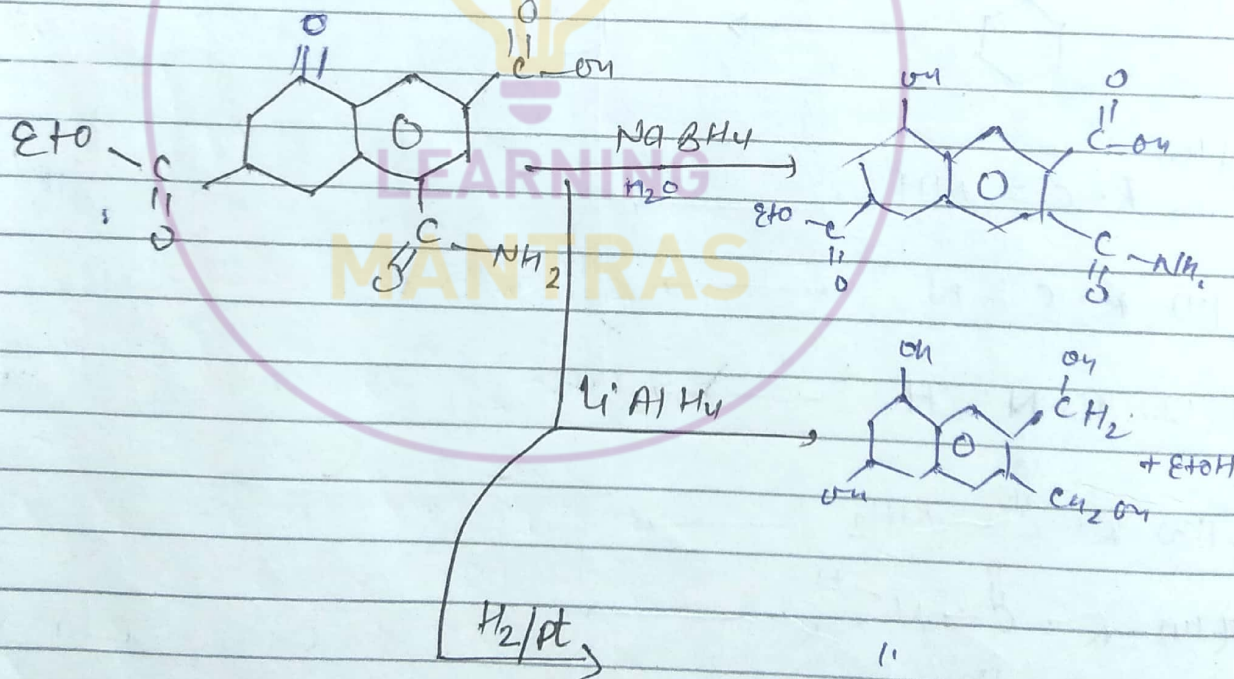




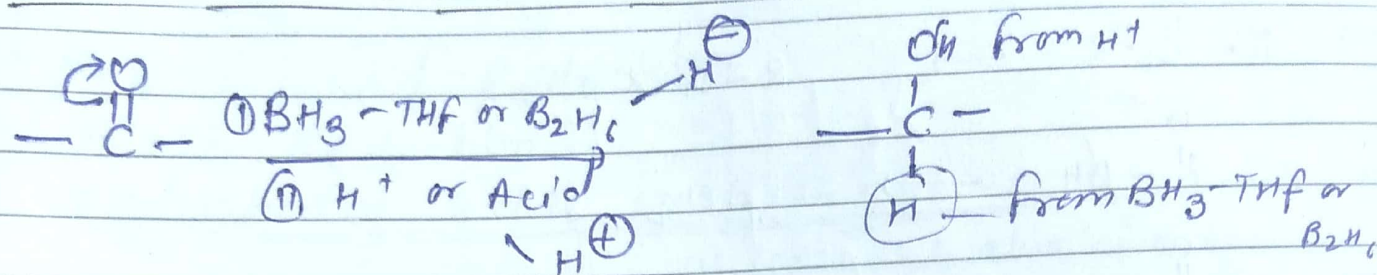




Q. 24

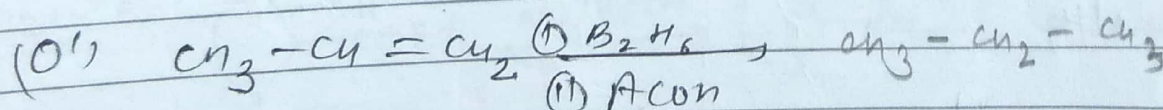
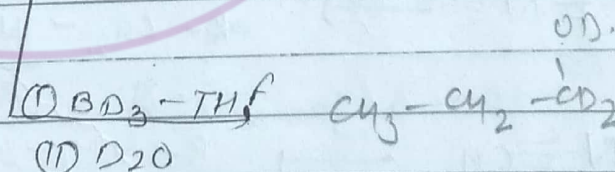
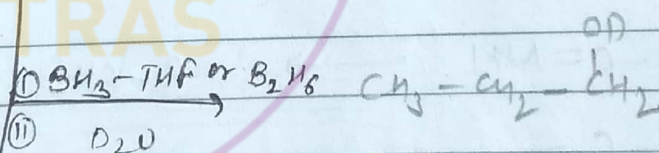
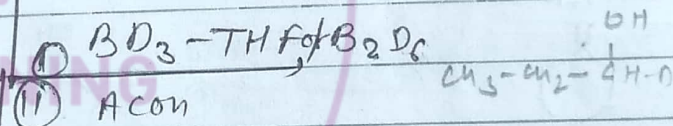
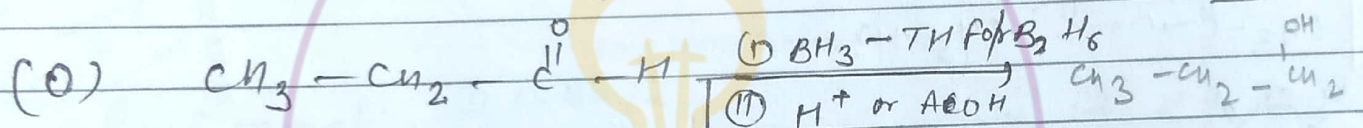


* Reduction by HBr ($\text{BH}_3\text{-THF}$ / H^+ or $\text{B}_2\text{H}_6/\text{H}^+$)

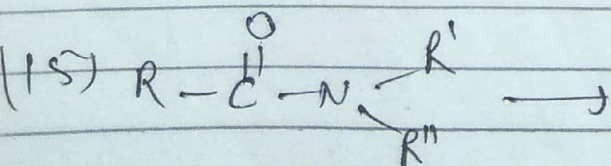
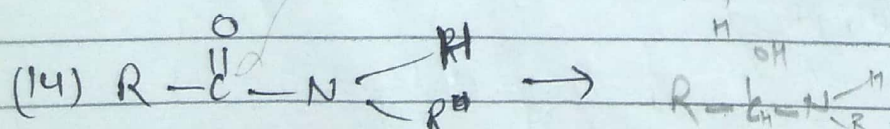
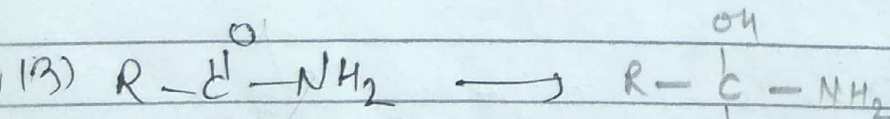
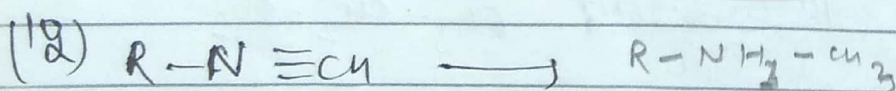
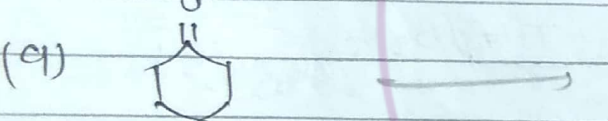
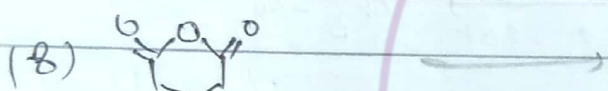
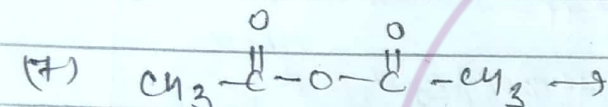
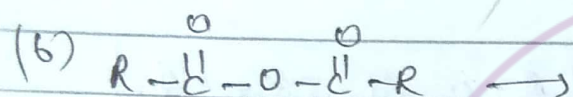
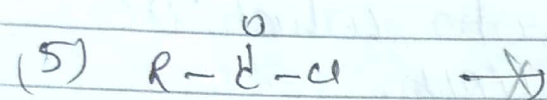
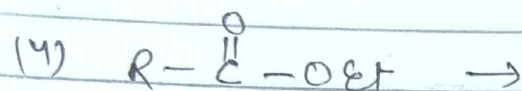
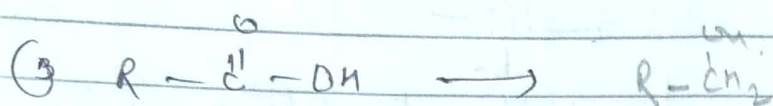
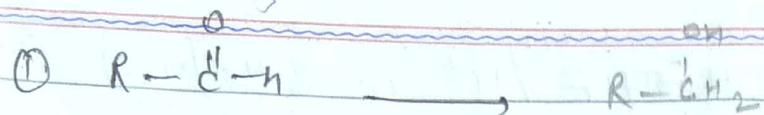


* It reduces all those comp. which are reduced by H_2 catalyst & LiAlH_4

Except $\text{R}-\text{C}(=\text{O})-\text{X}$ or $\text{R}-\text{X}$, $\text{R}-\text{O}-\text{R}$, $\text{R}-\text{NO}_2$



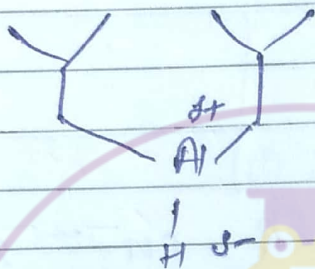
1 5x



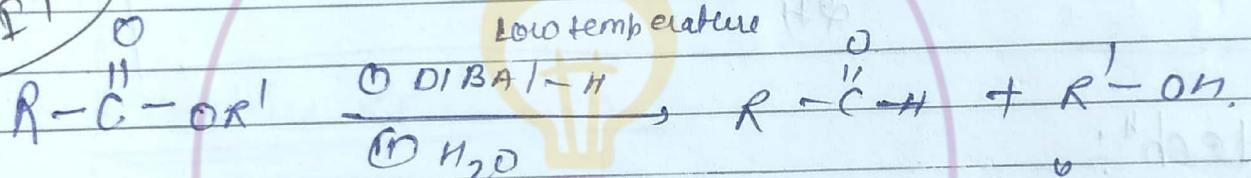
other

Some Important Reductions

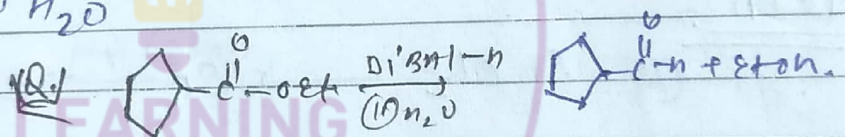
- ① Rosenmund Reduction
- ② Birch Reduction
- ③ Reduction of ester with DIBAL-H
Diisobutyl aluminium hydride



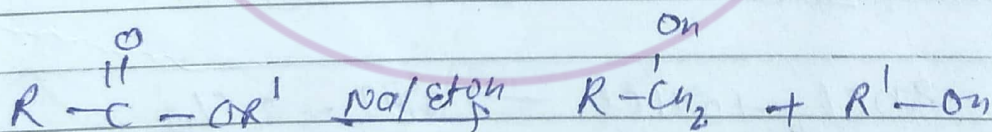
IPT



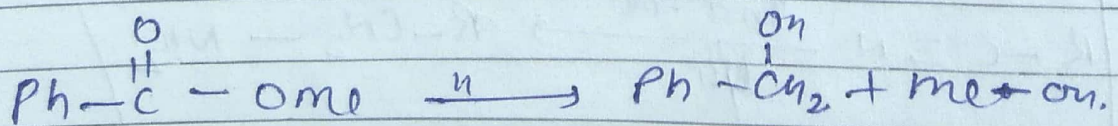
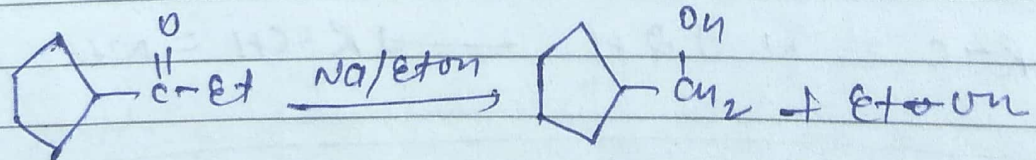
Dimer Reduces



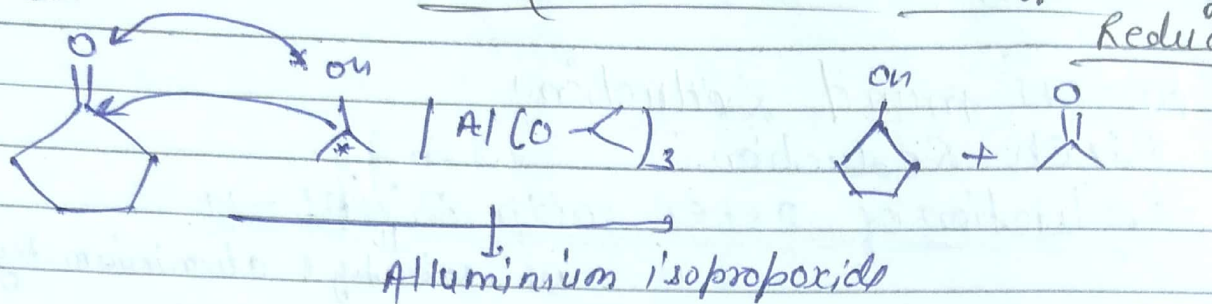
Bouveault Blanc Reduction



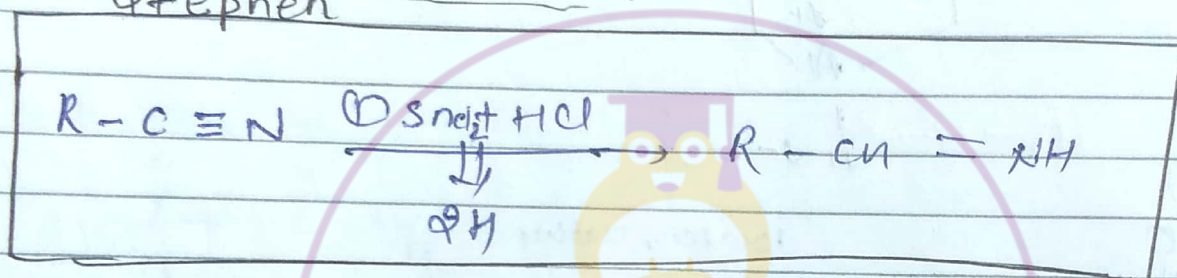
Mechanism:



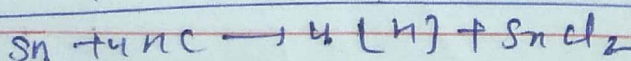
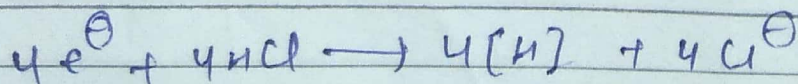
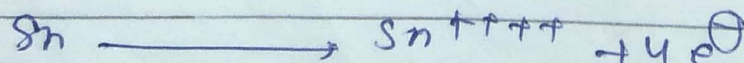
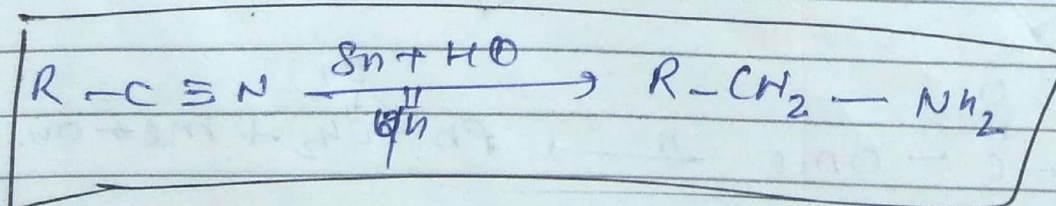
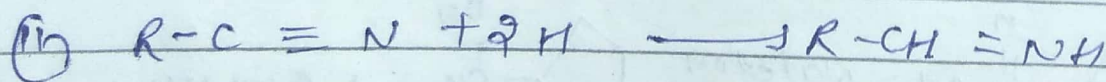
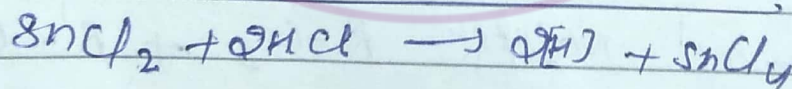
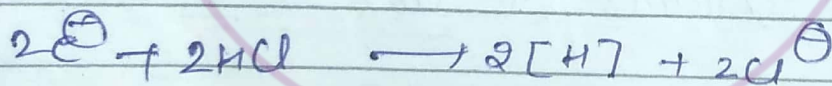
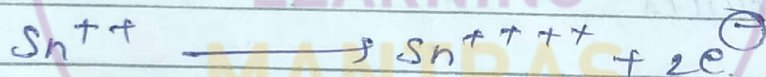
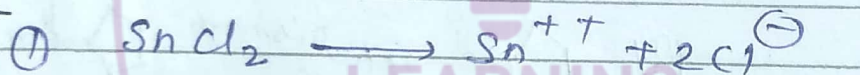
⑤ MPV - Reduction: (Meerwein - Ponderoff - Ziegler Reduction)

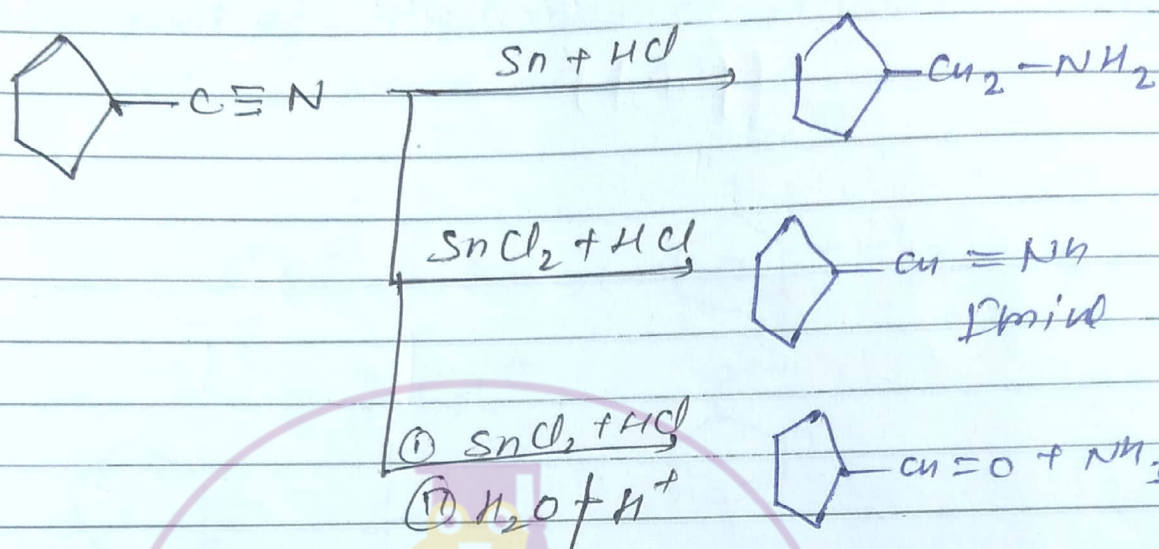


⑥ Mendius Reduction:
= Stephen

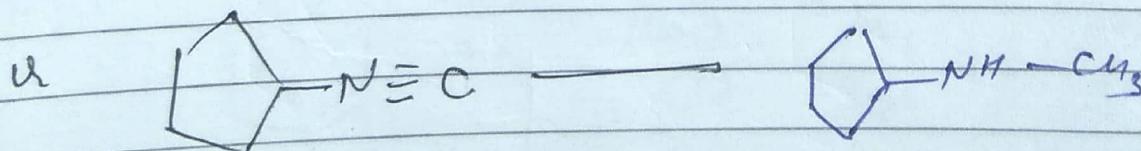
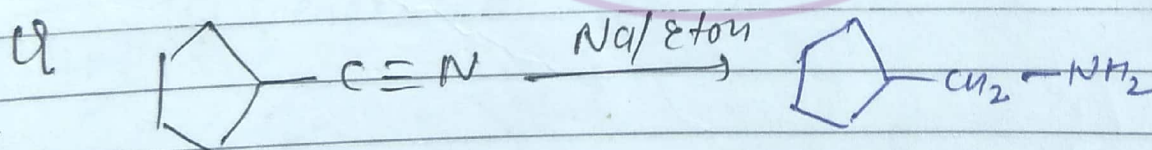
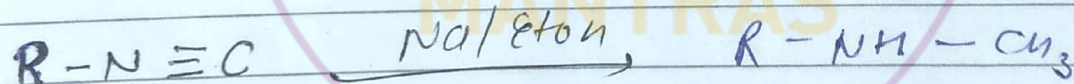
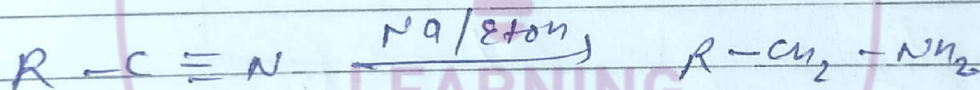


* Mechⁿ:



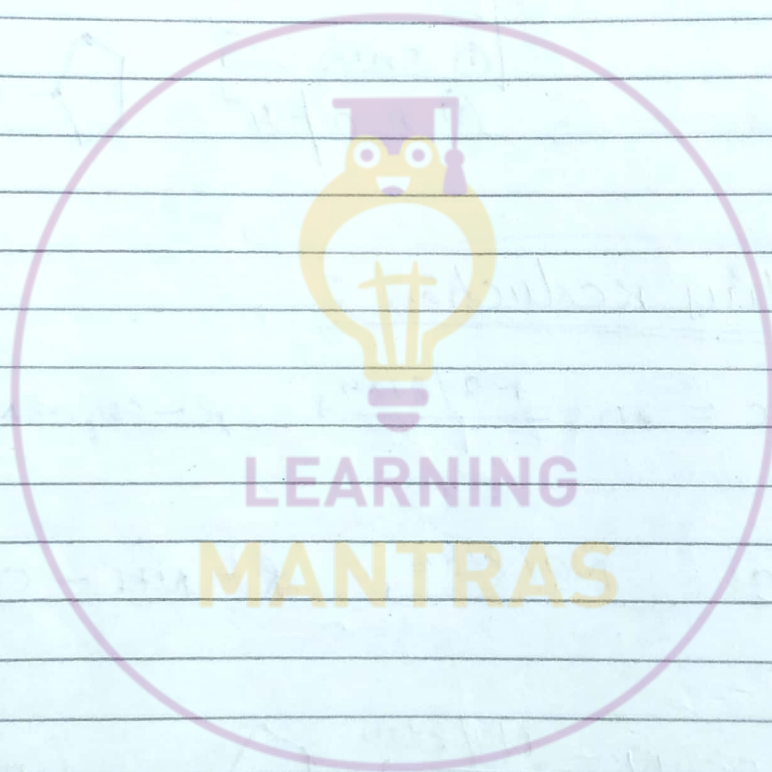


(7) Mendius reduction :-



$R-F < R-Cl < R-Br < R-I$

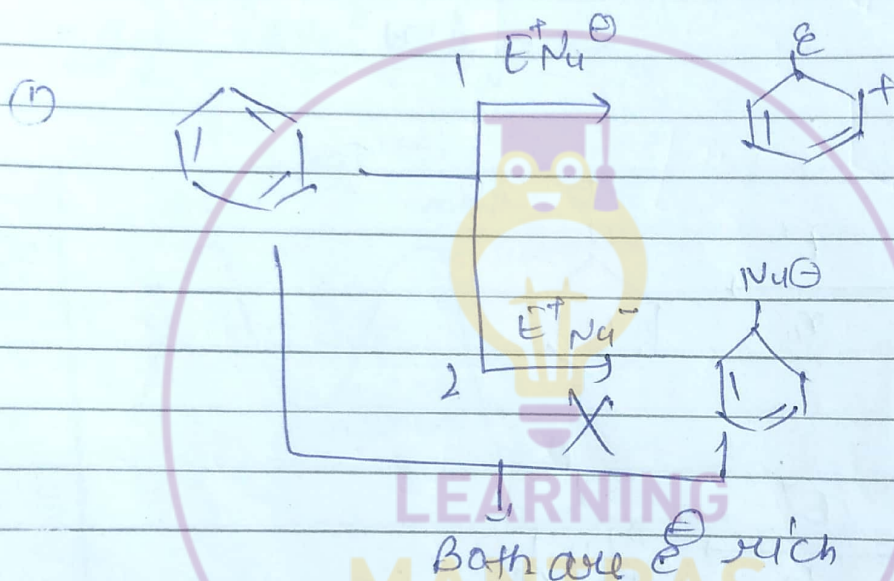
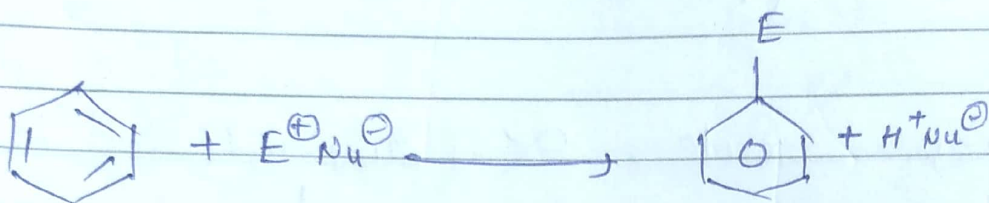
$Ph-F > Ph-Cl > Ph-Br > Ph-I$



(EAS) Electrophilic Aromatic Substitution

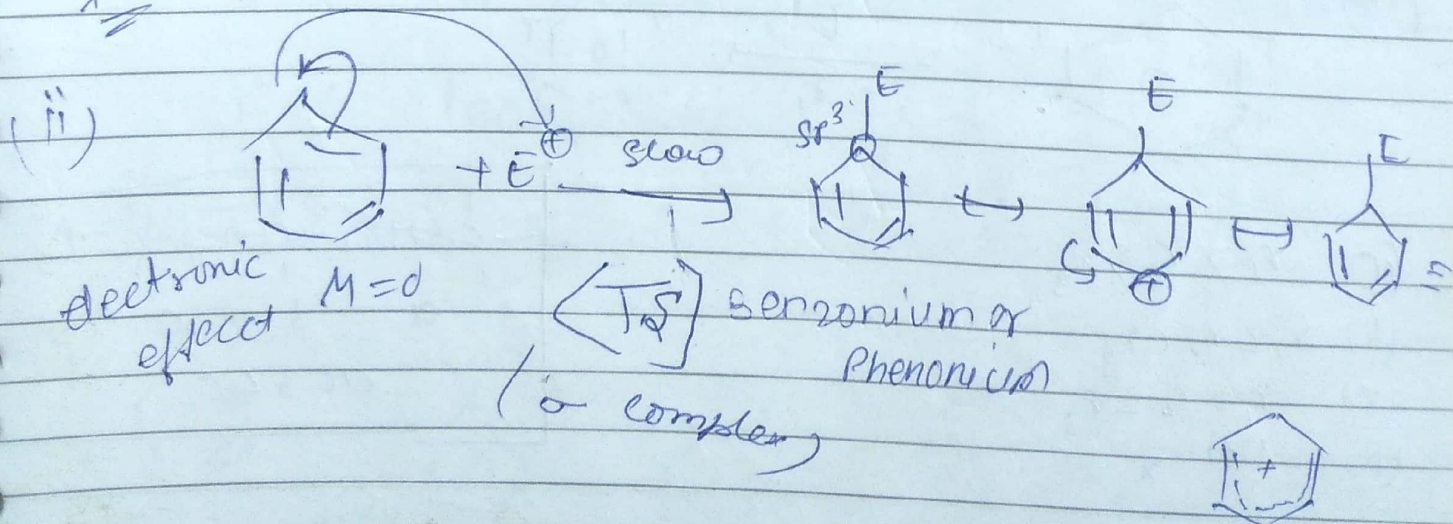
The replacement of Hydrogen of Aromatic Compound by electrophile is known as EAS.

Ex:

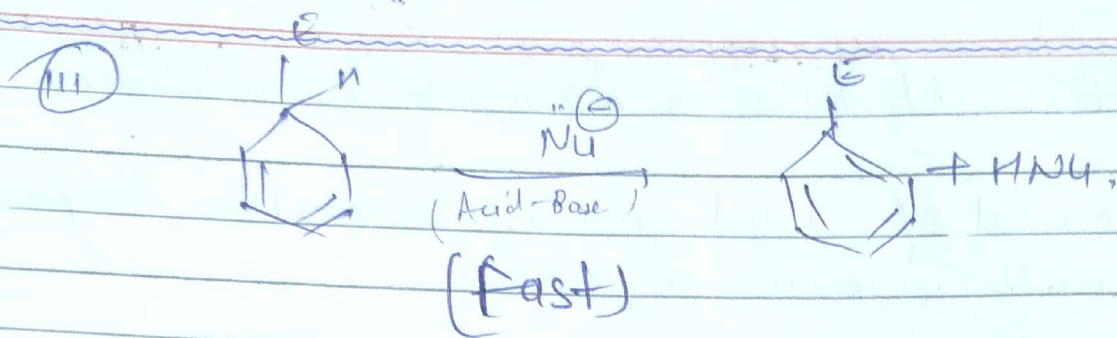


Mechⁿ:

Step 1 Generation of $\text{E}^+ \Rightarrow \text{E}^+ \text{Nu}^- \rightleftharpoons \text{E}^+ + \text{Nu}^-$

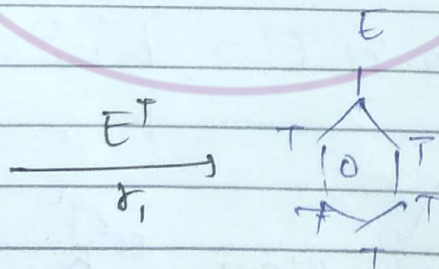
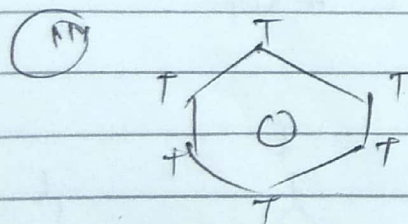
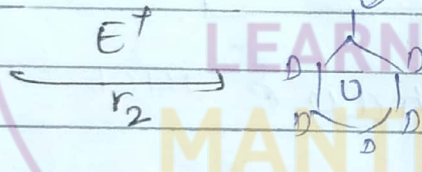
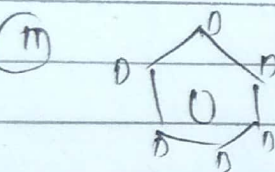
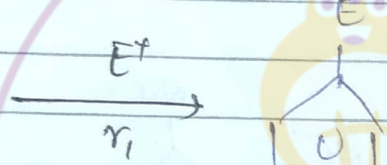
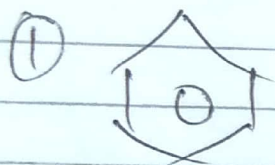


Behaviour of Electrophile



Kinetics: Rate \propto (Substrate) (E^+)

↓
a-1

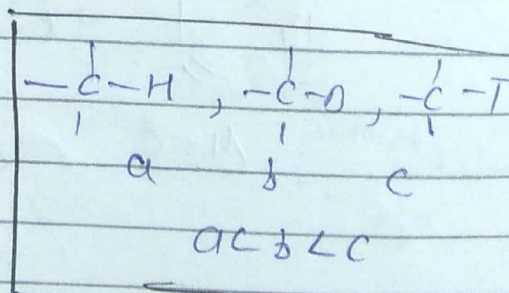


(a) $r_1 > r_2 > r_3$

(b) $r_1 < r_2 < r_3$

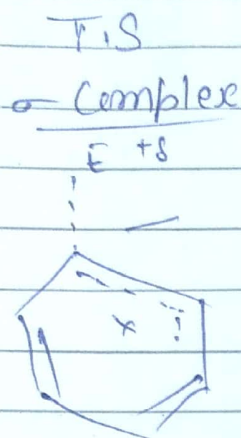
(c) $r_1 = r_2 = r_3$

(d) Not

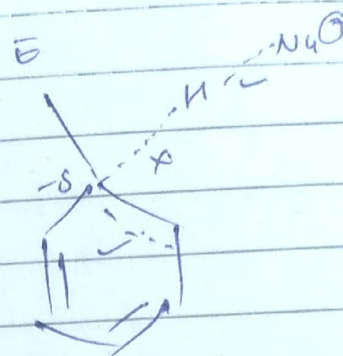


Comp.

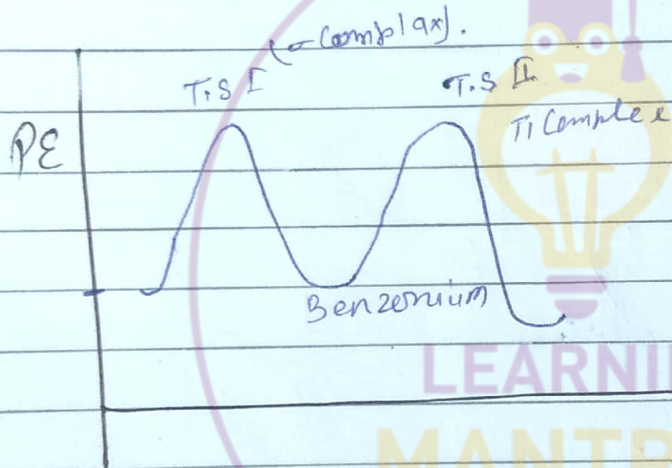
Slow step



π Complex



* Energy level diagram:

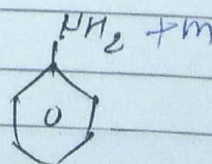
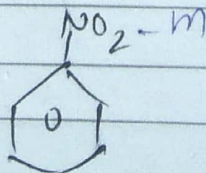
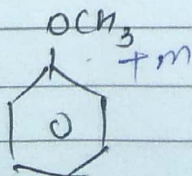
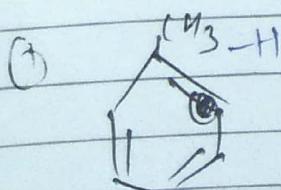


* Rate of R_N^A p

$r \propto$ nucleophilicity of Aromatic Compound

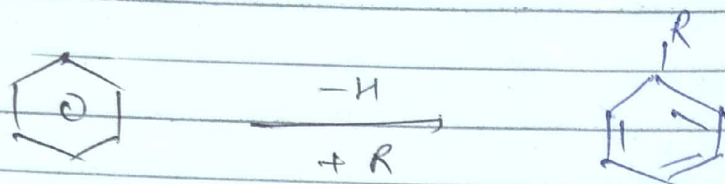
$r \propto$ electrophilicity of E^+

+ $N \equiv O \rightleftharpoons :N \equiv O^+$ Bad electrophile



4 > 2 > 1 > 3

* Alkylation (Friedel Craft Alkylation).



Attacking $E^+ \rightarrow R^+$

Reagent = $R-X + \text{Lewis Acid}$

Order of Lewis Acid $\Rightarrow \text{AlCl}_3 > \text{BF}_3 > \text{SnCl}_4 > \text{FeCl}_3 > \text{SnCl}_2$

Attack $E^+ = C^+$ (free)

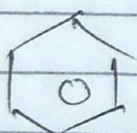
Rearrangement is possible

2nd Cl_2

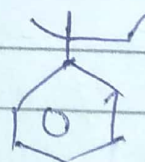
$A \cdot E^+ = \text{Complex}$

(Carbocation in complex)
Rearrangement is not possible

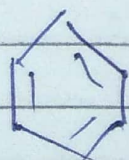
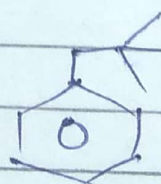
Ex:



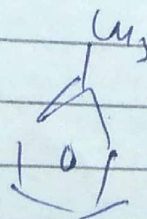
(a) $\xrightarrow{+ \text{Anh. AlCl}_3}$



(b) $\xrightarrow{+ 2\text{nd Cl}_2}$

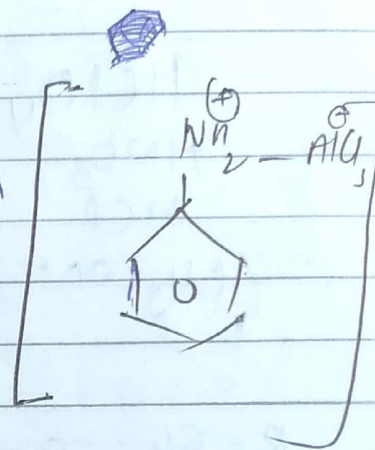
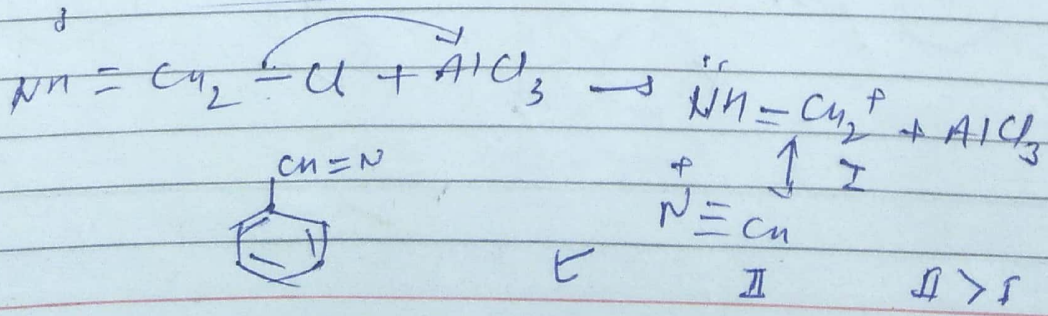
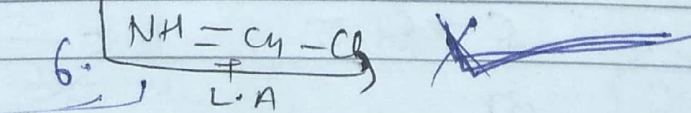
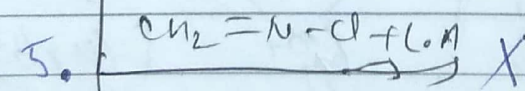
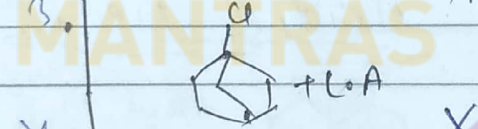
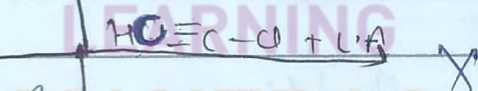
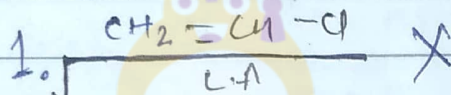
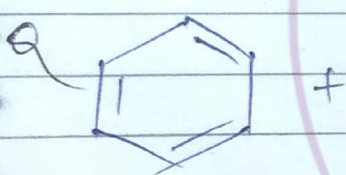
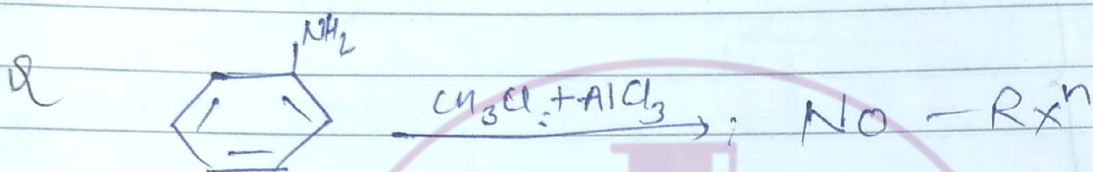
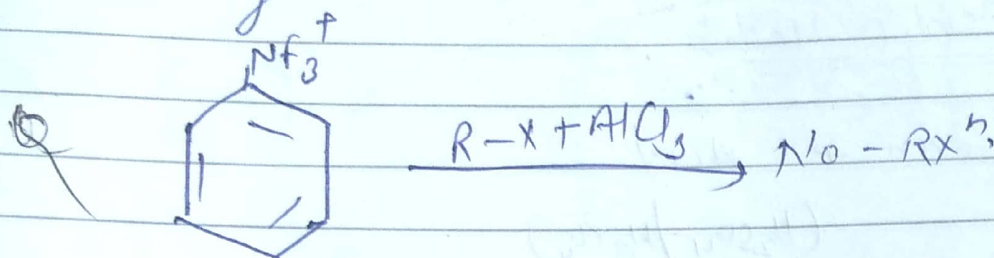


$+ \text{CH}_3\text{-Cl} \xrightarrow{\text{AlCl}_3}$



Toluene.

* Highly deactivated B.R. does not give alkylants.

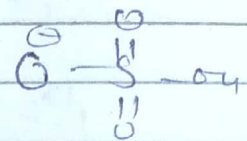
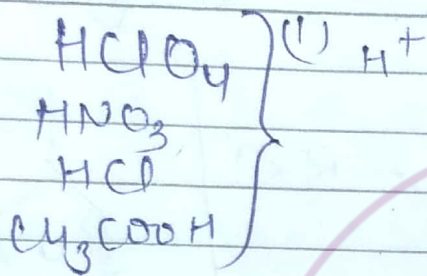
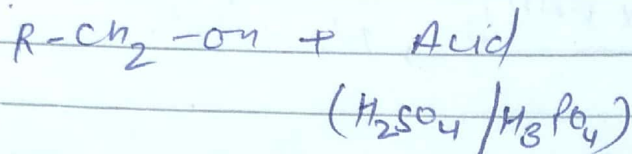


character

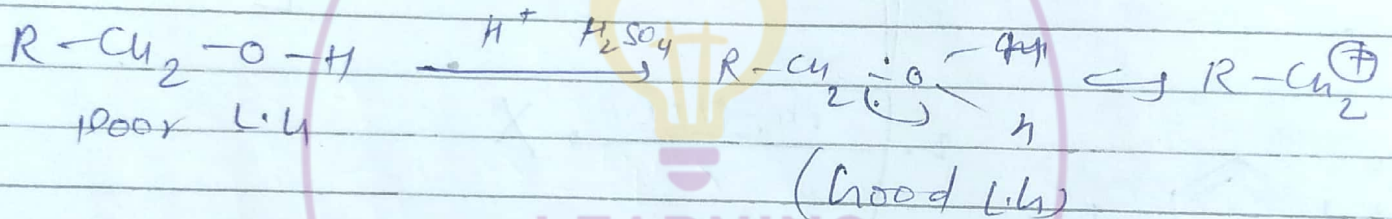
HClO₄

* other sources of C⁺

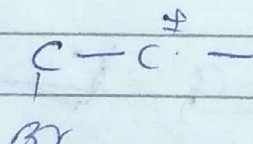
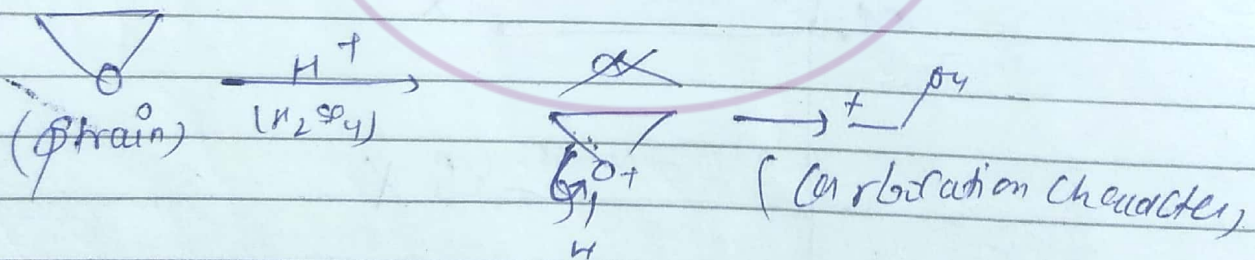
(a) Alcohol in Acidic Med.



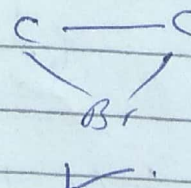
weak attack species.



(b) Ethers in Acidic Med.



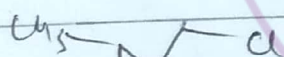
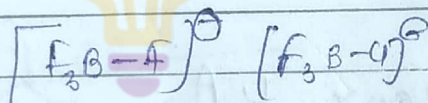
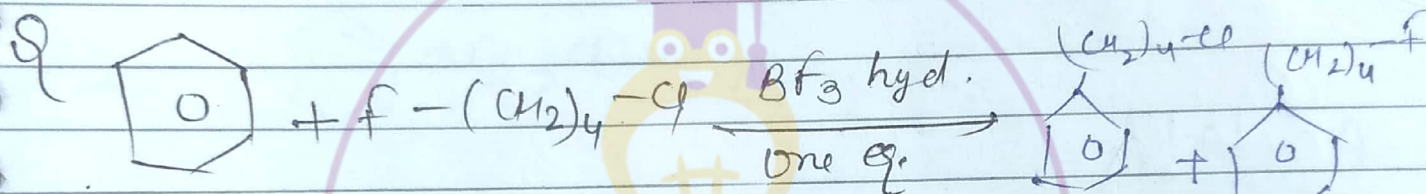
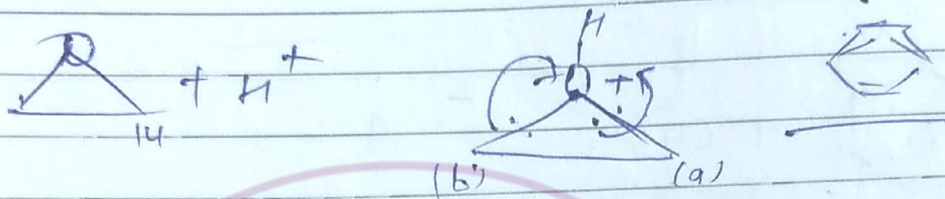
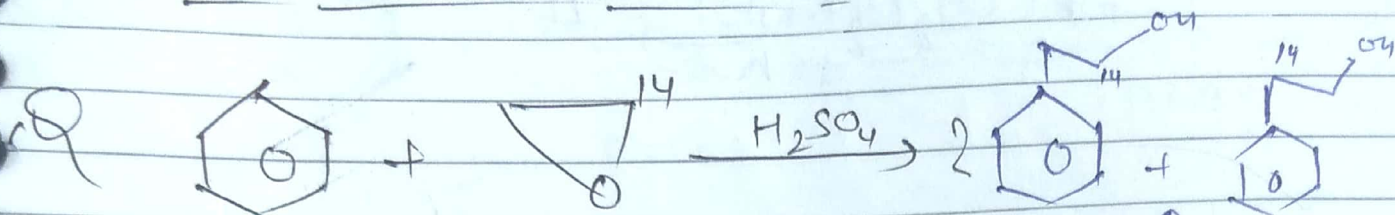
X



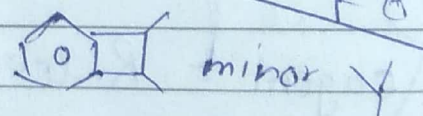
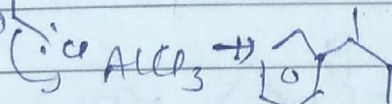
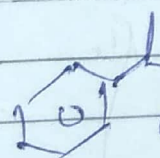
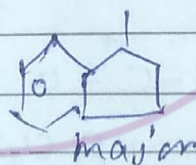
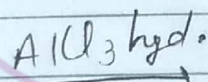
Size ↓ Bu ↓

Conceptual

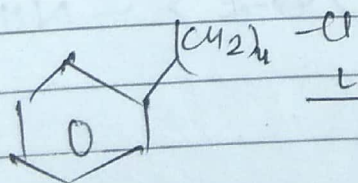
(C) Alkenes In Acidic Med. :-



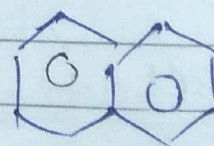
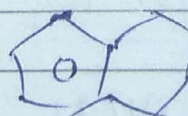
Q.

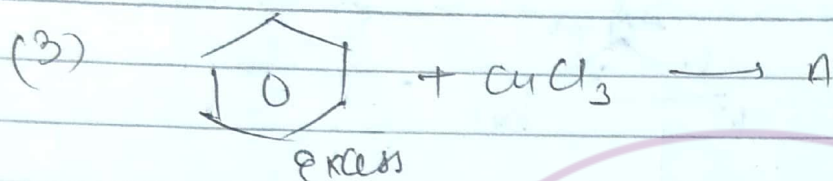
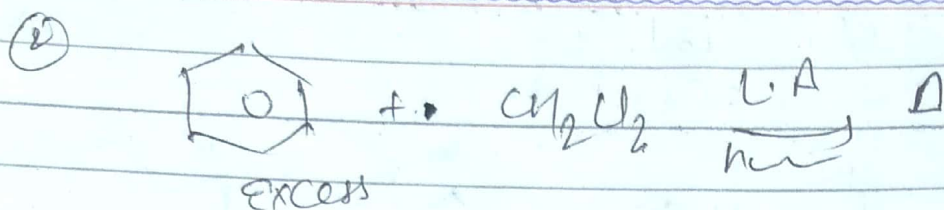


Q

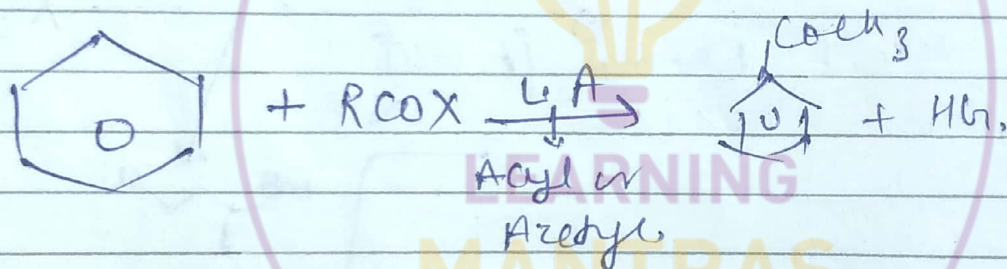


se. reht.





* Acylation:

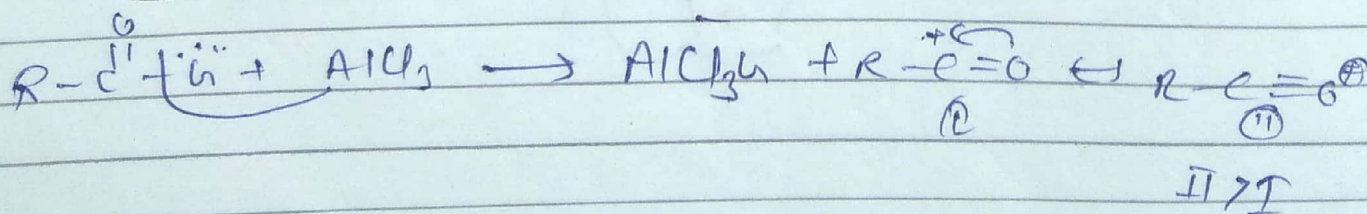


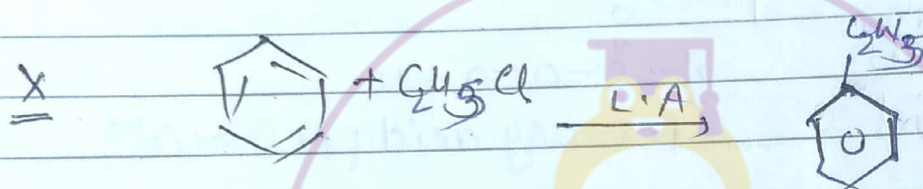
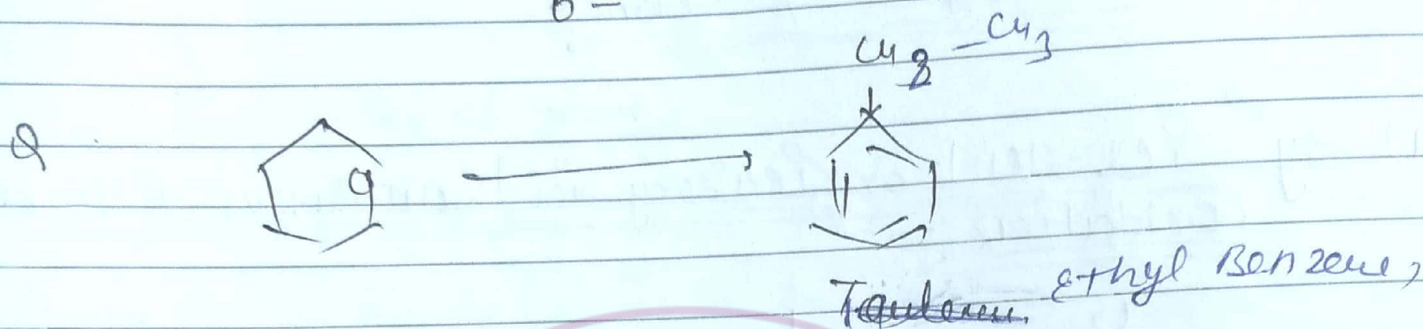
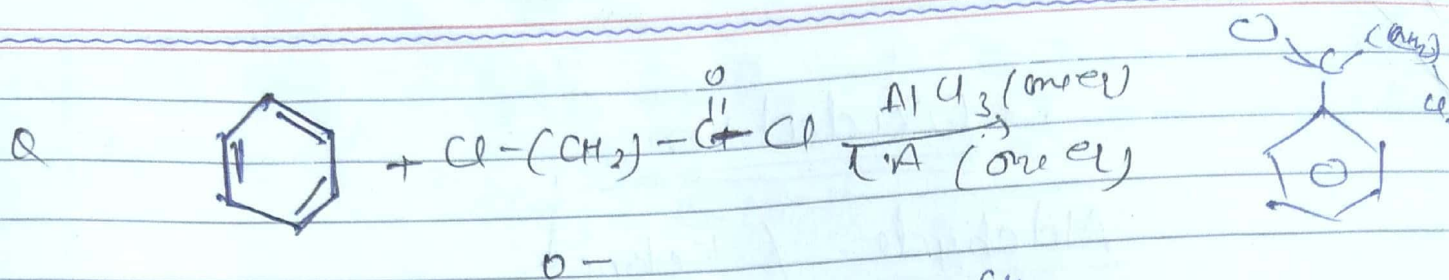
Attacking E^+ $\text{R}-\text{C}^+=\text{O}$
 Acylation

Reagent = $\text{RCO-Br} + \text{L.A}$

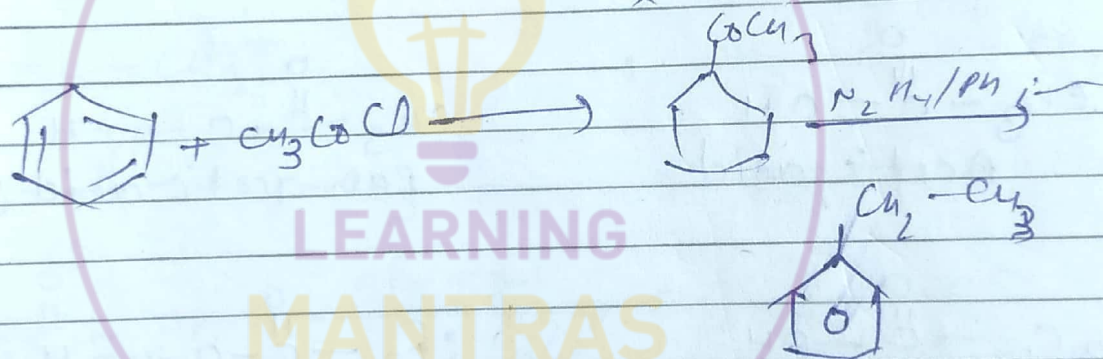
$\text{Br} = \text{X} > -\text{C}-\overset{\text{O}}{\underset{\text{||}}{\text{C}}}-\text{R} > -\text{OH} > -\text{OR} > -\text{NH}_2$

* Generation Acylium ion:





Better Method



Learning Mantras

Our Guidance, Your Success