CSIR-JRF (NET), GATE

DRDO, BARC, IISC…..

LONG COURSE For CSIR-NET (JRF)-June-2017

CHEMISTRY BY H. GAUR

ORGANIC CHEMISTRY

NAMED REACTIONS

SHEET-2

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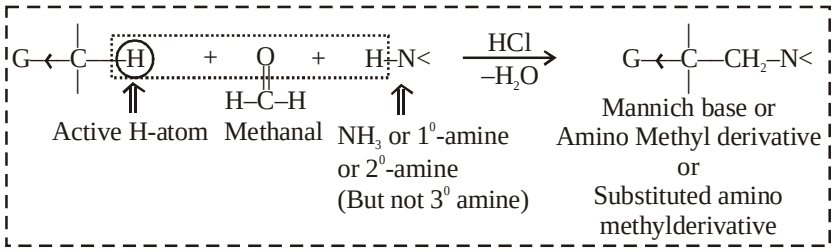
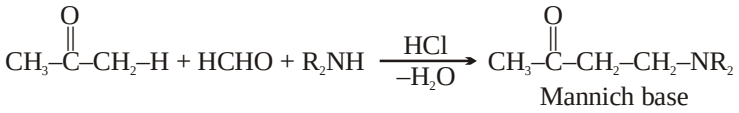
MANNICH REACTION:

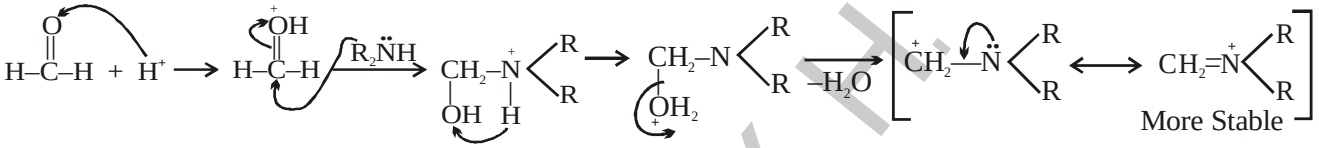
* It Involve the condensation of a compound having active methylene group (active H-atom) with formaldehyde & H-N< (H–N< $\Rightarrow$ NH_3 or, NH_2R or NHR_2 ,but not used NR_3) in the presence of acid and formed amino methyl derivative or substituted amino methyl derivative (**Mannich base**) is called **Mannich Reaction**.

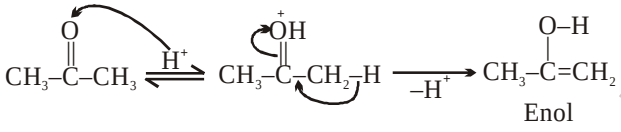


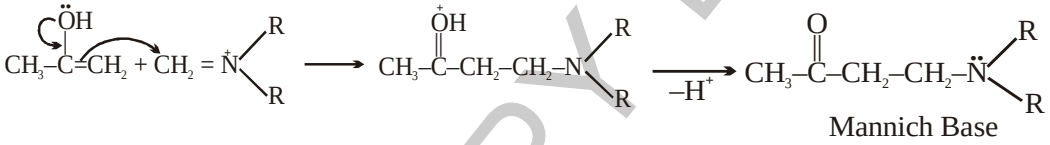


Mechanism:

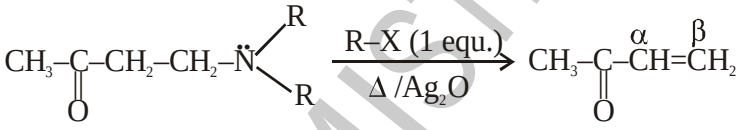
* It is acid catalysed as well as base catalysed.







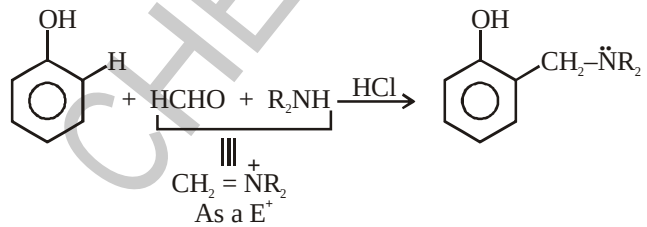
Generally, mannich base, used for the synthesis of $\alpha,\beta-$ unsaturated carbonyls.



* It is substrate of Michael addition

Examples of Mannich Reactons:

(1)



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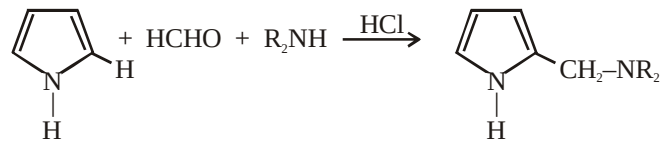
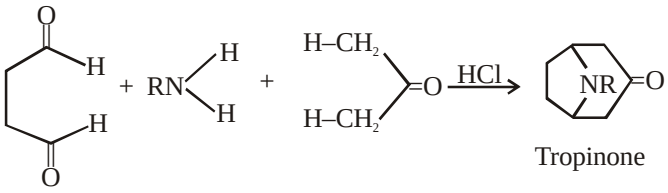
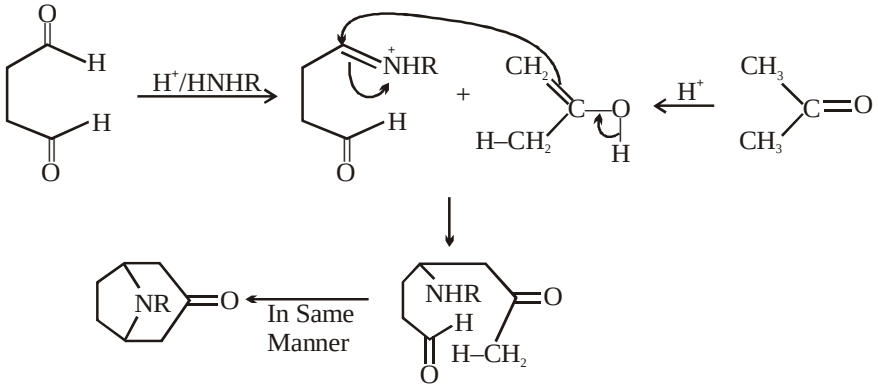


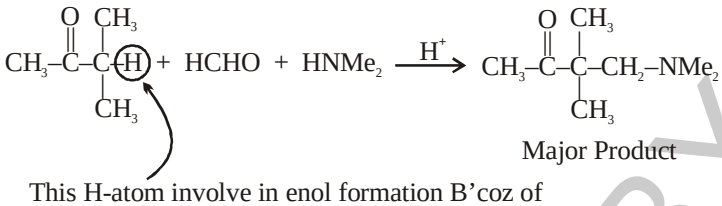
(3) 

Tropinone

* It is example of double **mannich base reaction**.

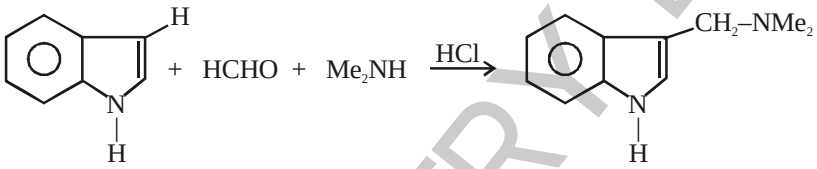
* This reaction takes place as;



(4) 

Major Product

This H-atom involve in enol formation B'coz of in acidic medium more substituted enol is the formed.

(5) 

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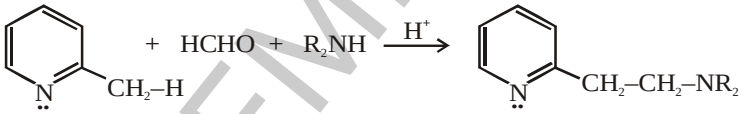
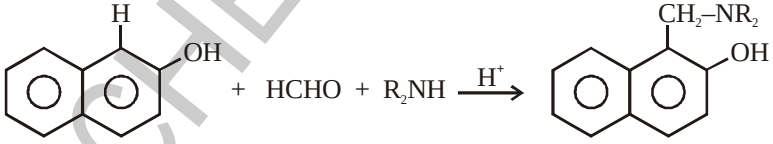
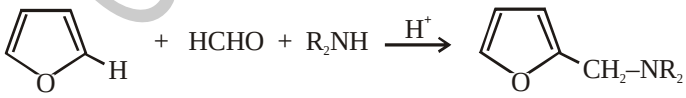
(7) 

(8) 

(9) 

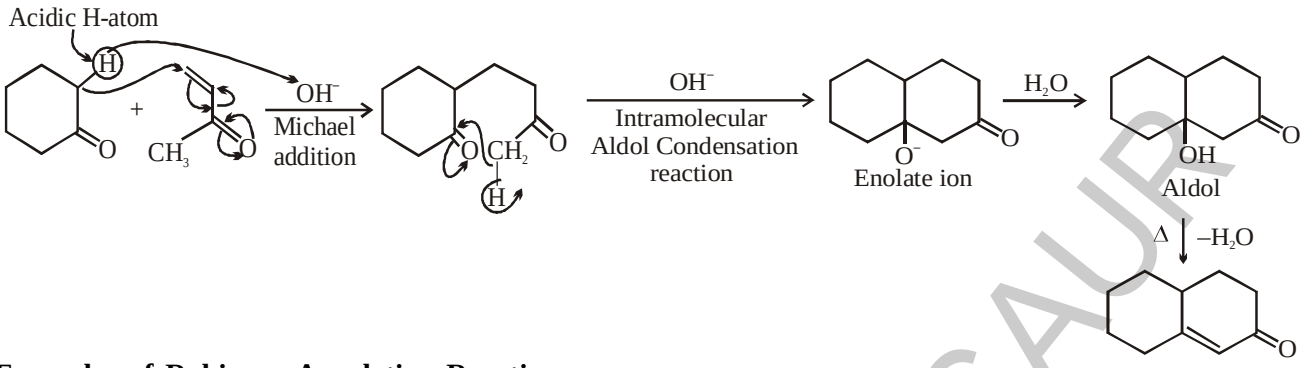
ROBINSON ANNELATION REACTION:

* It involve two reaction in following order.

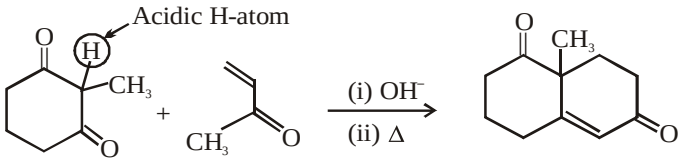
(A) Michael Addition followed by

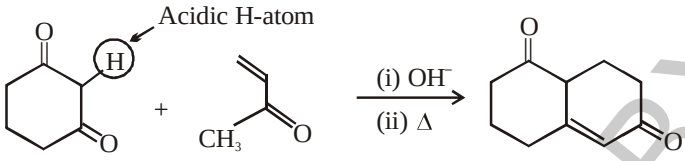
(B) Intramolecular aldol condensation reaction.

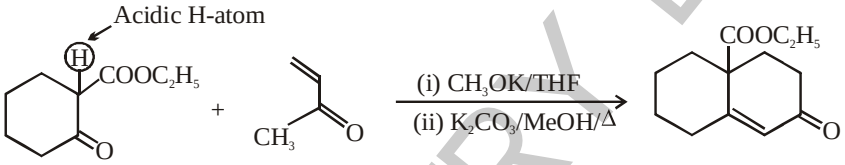
* This reaction can be very usefull in the synthesis of polycylic molecules due to this reason this reaction is also called **Robinson ring forming reaction.**



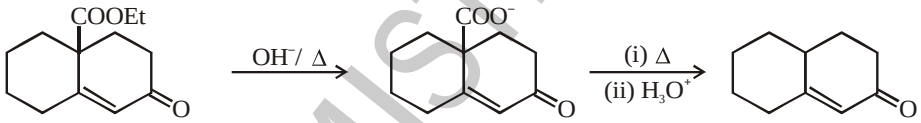
Examples of Robinson Annelation Reaction:

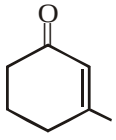
(1) 

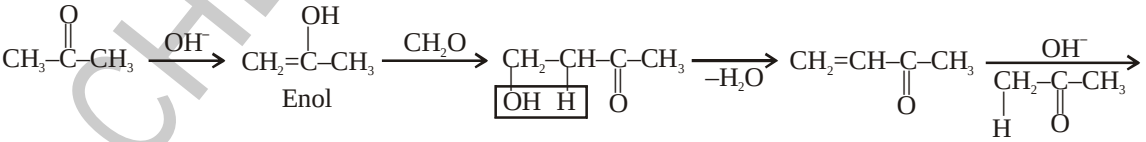
(2) 

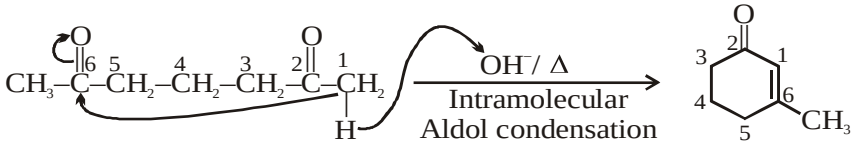
(3) 

* In this reaction, the ester group can be removed by Hydrolysis followed by decarboxylation

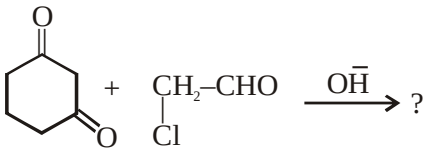


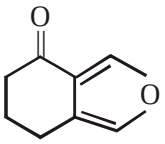
Q. $CH_2O + CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (Excess) $\xrightarrow{OH^-}$? Ans: 

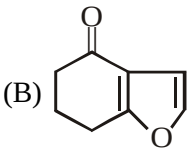
Sol. 

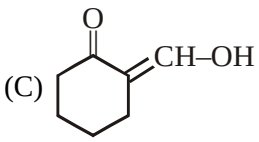


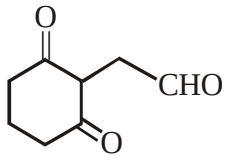
it is also substrate for Michael addition

Q.  ?

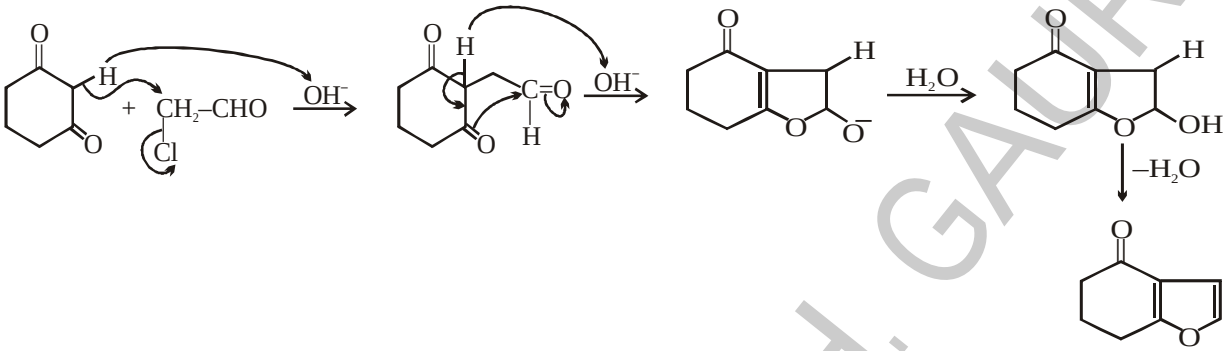
(A) 

(B) 

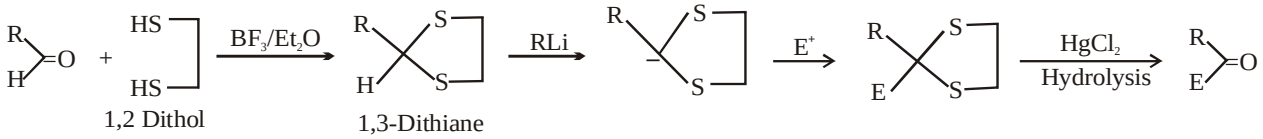
(C) 

(D) 

Ans: (B)

Sol. 

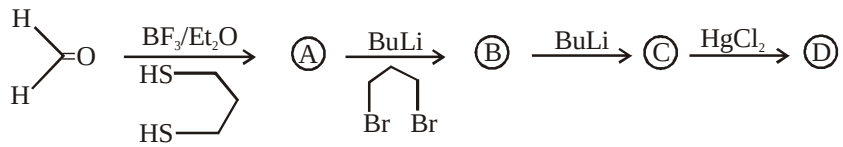
1,3-DITHIANES:



1,2 Dithol

1,3-Dithiane

Q.



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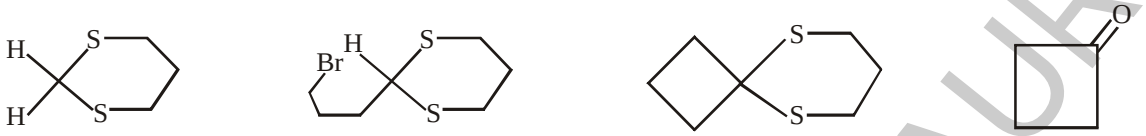

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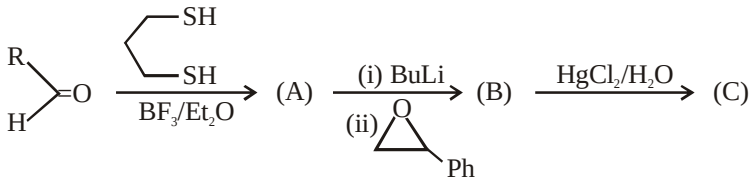
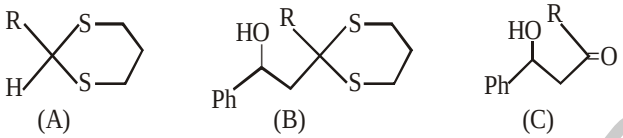


Ans:



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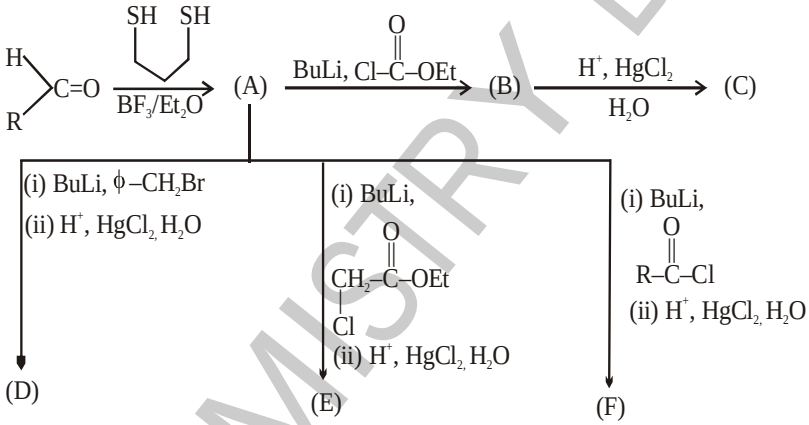

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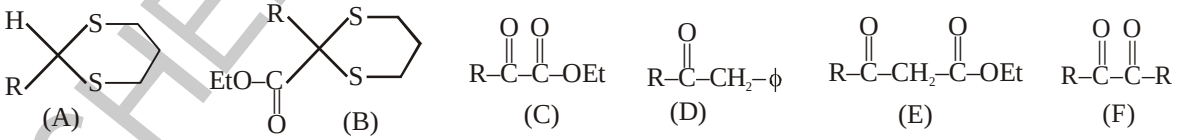
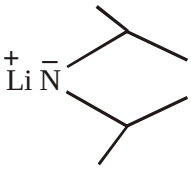
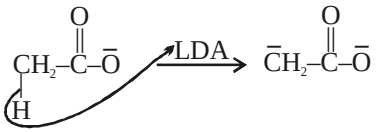


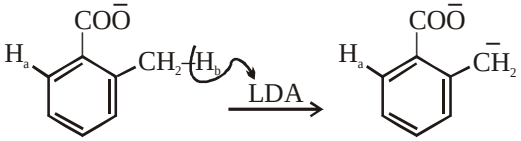
LDA (LITHIUM DIISOPROPYLAMIDE):

* It is strong base but weak nucleophilile.
* It is Bulky base
* Abstract less sterically hindard acidic H-atom
* Since, it is a strong base so it can also abstract very less acidic H-atom.



LDA (Lithium Diisopropyl Amide)





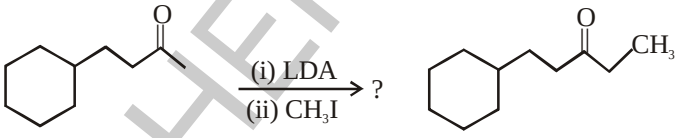
Important Questions:

(1) $R-CH_2-\underset{\underset{O}{\|}}{C}-R \xrightarrow[(ii)\ R-X]{(i)\ LDA} ?$ $R-\underset{\underset{R}{|}}{CH}-\underset{\underset{O}{\|}}{C}-R$

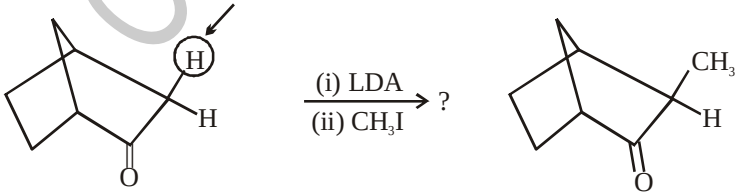
(2) $R-CH_2-COO^- \xrightarrow[(ii)\ R^1-X]{(i)\ LDA} ?$ $R-\underset{\underset{R^1}{|}}{CH}-COO^-$

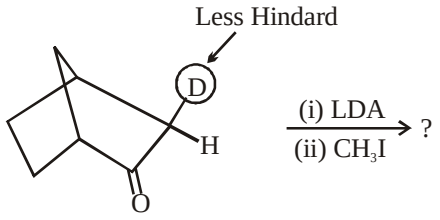
(3) $Ph-\underset{\underset{O}{\|}}{C}-\underset{\underset{R}{|}}{CH}-CH=CH_2 \xrightarrow[(ii)\ R^1-X]{(i)\ LDA} ?$ $Ph-\underset{\underset{O}{\|}}{C}-\underset{\underset{R}{|}}{\overset{\overset{R^1}{|}}{C}}-CH=CH_2$

(4) $CH_3-\underset{\underset{O}{\|}}{C}-O-CH_2-CH_3 \xrightarrow[(ii)\ >C=O^+\ (iii)\ H_3O/\Delta]{(i)\ LDA} ?$ $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!CH-\underset{\underset{O}{\|}}{C}-OCH_2-CH_3$

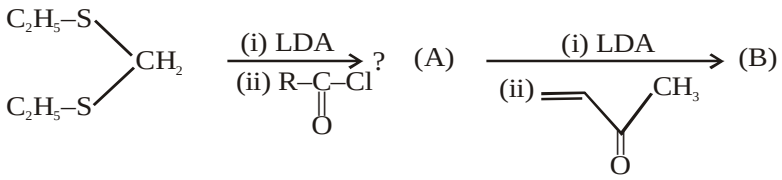
(5) 

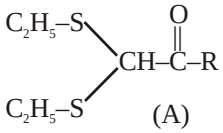
Less Hindard

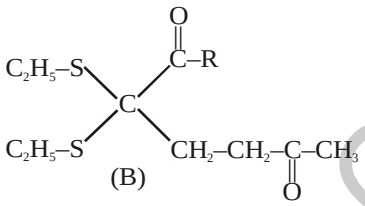
(6) 

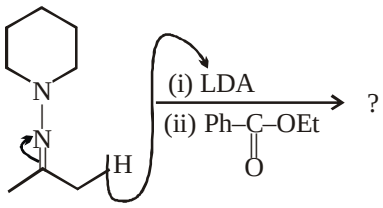
(7) 

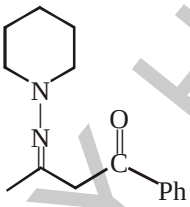
(Acidity of H & D are alsmost same)

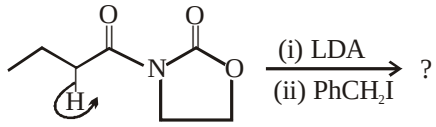
(8) 

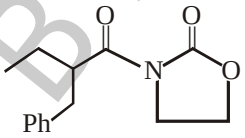


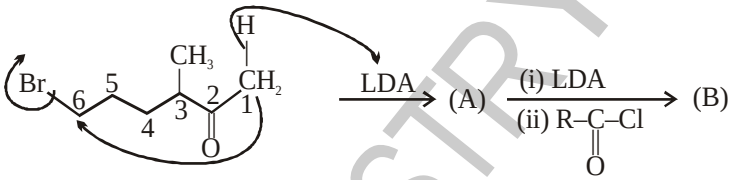


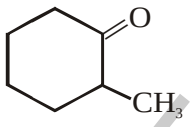
(9) 

Ans: 

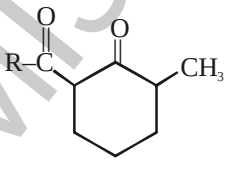
(10) 

Ans: 

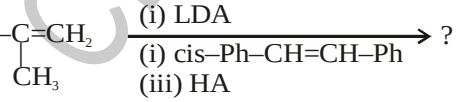
(11) 

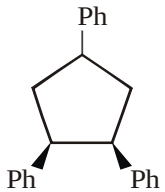


(A)



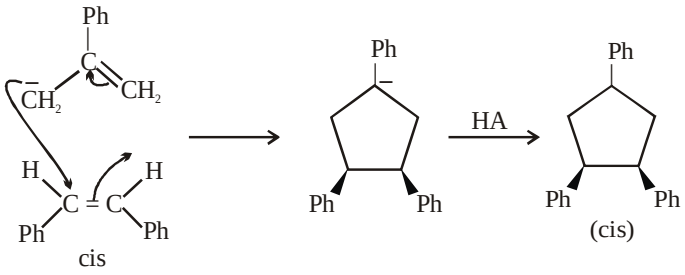
(B)

(12) 

Ans: 

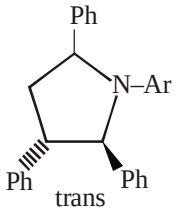
(cis)

Solution:

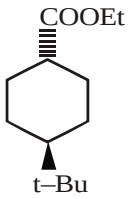


This reaction takes place by the concerted mechanism so that symmetry of reactant maintain in the product (i.e., cis ⟶ cis & trans ⟶ trans)

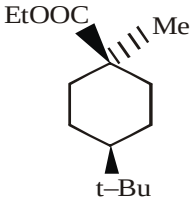
(13) Ph–C(CH3)=N–Ar —(i) LDA; (ii) E–Ph–CH=CH–Ph; (iii) HA→ ? Ans:



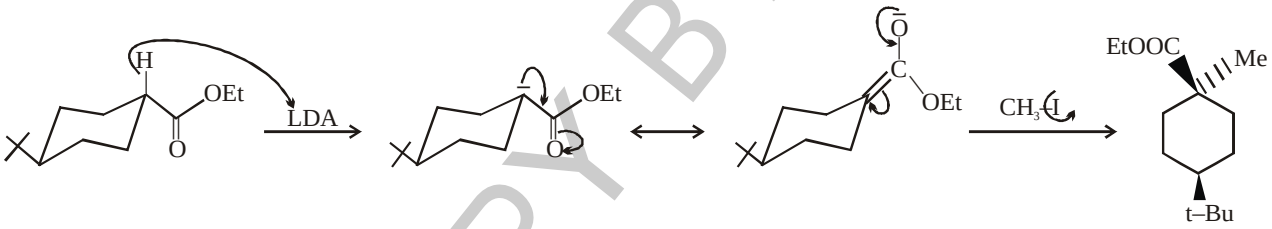
(14)



—(i) LDA; (ii) CH_3I→ ? Ans:

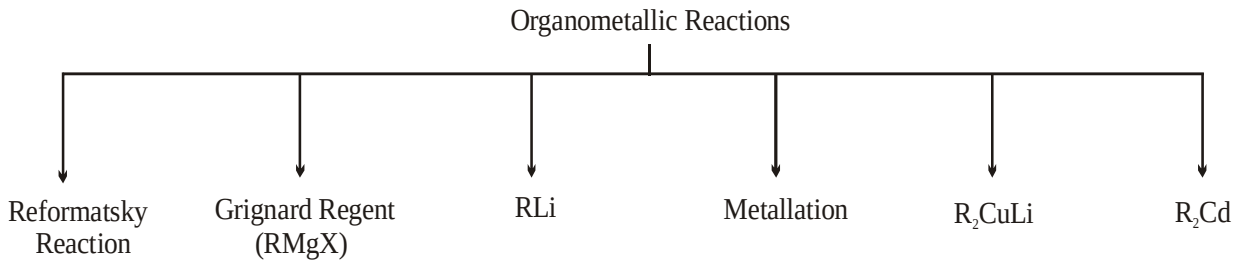


Solution:



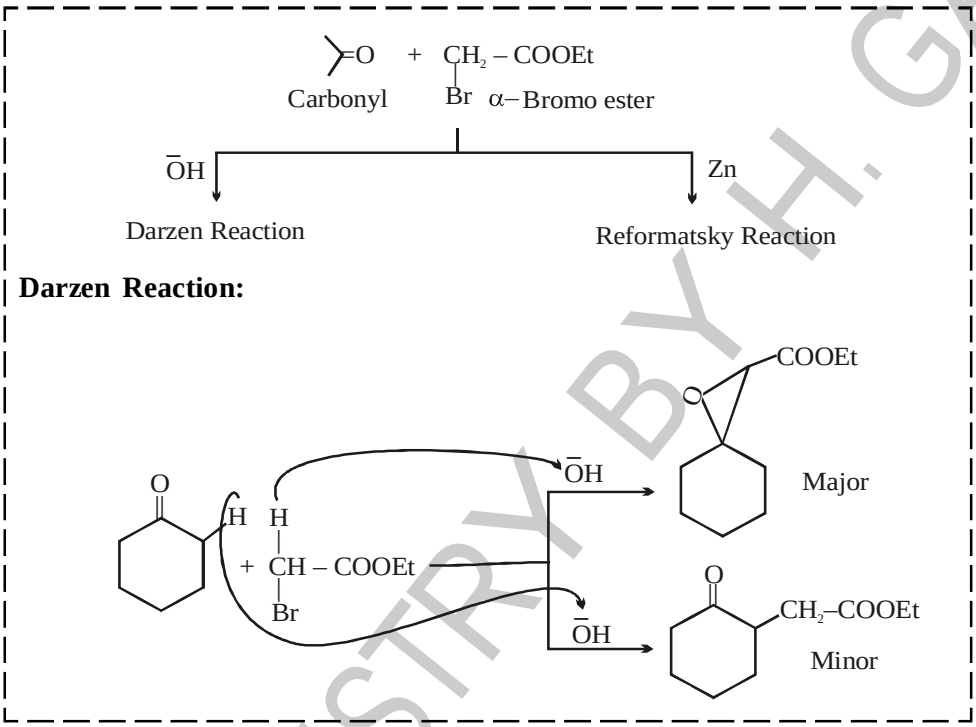
CH_3–I ⟹ Bulky Base, so equitorial attack takes place

ORGANOMETALLIC REACTION:



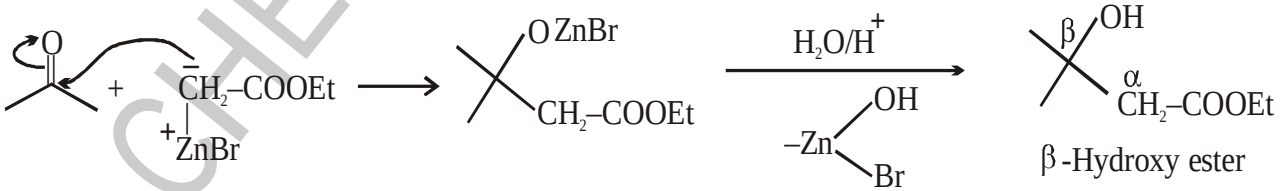
* Organometallic reactions takes place in following order always
1. Acid-base Reaction
2. Addition Reaction **[AASE]**
3. Substitution Reaction
4. Elimination Reaction

REFORMATSKY REACTION:



Darzen Reaction:

* Reformatsky Reaction take place with organozinc ester



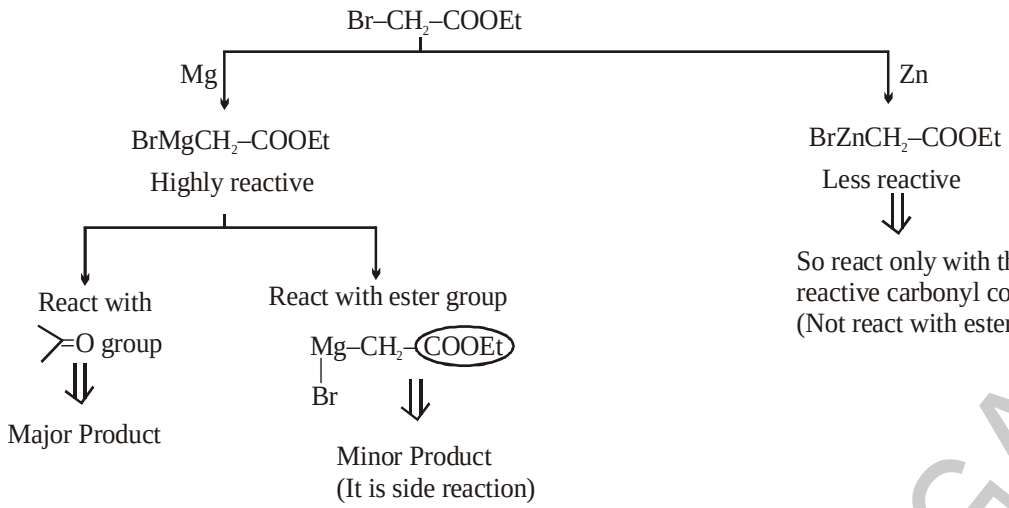
Reactivity w.r.t. Reformatsky reaction.

Reactivity: CH_2–COOEt (I) > CH_2–COOEt (Br) > CH_2–COOEt (Cl)

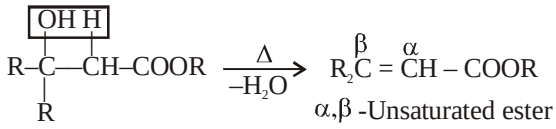
*** RMgX** have nucleophilic as well as basic character so it react with acidic-H-atom & give acid-base reaction.

*** Advantage of Zn:**

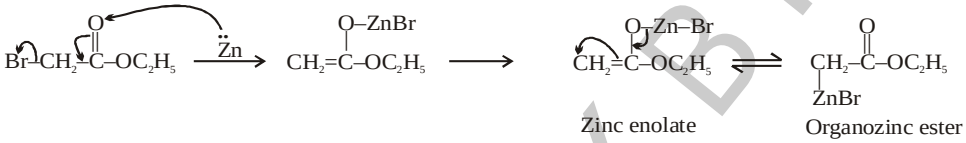
Zn is implace of Mg because of organozinc compound are less reactive than the organomangesim compound of α -Bromo ester. So it does not react with other ester molecules.



* On heating, $\beta-$ Hydroxy ester give $\alpha,\beta-$ unsaturated ester

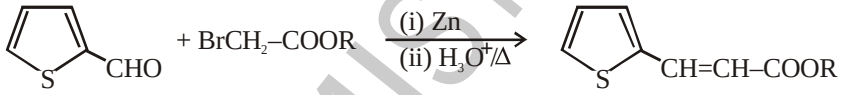


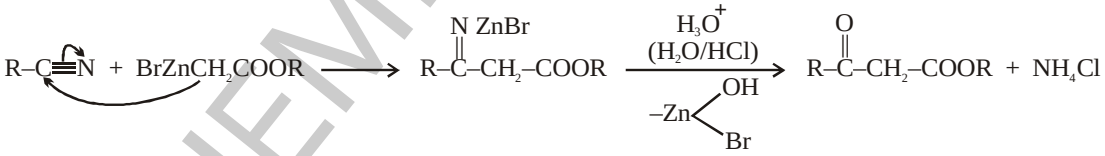
* During the reformatsky reaction, zinc enolate formed as a **Reformatsky reagent.**

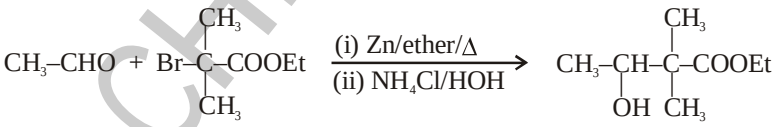


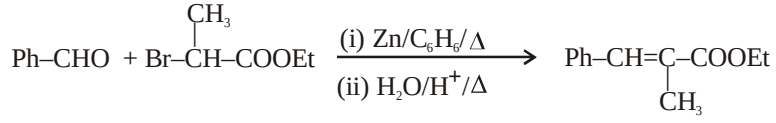
* During the reformatsky reaction, zinc (Zn) behave as two electron dondor

Example of Reformatsky reaction:

1. 

2. 

3. 

4. 

5. $CH_3–C\equiv N + Br–CH_2–COOEt \xrightarrow[(ii)\ H_2O/H^+]{(i)\ Zn/ether/\Delta} CH_3–\overset{\overset{O}{\|}}{C}–CH_2–COOEt$

6. $CH_3–CH_2–CHO + Br–CH_2–\overset{\overset{O}{\|}}{C}–N(CH_3)_2 \xrightarrow[(ii)\ H_2O/NH_4Cl]{(i)\ Zn/ether/C_6H_6/\Delta} CH_3–CH_2–\underset{\underset{OH}{|}}{CH}–CH_2–\overset{\overset{O}{\|}}{C}–N(CH_3)_2$

$\xrightarrow{H_2O/\ \bar{O}H/\Delta}$

$CH_3–CH_2–CH=CH–\overset{\overset{O}{\|}}{C}–N(CH_3)_2$

$CH_3–CH_2–\underset{\underset{OH}{|}}{CH}–CH_2–\overset{\overset{O}{\|}}{C}–N(CH_3)_2 \xrightarrow{H_2O/\ \bar{O}H/\Delta} CH_3–CH_2–CH=\overset{\overset{O}{\|}}{C}H–C–N$

GRIGNARD REAGENTS:

* It is very strong base

* It is give following reactions.

1. Acid-base reaction
2. Addition reaction
3. Substitution reaction
4. Elimination reaction

* It is organomatallic compound which have polar C-Mg bond.

Preparation:

$$R\text{–}X + Mg \xrightarrow{\text{Dry Ether}} RMgX$$

Grignard reagent

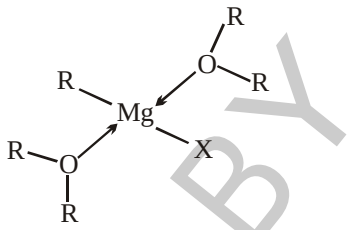
Mechanism:

$$R\text{–}X \longrightarrow R^{+} + X^{-}$$

$$R^{+} + Mg \longrightarrow R^{-} + Mg^{+2}$$

$$R^{-} + Mg^{+2} + X^{-} \longrightarrow RMgX$$

* Etheral solution of Grignard Reagent is used for the synthetic application because of it is highly reactive.



* Solvated form of RMgX is stable. It can not be isolate in individual form (i.e., pure form)

* In the Grignard Reagent following equilibrium also exist. (Schlenk equilibrium)

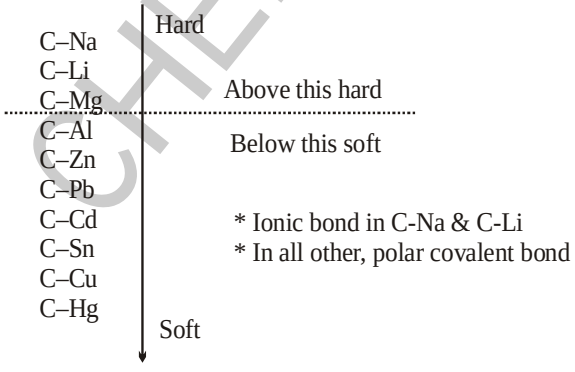
$$2RMgX \underset{\text{Equilibrium}}{\overset{\text{Schlenk}}{\rightleftharpoons}} R_2Mg + MgX_2$$

* Grignard Reagent fis an **umpolung reagent**

$$R\text{—}X \longrightarrow RMgX$$

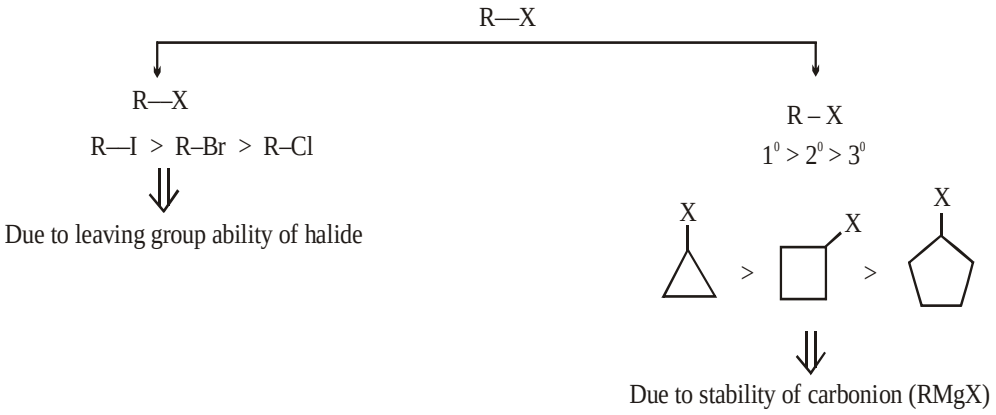
Electrophilic site — Nucleophilic as well as basic site

* There is polar covalent bon in between C-Mg in Grignard Reagent



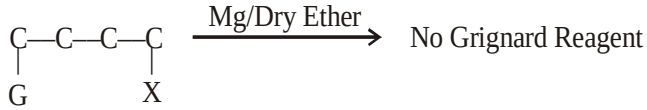
* Ionic bond in C-Na & C-Li
* In all other, polar covalent bond

*** Reactivity Order w.r.t. Preparation of Grignard Reagent:**



Points about the preparation of Grignard Reagent:

1. Compounds having acidic H-atom can not be used in preparation of Grignard Reagent.



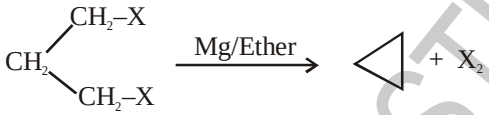
G = Functional groups having active H-atom like: $-NH_2$, –OH, –SH, –COOH etc.

2. 1,2-dihaloalkanes (Vicinal) are not used for the preparation of Grignard Reagent.

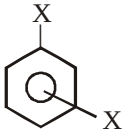
3. 

* L = OTs, OBs, OAc, etc.

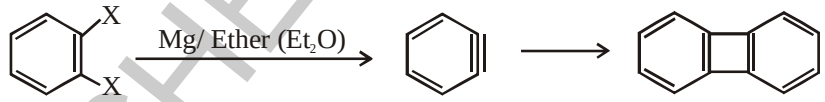
4. 1,3- Dihaloalkanes not used for the preparation of Grignard Reagent



5. 1,4- & higher dihalides may be used for the preparation of Grignard Reagent

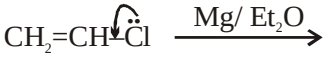
6. 

m- & p- may be used for the preparation of Grignard Reagent but O-form is not used because of,



o-Dihalo benzene Benzyne Dimer

7. Generally allylic & benzylic halides are not used for the preparation of Grignard Reagent. (Also rarely used so answer give according to option)

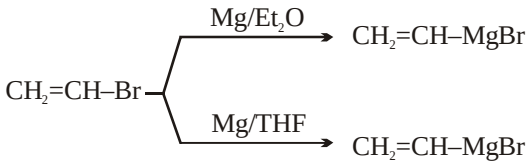
8. 

In the reaction Grignard reagent is not formed, because of, during the reaction high temperature is required which is greater than boiling point of Et_2O but if THF is used then.

9. $CH_2=CH-\ddot{Cl} \xrightarrow{Mg/THF} CH_2=CH-MgCl$

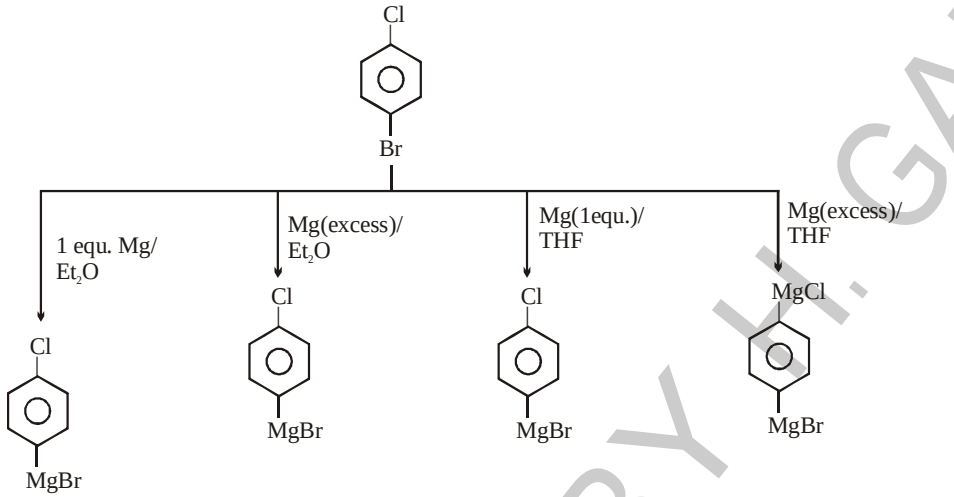
Due to high boiling point of THF

But

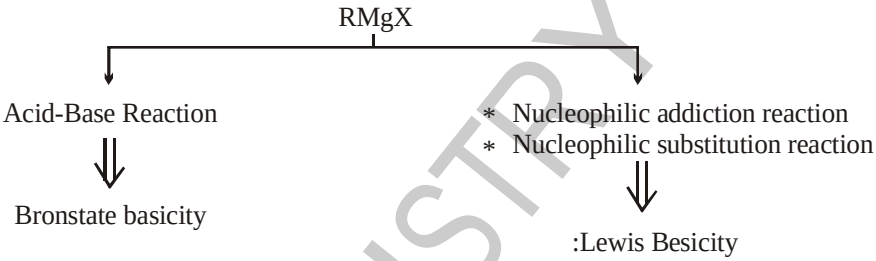


Because of less double bond character in C-Br bond of $CH_2=CH-Br$

similarly:



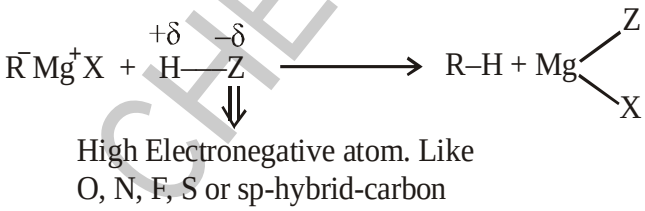
Chemical Properties of the Grignard reagent:



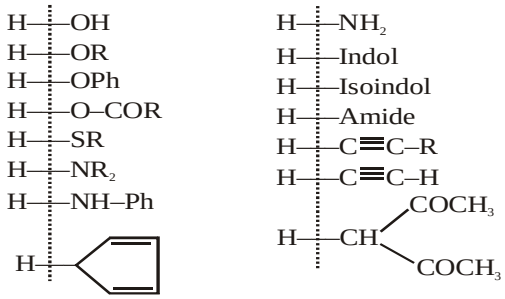
Acid-Base Reaction:

It is required less amount of energy (activation energy) so allowed always first.

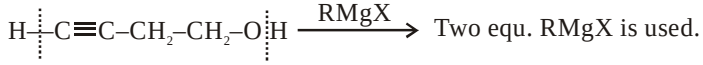
So that, Always first check acid-base reaction with RMgX. before the other reactions.



Above reaction takes place in



Due to Aramaticity



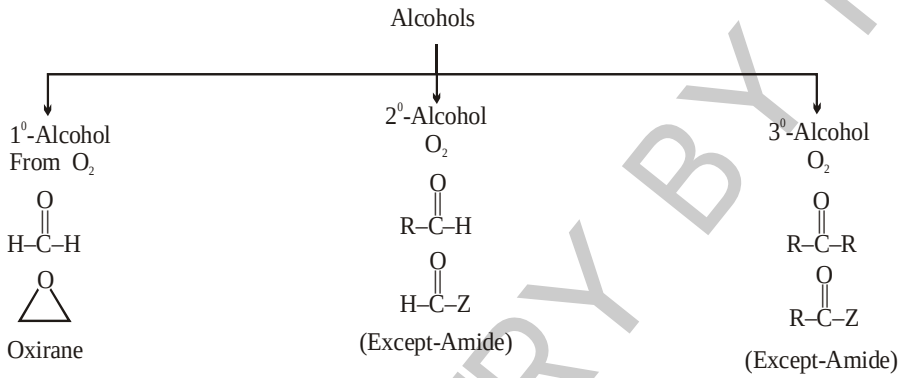
* The reactivity of the compounds w.r.t. RMgX would be high which have more acidic H-atom, so that

Acidity of H-atom ↑ ses ⇒ reactivity w.r.t. Grignard reagent ↑ ses

* During the acid base reaction Grignard reagent behave as the Bronstate base.

Nucleophilicity of RMgX (Lewis Basicity):

*** Preparation of Alcohols:**

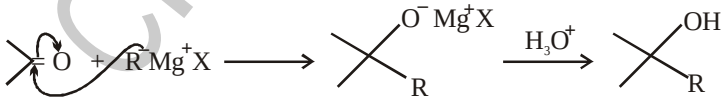


Reaction with O_2:

Nature of Alcohol is depends on the Alkyl groups in grignard reagent

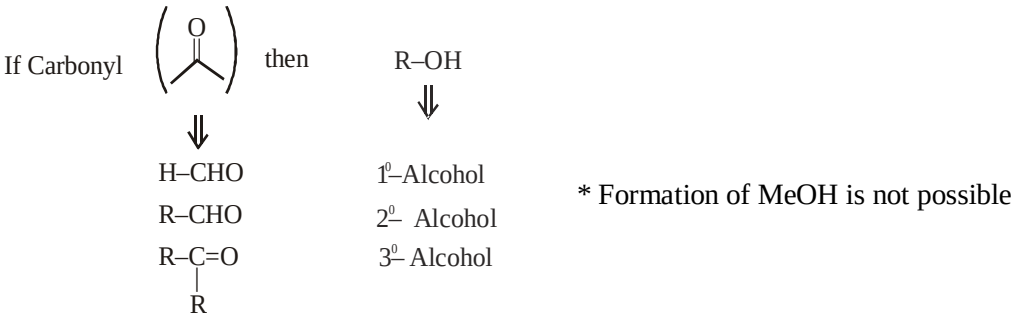
If R in G.R. ⇓ Me–, 1^0, 2^0, 3^0 then R–OH ⇓ MeOH, , 1^0, 2^0, 3^0-Alcohol

Reaction with Carbonyl Compounds:

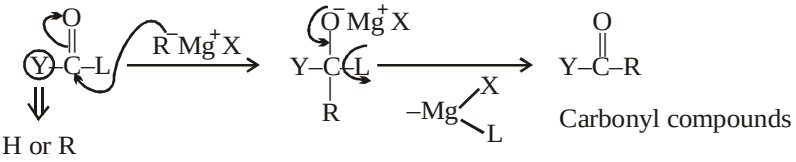


* It is nucleophilic Addiction reaction

* So nature of alcohol is independed on the nature of G.R. but depend the nature of carbonyl compound.

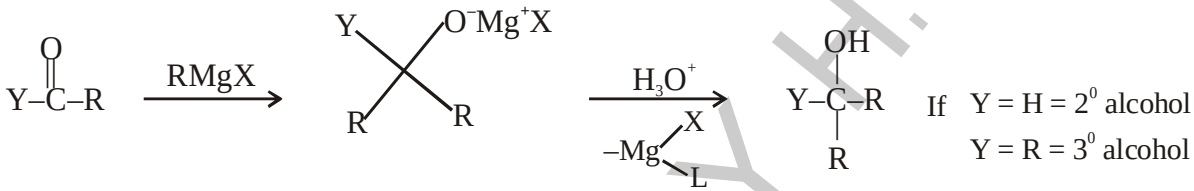


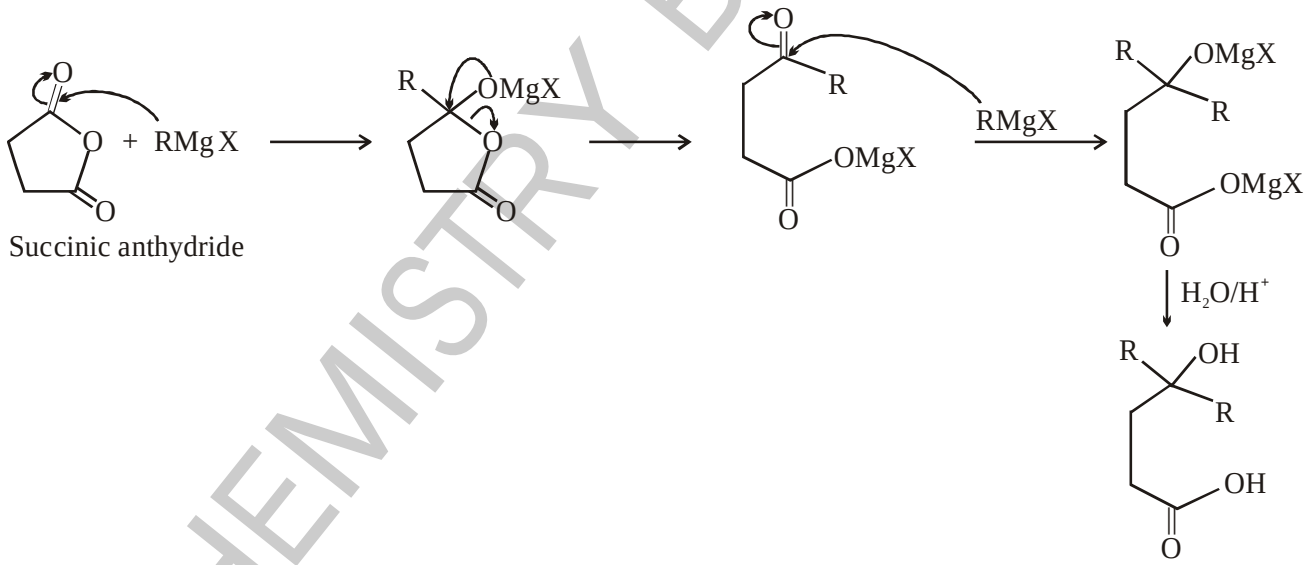
Reaction with Acid Derivation:

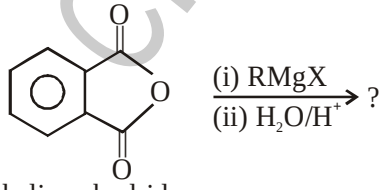


* Acid halide,
Ester or Anhydride

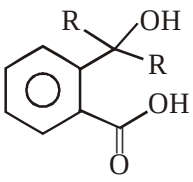
* MeOH & 1^0 alcohol can not be formed by this reaction

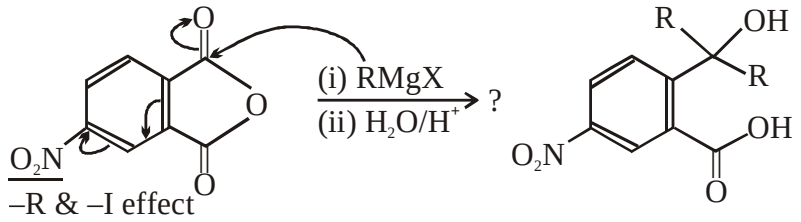




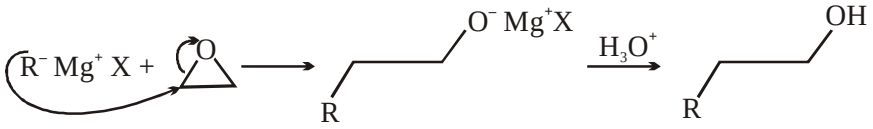


Ans.

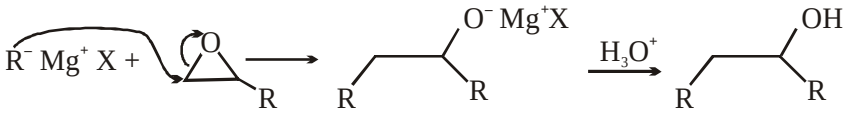




Reaction with Epoxide Ring:



If Grignard reagent react with the unsmmetrical epoxide ring, then ring opening takes place from the less hindrad site.



*** Here:** o-atom can be replaced by the other hetero atom like S, N etc.

* Prepared alcohol have two C-atom more than the R of Grignard reagent

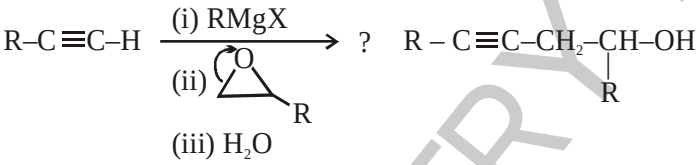
But in case of carbonyl only one C-atom more than the R of G.R.

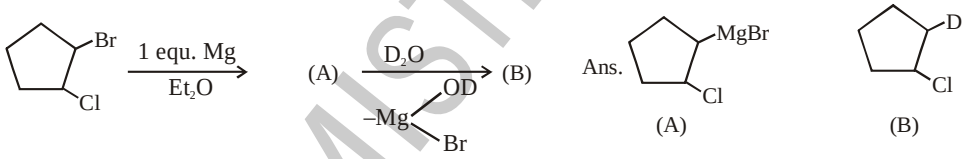
if the case of

(i) O_2 with RMgX = ROH of same C

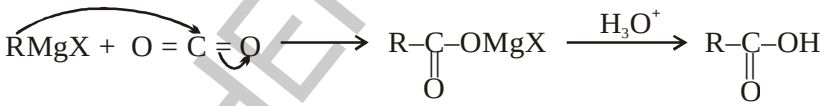
(ii) $\rangle$=O with RMgX = ROH of more than one C.

(iii)  with RMgX = ROH of more than two C.

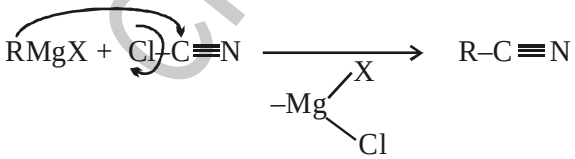
Q. 

Q. 

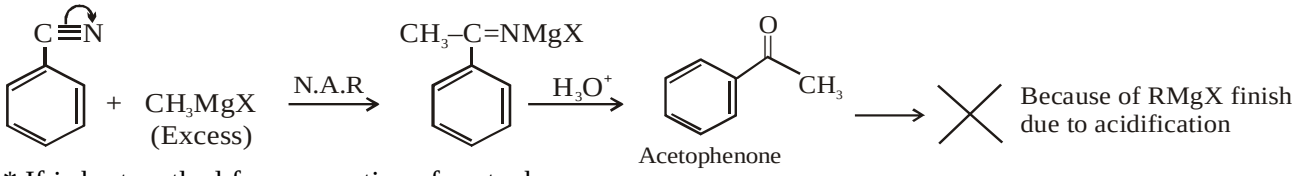
*** Preparation of Acid:**



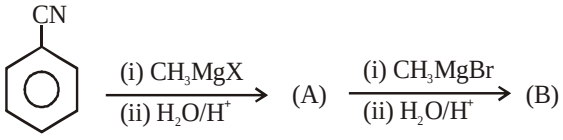
*** Preparation of Cyanide:**

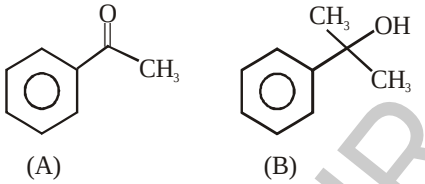


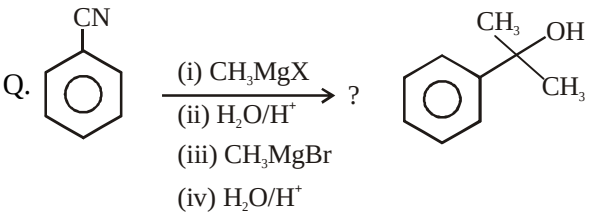
*** Reaction with benzene carbonitrile:**



* If is best method for preparation of acetophenone

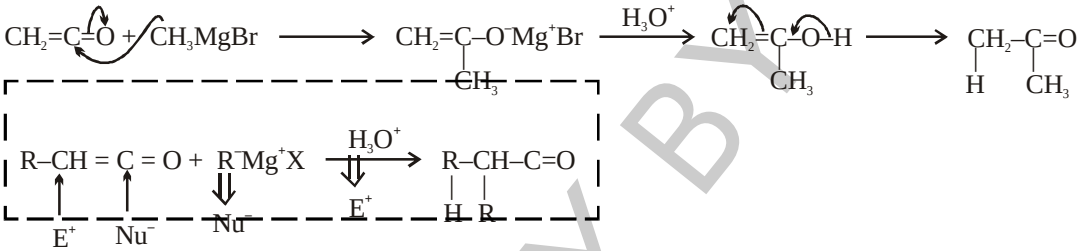
Q. 

Ans. 

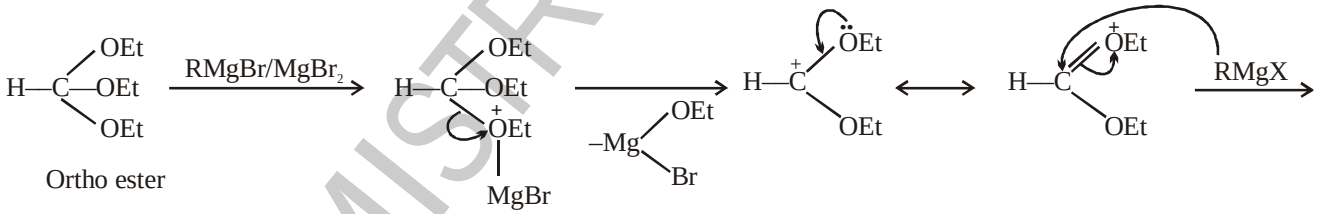
Q. 

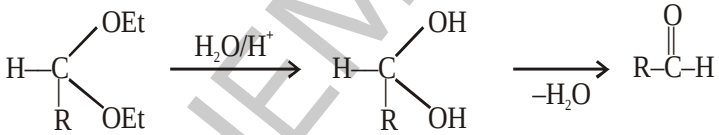
* RMgX or RMgX(excess) ⟹ Assuming both condition as excess

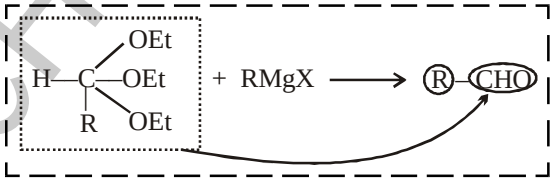
*** Reaction with ketene:**

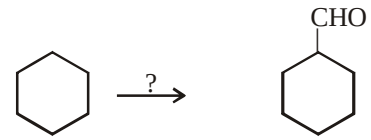


*** Reaction with Ortho Ester:**



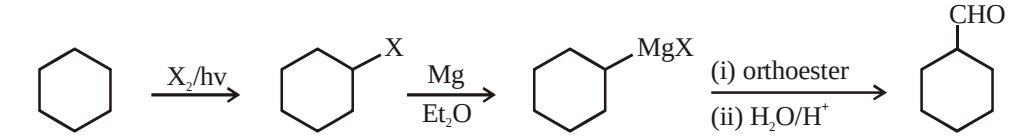




Q. 

Cyclohexane Cyclohexane carbeldehyde

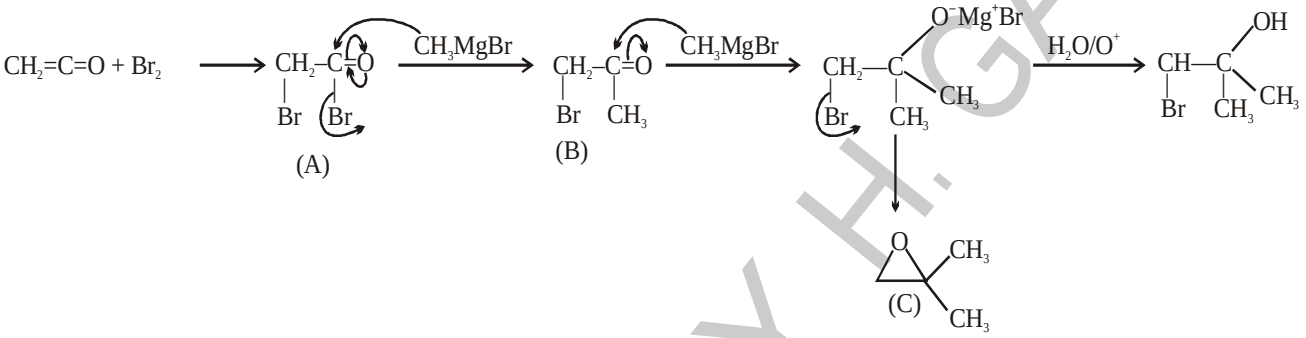
Solution:



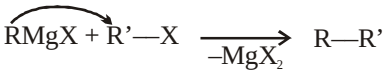
Cyclohexane

Q. $CH_2=C=O+Br_2 \longrightarrow (A) \xrightarrow{CH_3MgBr} (B) \xrightarrow{CH_3MgBr} (C)$

Solution:

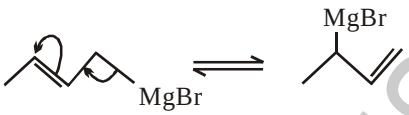


*** Reaction With Alkylhalide:**



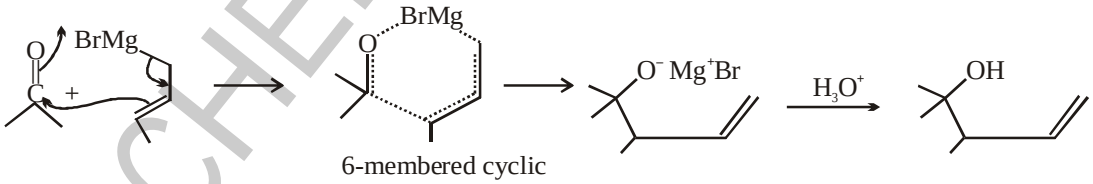
Higher alkanes

Abnormal Behaviour of Grignard reagent:



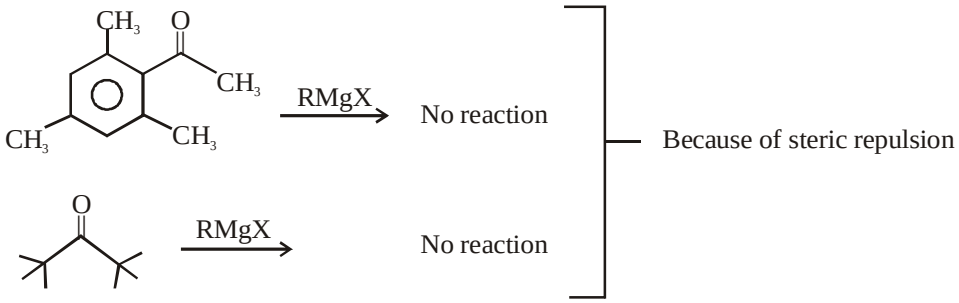
Q. 

Solution:

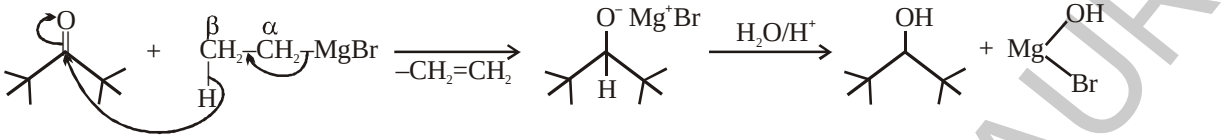


6-membered cyclic

* Allylic Grignard reagent react with the allylic shift.

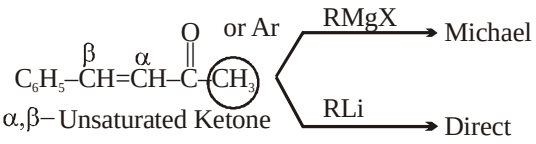


* If the Grignard reagent has β – H-atom then following reaction takes place.

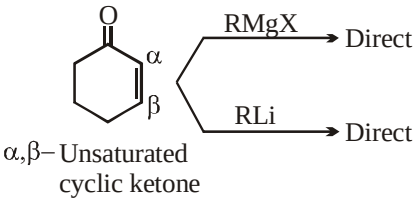


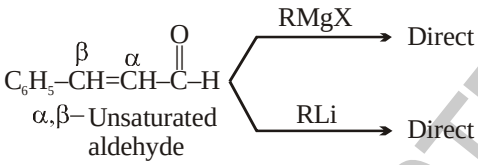
G.R. & Michael Addition:

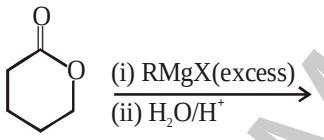
Michael addition takes plcae only in acyclic α,β unsaturated ketones with G.R. (in carbonyl compounds)

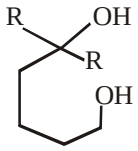


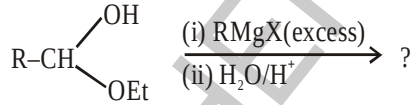
But in

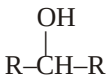


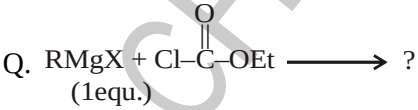


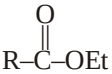
Q. 

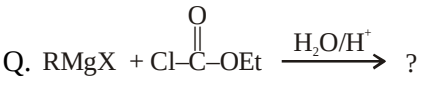
Ans. 

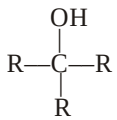
Q. 

Ans. 

Q. 

Ans. 

Q. 

Ans. 

Q. $HO-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-OEt \longrightarrow$ How many equivalents of RMgX will be used

Ans. 4-equivalent of RMgX is used.

Q. RMgX + Ethylcarbonate (excess) $\xrightarrow{H_2O/H^+}$? Ans. $R-\underset{\underset{OH}{|}}{\overset{\overset{R}{|}}{C}}-R$

Solution:

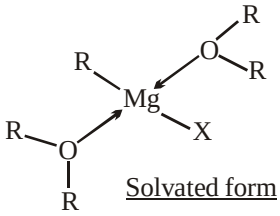
$$RMgX + EtO-\underset{\underset{O}{\|}}{C}-OEt \longrightarrow R-\underset{\underset{OH}{|}}{\overset{\overset{R}{|}}{C}}-R$$

Excess; Ethyl carbonate; 3^0- Alcohol

*** Best Grignard reagent** $\Rightarrow$ CH_3MgI

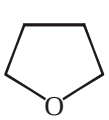
* In Grignard reagent R $\Rightarrow$ Alkyl group, phenyl group, allylic group but **not vinyl group**.

* Solvated form of RMgX is stable. It can not be isolated in individual (pure) form.

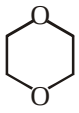


Solvated form

* Solvents for RMgX $\Rightarrow$ Saturated ethers



THF



1,4-dioxane

*** Reaction with AAE:**

$$\underset{\text{Keto form}}{CH_3-\underset{\underset{O}{\|}}{C}-CH_2-\underset{\underset{O}{\|}}{C}-OEt} \rightleftharpoons \underset{\text{Enol form}}{CH_3-\overset{\overset{OH}{|}}{C}=CH-\underset{\underset{O}{\|}}{C}-OEt} \xrightarrow{RMgX} CH_3-\overset{\overset{OMgX}{|}}{C}=CH-\underset{\underset{O}{\|}}{C}-OEt + R-H$$

Similarly:

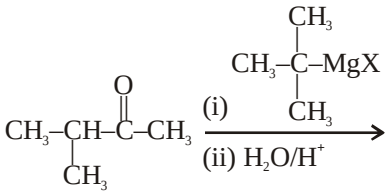
$$\underset{\text{Acetylacetone}}{CH_3-\underset{\underset{O}{\|}}{C}-CH_2-\underset{\underset{O}{\|}}{C}-CH_3} \rightleftharpoons CH_3-\overset{\overset{OH}{|}}{C}=CH-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow{RMgX} CH_3-\overset{\overset{O^- Mg^+ X}{|}}{C}=CH-\underset{\underset{O}{\|}}{C}-CH_3 + R-H$$

*** Preparation of thiols, amines & ethers:**

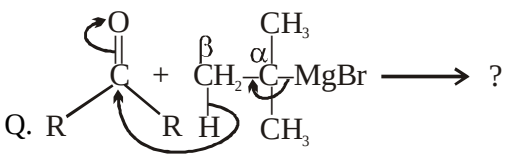
$$RMgX + S \longrightarrow RS^- Mg^+X \xrightarrow{H_2O/H^+} \underset{\text{Thiols}}{R-SH} + \begin{matrix} X \\ -Mg \\ OH \end{matrix}$$

$$RMgX + Cl-NH_2 \longrightarrow \underset{\text{Amine}}{R-NH_2} + \begin{matrix} Cl \\ Mg \\ X \end{matrix}$$

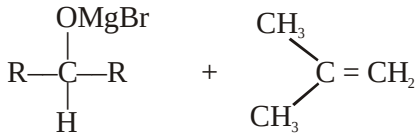
$$R'-MgX + R-O-CH_2X \longrightarrow \underset{\text{Ether}}{R-O-CH_2R'} + MgX_2$$

Q. 

No Reaction Due to Steric hindrance

Q. 

(Because of steric hindrance)

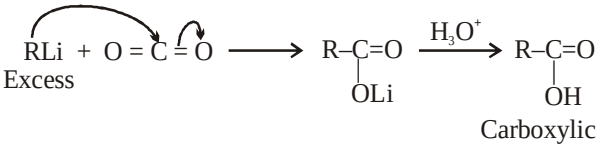
Ans. 

ORGANOLITHIUM COMPOUNDS:

* ionic bond in between C–Li so hard species than RMgX

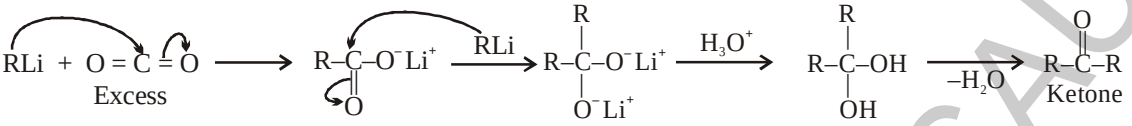
*** Reaction with CO_2:**

When CO_2 in excess:

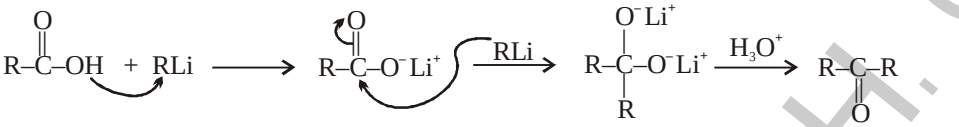


Carboxylic acid

*** When RLi in excess:**

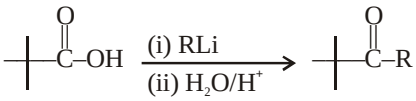


*** Reaction with Carboxylic Acid:**

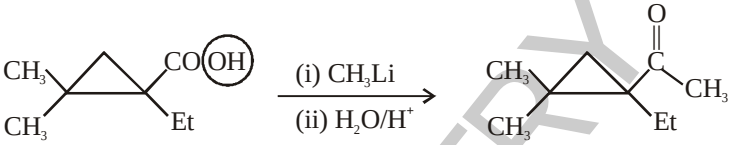


Symmetric ketone

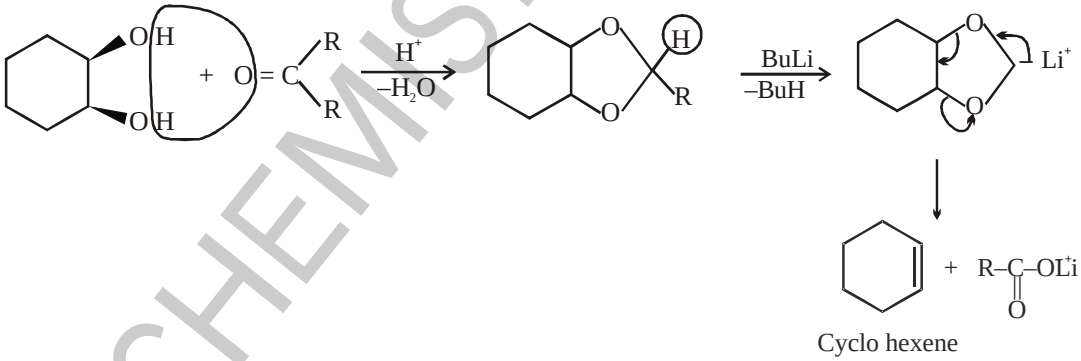
*** Similarly:**



With reaction in configuration

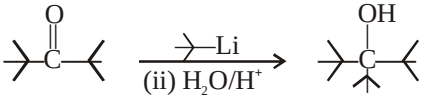


*** Reaction with Acetal:**



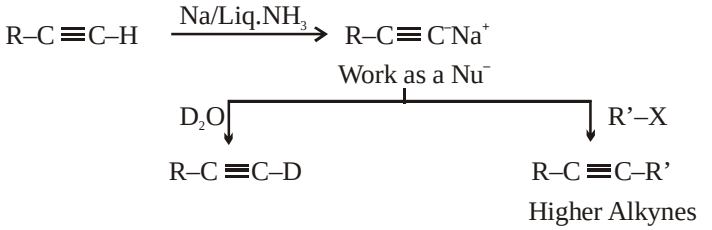
Cyclo hexene

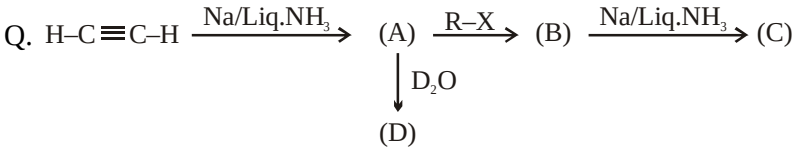
* RLi has advantage over Grignard reaction when the Grignard reaction is fail to react with highly hindard carbonyl group, the oganolithium react with such compound to give normal product.



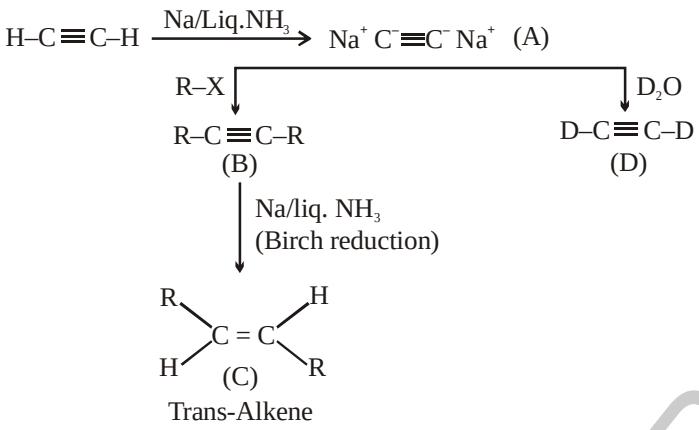
Tritertiary butyl-carbinol

METALLATION REACTIONS:





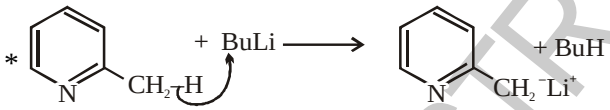
Solution:

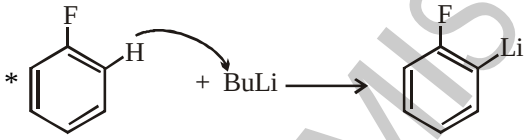


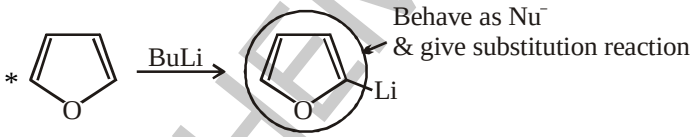
Lithation Reaction:

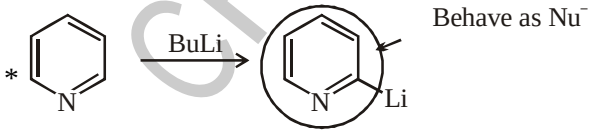
* It is addition of Lithium

* Takes place of active H-atom

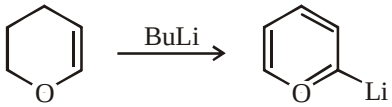








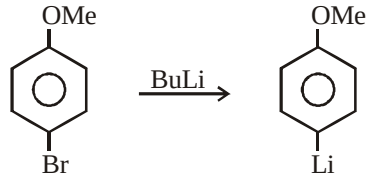
* For Pyridine, first preority lithation (acid-base reaction) after then chichibabine reaction (second priority)



*** Lithation reaction by Halogen Exchange:**

* 

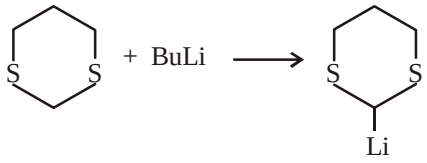
(X = Br, or Cl but not F)

* 

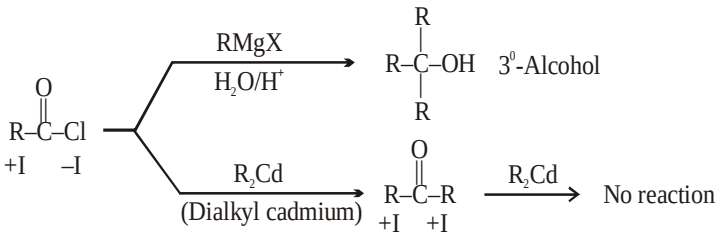
* $R-C\equiv C-H+BuLi\longrightarrow R-C\equiv C-Li$

* $CH_2=C=CH_2+BuLi\longrightarrow CH_2=C=CHLi$

* $CH_2=CH-CH_3+BuLi\longrightarrow CH_2=CH-CH_2Li$

* 

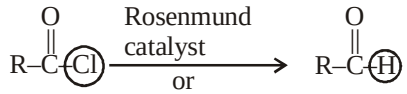
DIALKYL CADMIUM:



Reactivity towards the nucleophilic addition reaction.

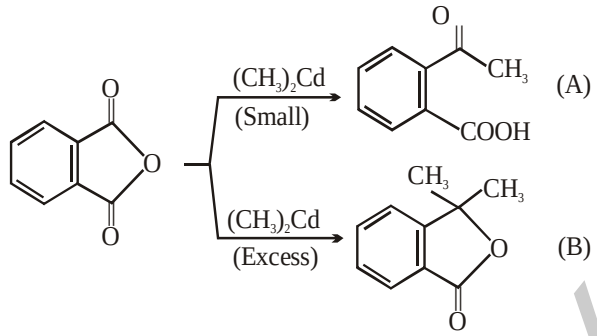
Acid halide > Carbonyl

$RMgX > R_2Cd$



*

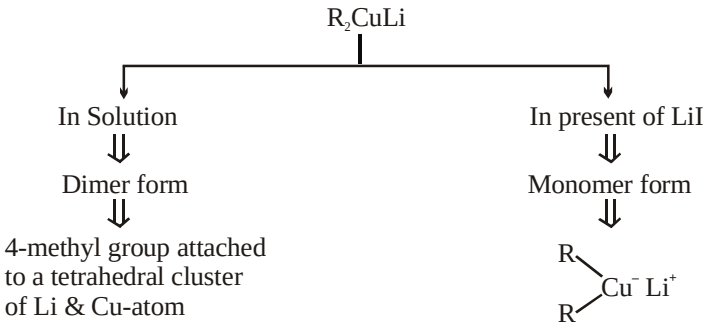
Reaction with Acid Anhydride:

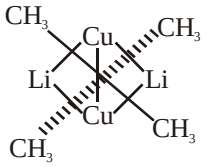


*

* But the above reaction in acyclic anhydrides is not particularly useful.

GILMAN REAGENTS:





* It is soft organocupper reagent.

* It is source of carbanions.

* It is a umpolung reagent.

* It is very weak base so in the presence of Gilmann reagent present, halides does not give elimination reactions.

* It is replacement method of the wurtz reaction.

$$R\text{–}X + 2Na + X\text{–}R \xrightarrow[\text{Wurtz reaction}]{\text{Dry ether}} R\text{—}R$$

Higher alkanes

$$R_2CuLi + R'\text{–}X \xrightarrow[\text{Reaction}]{\text{Corey-House}} R\text{–}R'$$

Higher alkane

* & by using this method we can also prepared alkanes having odd number of C-atom **(corey-house method)**

Reagents:

$$\xrightarrow[\text{RMgX / CuCl}\ \text{or}\ \text{CuI}\ \text{or}\ \text{RLi / CuCl or CuI}\ \text{or}\ \text{R/Cu}]{R_2CuLi \quad \text{or}}$$

* Gilman reagents give following type of reactions.

(i) SN-reaction (Nucleophilic substitution reactions)

(ii) Nucleophilic addition reactions.

(iii) Michael addition.

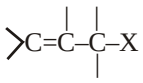
(iv) Intramolecular cyclisation reactions.

Nucleophilic Substitution Reactions:

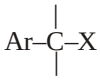
(i) In alkyl halides $\Rightarrow$ R–X (But 3^0 alkyl halides are not used because of eleminated product will be formed)

(ii) In Aryl halides $\Rightarrow$ Ar–X

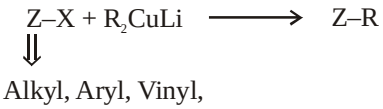
(iii) In Vinyl halides $\Rightarrow$ $>\!\!=\!\!\overset{|}{C}\text{–}X$

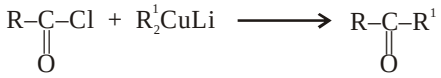
(iv) In Alylichalides ⇒ 

(v) In Properglylic halides ⇒ 

(vi) In Benzyl halides ⇒ 

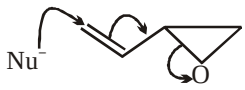
* Above all substrates give coupling reaction with R_2CuLi



* 

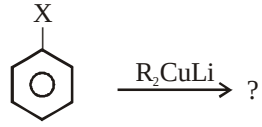
* In the case of Allylic & propargyl substrates, allylic shift will be takes place (Migration of n-bond or $SN^{2'}$ mechanism) always.

* Epoxides ring opening takes place from less hindard side (if possible alylic shift or $SN^{2'}$ - mechanism takes place.)

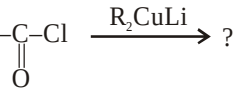


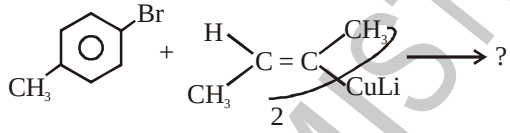
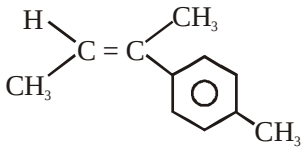
* Epoxide ring opening take place always anti periplaner manner.

Q.1 $CH_3–(CH_2)_4–CH_2–I \xrightarrow{R_2CuLi}$? Ans. $CH_3(CH_2)_4CH_2–R$

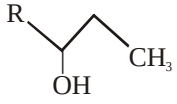
Q.2  Ans. 

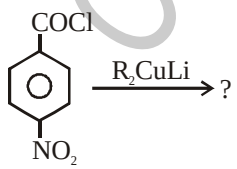
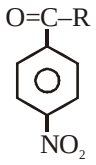
Q.3 $CH_2=CH–X \xrightarrow{R_2CuLi}$? Ans. $CH_2=CH–R$

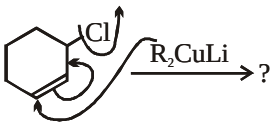
Q.4  Ans. 

Q.5  Ans. 

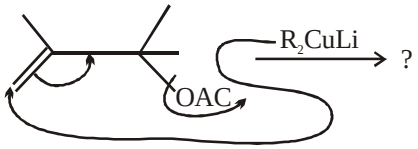
Here stereo-chemistry will be mantain i.e.,Retension in configure.

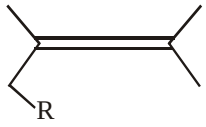
Q.6  Ans. 

Q.7  Ans. 

Q.8 

Ans. 

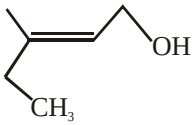
Q.9 

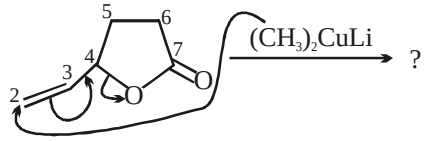
Ans. 

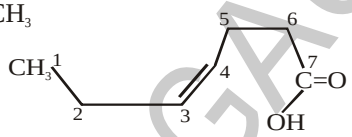
Q.10 $CH_3O–\underset{\underset{O}{\|}}{C}–CH_2–CH_2–\underset{\underset{O}{\|}}{C}–Cl \xrightarrow{R_2CuLi} ?$

Ans. $CH_3O–\underset{\underset{O}{\|}}{C}–CH_2–CH_2–\underset{\underset{O}{\|}}{C}–R$

Q.11 

Ans. 

Q.12 

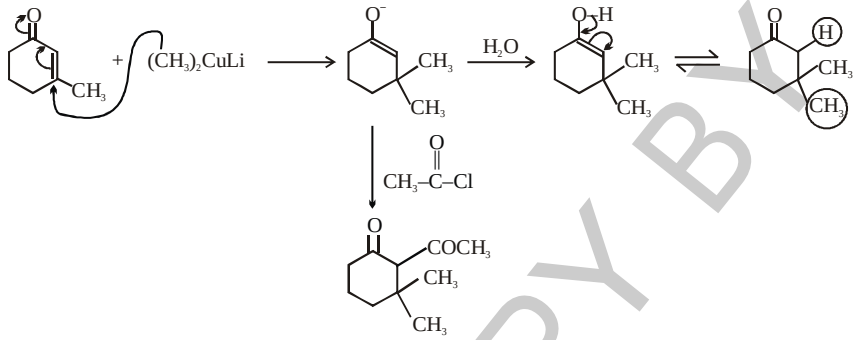
Ans. 

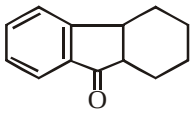
or

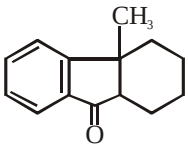
$CH_3–CH_2–CH=CH–CH_2–CH_2–COOH$

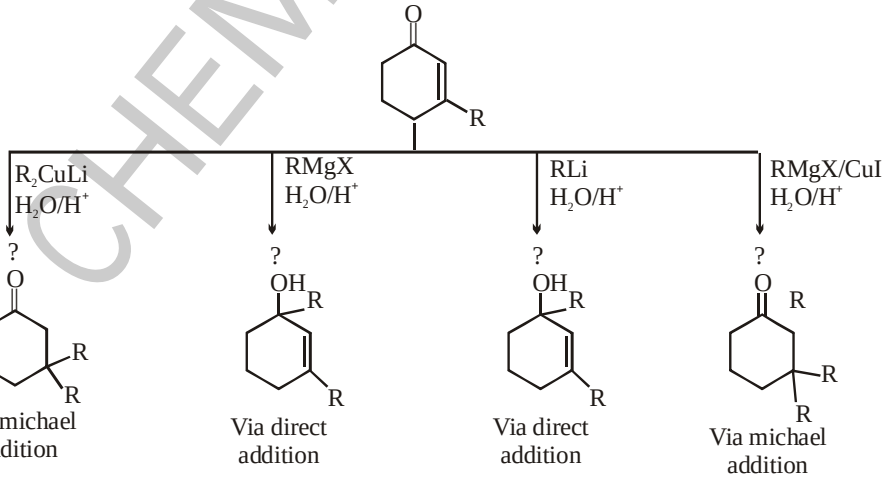
Hept- 4- enoic acid

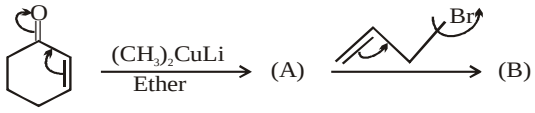
Michael Addition:

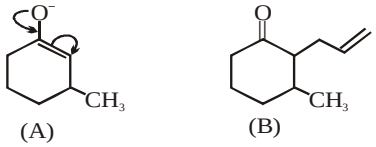


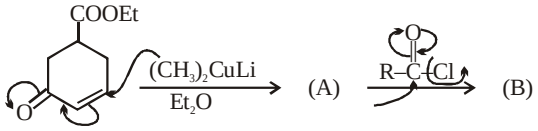
Q.1 

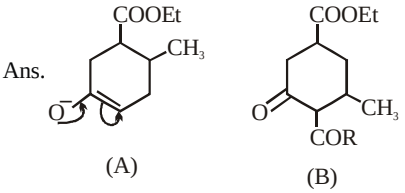
Ans. 

Q.2 

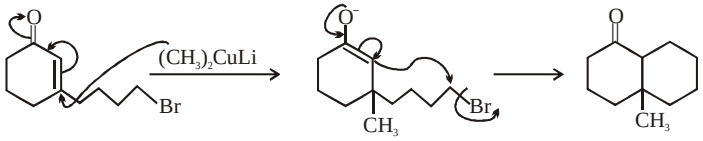
Q.3 

Ans: 

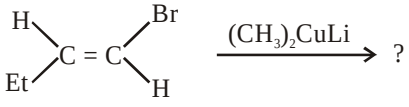
Q.4 

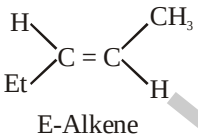
Ans. 

Cyclisation Reaction:

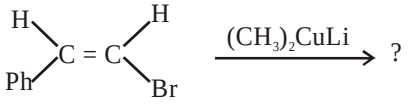


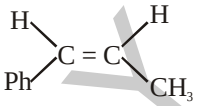
Questions:

Q.1 

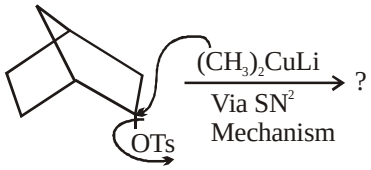
Ans. 

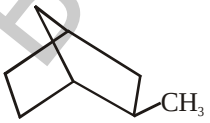
E-Alkene

Q.2 

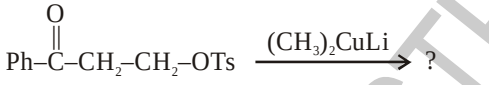
Ans. 

Z-Alkene

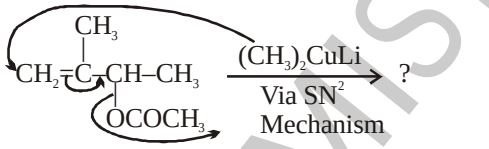
Q.3 

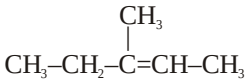
Ans. 

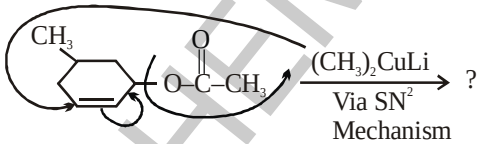
Inversion in configuration

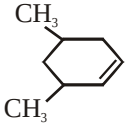
Q.4 

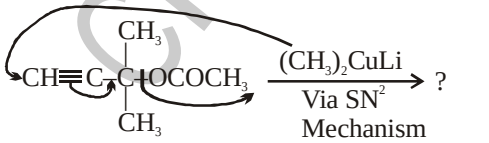
Ans. 

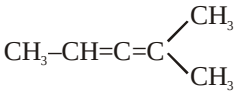
Q.5 

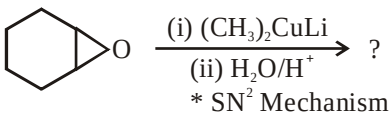
Ans. 

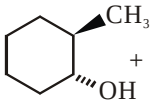
Q.6 

Ans. 

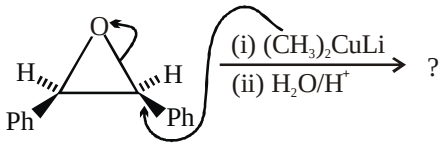
Q.7 

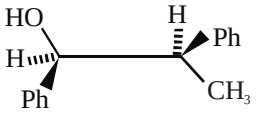
Ans. 

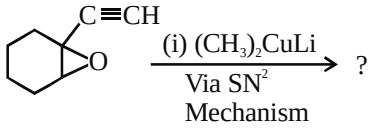
Q.8 

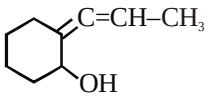
Ans. 

+ Enantiomer

Q.9 

Ans. 

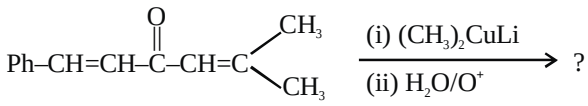
Q.10 

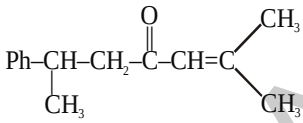
Ans. 

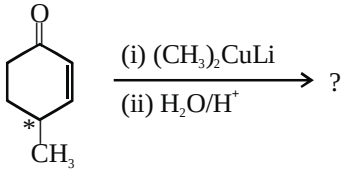
* Michael addition takes place at less substituted C–C double bond.

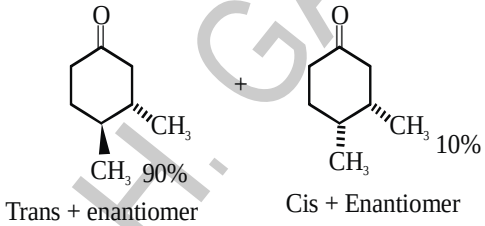
* In biocylic $\alpha,\beta-$ unsaturated ketones always only cis product will be formed.

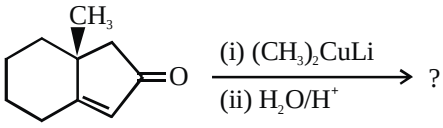
* In chiral centre containing $\alpha,\beta-$unsaturated ketones, give two diastereomeric product.

Q.1 

Ans. 

Q.2 

Ans. 

Q.3 

Ans.