SYNTHETIC APPLICATIONS

(1) Synthesis of hydrocarbons -

(a) Synthesis of saturated hydrocarbon (Reaction with compounds containing active hydrogen)

Grignard reagent reacts with active hydrogen such as water, alcohol, ammonia, primary amine, Sec amine to form hydrocarbon.

$C_2H_5MgBr + H_2O \longrightarrow C_2H_6 + Mg(OH)Br$
water — ethane

$C_2H_5MgBr + HNH_2 \longrightarrow C_2H_6 + Mg(NH_2)Br$
Ammonia — Ethane

$C_2H_5MgBr + HNHR \longrightarrow C_2H_6 + Mg(NHR)Br$
Sec amine — ethane.

(b). Synthesis of Olefines (Alkenes).

Grignard reagent reacts with halogenated compound of alkenes to form higher members.

$C_2H_5MgBr + BrCH_2CH=CH_2 \longrightarrow C_2H_5CH_2CH=CH_2 + MgBr_2$
Allyl bromide — Pentene-1

(c). Synthesis of Alkynes:- When lower members of alkynes are treated with Grignard reagent followed by treatment with alkyl halide to form higher members.

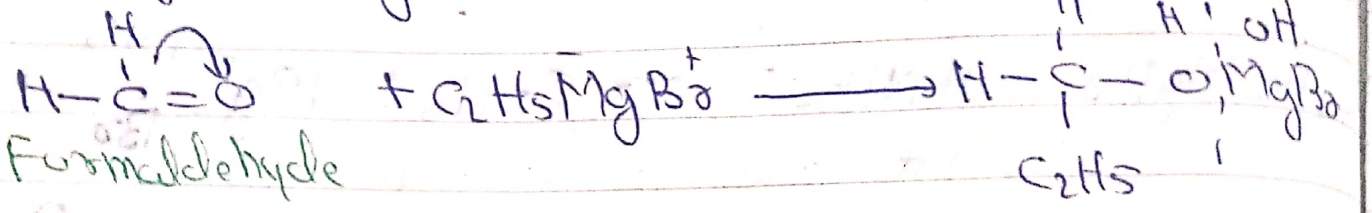
$CH_3-C\equiv CH + C_2H_5MgBr \longrightarrow CH_3-C\equiv CMgBr + C_2H_6$
$CH_3-C\equiv CMgBr + CH_3Br \longrightarrow CH_3-C\equiv C-CH_3 + MgBr_2$
Methyl bromide — But-2-yne

Synthesis of Alcohols :-

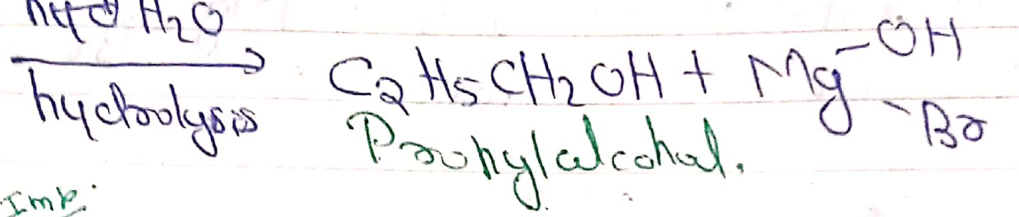
(a). Primary alcohols :-

Imp

Grignard reagent reacts with Formaldehyde, oxygen, ethylene oxide etc to form alcohol.



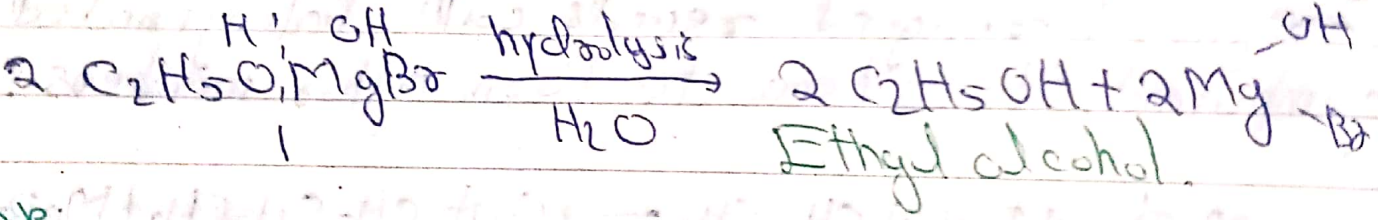
Formaldehyde



Propyl alcohol.

Imp

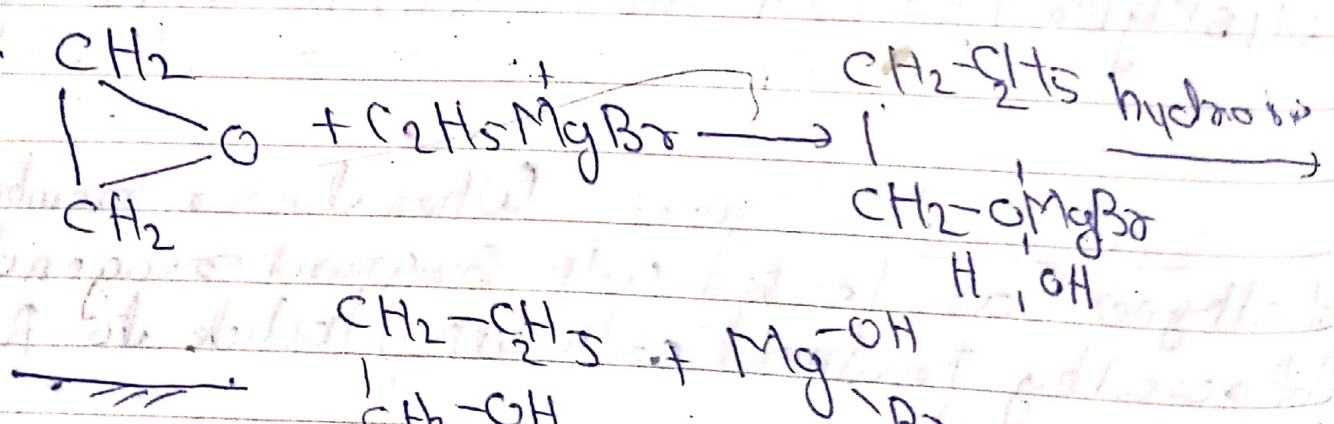
(ii). $C_2H_5MgBr + O_2 \longrightarrow C_2H_5OMgBr \xrightarrow{C_2H_5MgBr}$



Ethyl alcohol.

Imp

(iii).



Butanol-1.

Imp

(b). Secondary alcohols - Grignard reagent reacts with aldehydes (except Formaldehyde) and esters of Formic acid to form secondary alcohol.

(i) $CH_3-\underset{H}{\underset{|}{C}}=O + C_2H_5MgBr \longrightarrow CH_3-\underset{C_2H_5}{\underset{|}{\overset{H}{\overset{|}{C}}}}-OMgBr$

$\xrightarrow{\text{hydrolysis}}$ $CH_3CH(OH)C_2H_5 + Mg(OH)Br$

Butanol-2.

Imp.

(ii) $H-\underset{OC_2H_5}{\underset{|}{C}}=O + C_2H_5MgBr \rightarrow H-\underset{OC_2H_5}{\underset{|}{\overset{C_2H_5}{\overset{|}{C}}}}-OMgBr \xrightarrow{C_2H_5MgBr}$

$\xrightarrow{H_2O}$ $C_2H_5CH(OH)C_2H_5 + Mg(OH)Br$

Imp.

(c). Tertiary alcohols – Grignard reagent reacts with ketones, acid chloride and ester (except Formic acid ester) to form tertiary alcohol.

(i) $CH_3-\underset{CH_3}{\underset{|}{C}}=O + C_2H_5MgBr \longrightarrow CH_3-\underset{CH_3}{\underset{|}{\overset{C_2H_5}{\overset{|}{C}}}}-OMgBr \xrightarrow{\text{hydrolysis}}$

$CH_3-\underset{CH_3}{\underset{|}{\overset{C_2H_5}{\overset{|}{C}}}}-OH + Mg(OH)Br$

3-Phenyl alcohol.

2 methyl Butanol-2.

(ii) $CH_3-\underset{\underset{Cl}{|}}{C}=O + C_2H_5MgBr \longrightarrow CH_3-\underset{\underset{Cl}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-OMgBr$

Acetyl Chloride

$\xrightarrow{C_2H_5MgBr}$ $CH_3-\underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-\underset{H}{\overset{OH}{|}}-OMgBr \xrightarrow{\text{Hydrolysis}} CH_3-\underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-OH + Mg\overset{OH}{\underset{Br}{}}$

2 methyl pentanol-3.

(iii) $CH_3-\underset{\underset{OC_2H_5}{|}}{C}=O + C_2H_5MgBr \longrightarrow CH_3-\underset{\underset{OC_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-OMgBr \xrightarrow{C_2H_5MgBr}$

Ethyl acetate.

$\longrightarrow CH_3-\underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-\underset{H}{\overset{OH}{|}}-OMgBr \xrightarrow{\text{Hydrolysis}} CH_3-\underset{\underset{C_2H_5}{|}}{\overset{\overset{C_2H_5}{|}}{C}}-OH + Mg\overset{OH}{\underset{Br}{}}$