Class - B.Sc Part I (Honours)
Subject - chemistry
Paper - IC
Topic - Synthetic application of organometallic compd of Mg.

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Synthetic application of organometallic compound of Mg (Grignard reagent)

Grignard reagents react with a variety of compounds yielding almost the entire range of organic substances. The following reactions illustrate the synthetic importance of grignard reagents.

(1) Synthesis of alkanes (Reaction with alkyl-halide) -

When grignard reagents are treated with alkyl halide, higher alkanes are formed.

$$CH_3MgI + C_2H_5I \longrightarrow \underset{\text{Propane}}{CH_3-C_2H_5} + MgI_2$$

(2) Synthesis of alkenes (Reaction with alkenyl-halides) -

On treatment with alkenyl halides, alkenes are formed by double decomposition.

a. $CH_3MgBr + Br\text{-}CH_2\text{-}CH=CH_2 \longrightarrow CH_3\text{-}CH_2\text{-}CH=CH_2 + MgBr_2$

1-Butene

b. $C_2H_5MgBr + BrCH_2\text{-}CH=CH_2 \longrightarrow C_2H_5\text{-}CH_2\text{-}CH=CH_2 + MgBr_2$

Pentene-1

(3) Synthesis of alkynes (Reaction with alkynyl halides)

Grignard reagent reacts with alkynyl-halides to form alkynes.

$CH_3MgBr + Br\text{-}CH_2\text{-}C\equiv CH \longrightarrow CH_3\text{-}CH_2\text{-}C\equiv CH + MgBr_2$

Butyne-1

Alternatively alkynyl magnesium halide may be reacts with an alkyl halide to yield alkynes.

$CH_3\text{-}C\equiv C\text{-}MgI + CH_3I \longrightarrow CH_3\text{-}C\equiv C\text{-}CH_3 + MgI_2$

Butyne-2

(4) Synthesis of higher ether (Reaction with lower halogenated ether)

Grignard reagent reacts with lower halogenated ether to form higher ether.

$CH_3CH_2MgBr + ClCH_2OCH_3 \longrightarrow MgBr(Cl) + CH_3CH_2CH_2OCH_3$

chloro methyl ether

methyl propyl ether

(5) Synthesis of 1° alcohol (Reaction with ethylene oxide)

Grignard reagents react with ethylene oxide to give an addition product which on hydrolysis forms Primary (1°) alcohol which contain two carbon atoms more than the grignard reagent.