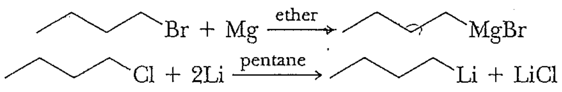
1. Formation of Organomagnesium (Grignard) and Organolithium Compounds (Section 15.1A)

Organomagnesium compounds are prepared by treating an alkyl, aryl, or alkenyl (vinylic) halide with magnesium in diethyl ether or THF. Organolithium compounds are prepared by treating an alkyl, aryl, or alkenyl halide with lithium in pentane or other hydrocarbon solvent.



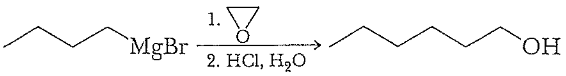
2. Reaction of RMgX and RLi with Proton Donors (Section 15.1B)

Both organomagnesium and organolithium compounds are strong bases and react with any proton donor stronger than the alkane from which the organolithium or magnesium compound is derived. Water or other proton donors must be completely excluded during their preparation and use.

$$CH_3CH_2MgBr + H_2O \longrightarrow CH_3CH_2{-}H + Mg(OH)Br$$

3. Reaction of a Grignard Reagent with an Epoxide (Section 15.1C)

Treatment of a Grignard reagent with an epoxide followed by protonation of the magnesium alkoxide salt in aqueous acid gives an alcohol with its carbon chain extended by two carbon atoms.



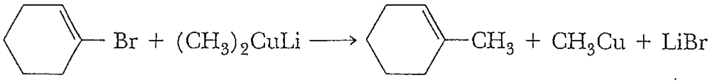
4. Formation of Gilman Reagents (Section 15.2A)

Lithium diorganocopper (Gilman) reagents are prepared by treating an organolithium compound with copper(I) iodide.

$$2\ CH_3CH_2CH_2CH_2Li + CuI \xrightarrow[\text{or THF}]{\text{ether}} (CH_3CH_2CH_2CH_2)_2CuLi + LiI$$

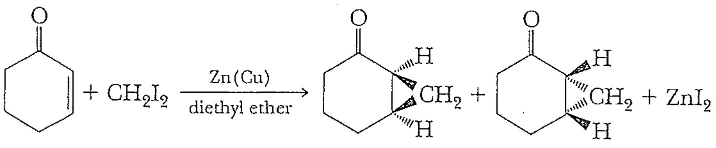
5. Treatment of a Gilman Reagent with an Alkyl, Aryl, or Alkenyl Halide (Section 15.2B)

Coupling of a Gilman reagent with an alkyl, alkenyl, or aryl halide results in formation of a new carbon-carbon bond.



7. The Simmons-Smith Reaction (Section 15.3C)

Treatment of CH_2I_2 with a zinc-copper couple generates an organozinc compound, known as the Simmons-Smith reagent, which reacts with alkenes to give cyclopropanes.



(racemic)