

GENERAL:

OMCs are similar to H- compounds (similar elect-ve of M-C, C-H & M-H)

*The species that lose H form ionic compounds with alkali metals.

OMC's are used in organic synthesis.

They are superior to Grignard reagents (e.g. in alkene polymerization).

*They are liquids or low melting solids, thermally stable than other OMC of the same group. Soluble in organic and non-polar solvents. All OMC's of alkali metals are unstable.

*In alkaline earth metals, the reactivity and electropositivity \uparrow in the group. Therefore, the OMC of Be and Mg are covalent, while Ca, Sr and Ba form only few ionic compds that are unstable and of little utility.

*OMC's of group 13 elements exist as electron deficient species having +3 OS (e.g. Al^{3+}), with 3c-2e bonding.

Organoaluminium compounds are used for alkene polymerization, catalysts & chemical intermediates.

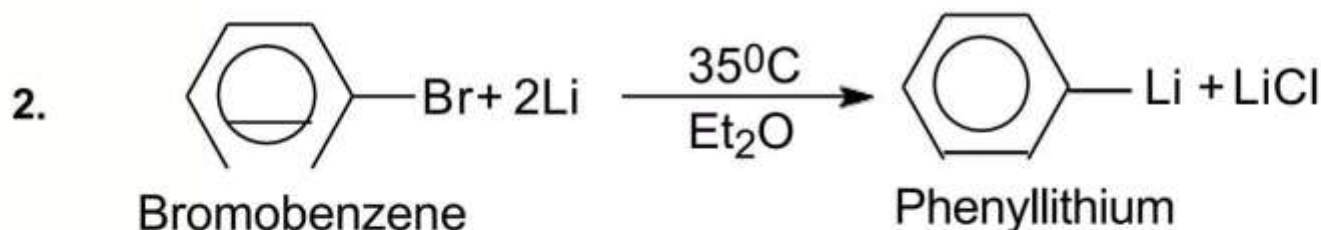
Trialkylaluminum is a dimer but often written as the monomer, AlR_3 .

A) Organolithium Compounds

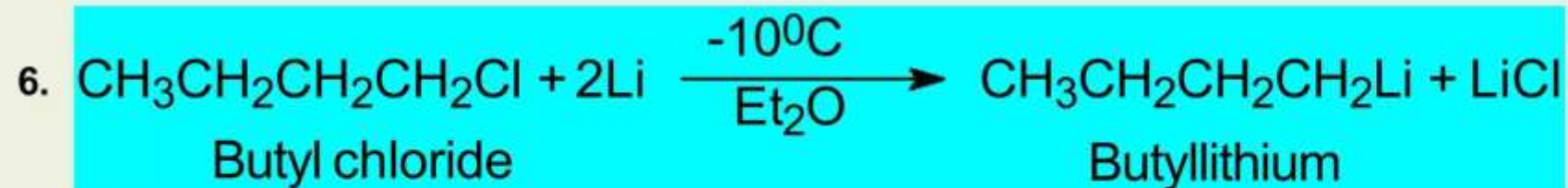
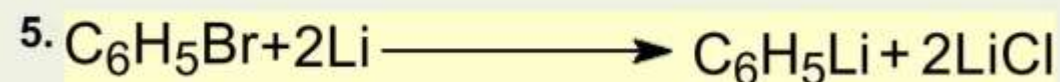
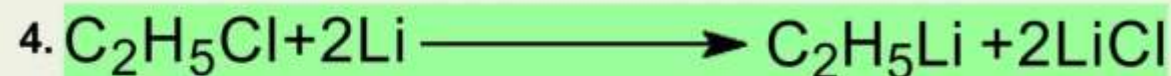
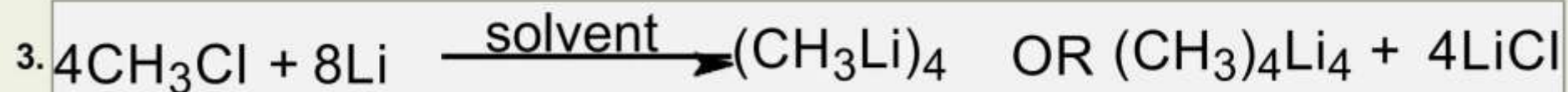
i) Reaction of Alkyl or Aryl Halide with Li Metal:

Alkyl/Aryl halides react with lithium in inert solvent such as ether, benzene, petroleum ether, cyclohexane etc.

The moisture and air must be excluded as they react with reactant and products.



Examples

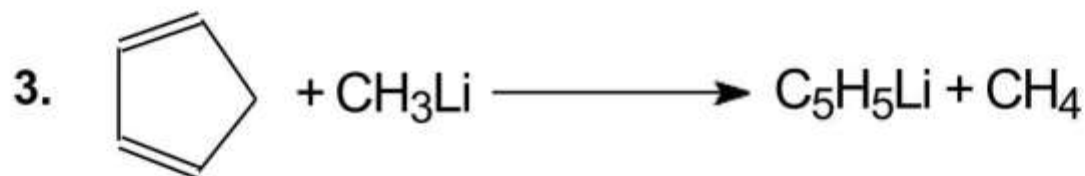
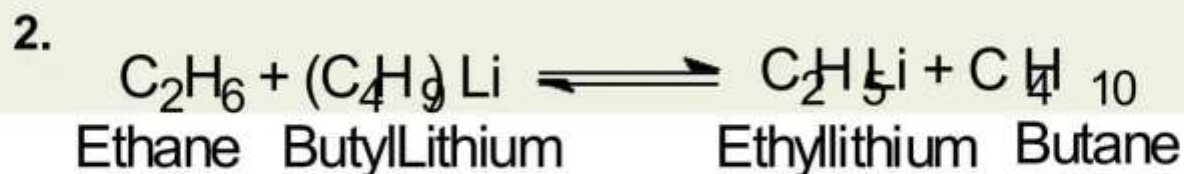


Features:

- *The organolithiums react slowly with ether, therefore, the synthesis is usually carried out in inert atmosphere of nitrogen or argon at low temperature.
- *The use of cyclohexane as solvent, alkyl or aryl chlorides over bromides and iodides minimizes the possibility of side reactions
- *The yield and reactivity is improved by adding 0.5-1% Na.

ii) Metal Hydrogen Exchange (Metallation):

Alkyl and aryl lithium can be synthesized by reacting the Organic compounds with alkyl/ n-butyl lithium, ((C₄H₉)Li called nBuLi). The reaction, in general, can be written as;



The reactions gives small aggregates having multi-center bonding;

e.g. $(\text{CH}_3)_4\text{Li}_4$ or $(\text{C}_2\text{H}_5)_6\text{Li}_6$

which contain bridging alkyl groups

***When ethers are solvent, methyl lithium exists as $(\text{CH}_3)_4\text{Li}_4$.**

***while in hydrocarbon solvents (e.g THF), it exist as $(\text{CH}_3)_6\text{Li}_6$.**

***LiCl destroys $(\text{CH}_3)_4\text{Li}_4$, so, LiCl is added in reaction.**

iii) M-X Exchange (Metathesis/ Double Displacement):

Double displacement reaction betn OMC (MR') & organohalide, (RX) involves M-X exchange therefore, it is called *metal-halogen exchange or metathesis*.

A large number of OMC are prepared in this way.

The common reagents used are;

alkyllithium,

alkylmagnesium and

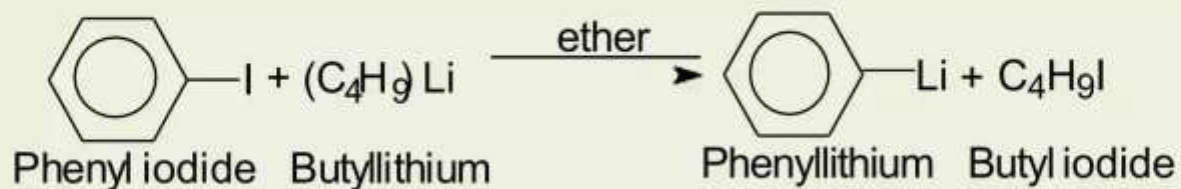
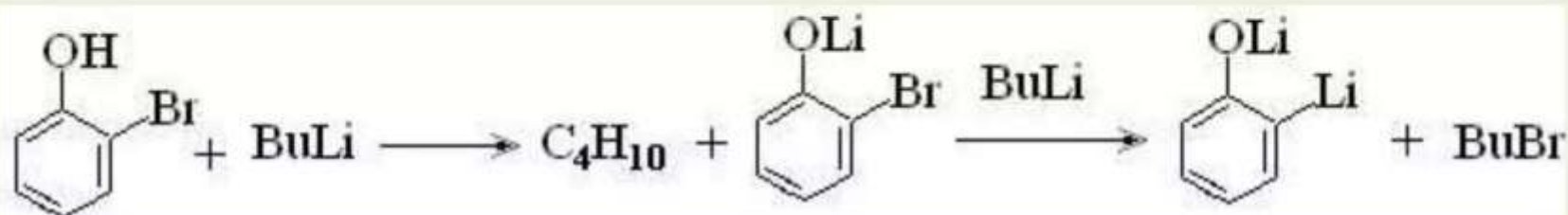
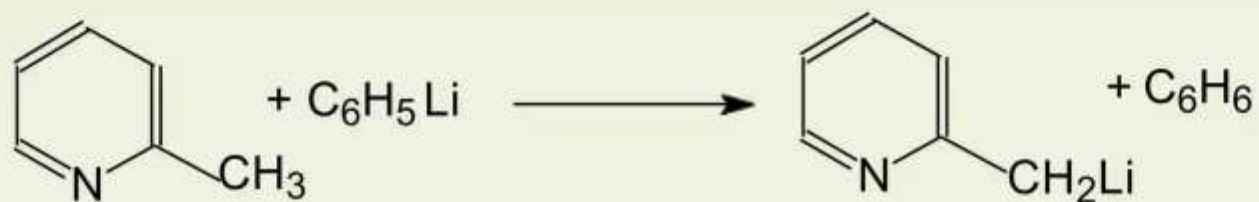
alkylaluminium.

Butyllithium is most suitable for preparing lithium derivatives of comparatively acidic hydrocarbons.

This type of reaction can be represented as;



Examples



iv) Transmetallation:

One OMC react with other, the exchange of organic part takes place between them, such reaction is called **transmetallation** reaction.

These reactions are most convenient to prepare vinyl, allyl and unsaturated derivatives.



Lithium alkyls can also be prepared by metal displacement reaction. Usually organomercury compounds are used when the isolation of the product is required.

For example:



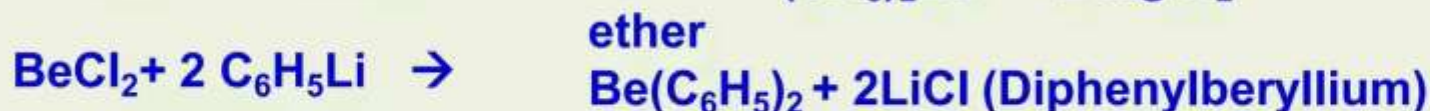
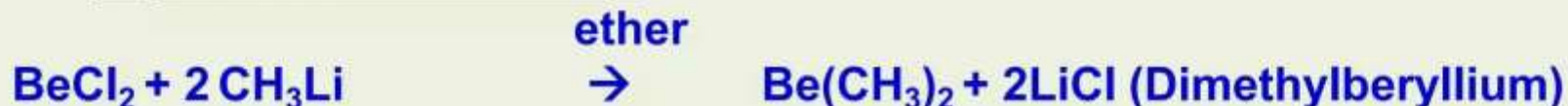
*Organolithium compounds are mainly used in homogeneous catalysis, for example, in stereospecific **polymerization of alkene***

B)

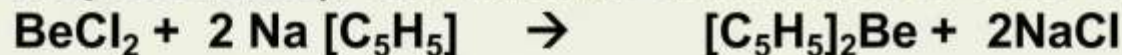
i) Metathesis:

Beryllium halide reacts with an OMC of a different metal
(e.g. lithium, sodium etc.).

ORGANOBERYLLIUM



BeCl_2 reacts with $\text{Na}[\text{C}_5\text{H}_5]_2$ to give Bis(cyclopentadienyl)Be (double displacement). The anion is transferred to less electropositive Be(II).



Beryllium is less electro+ (or more electro-) than Li, Na, Mg, so it forms OMC while more electropositive metal forms halide.

However, the product is always associated with ether molecules which can not be separated easily.