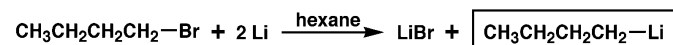


# Preparation and Reactions of Organometallic Compounds

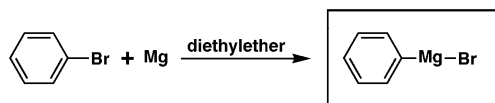
## Reactions of Alkyl Halides:

- ✓ Substitution and elimination reactions;
- Organometallic reagents and coupling reactions;
- Reduction of alkyl halides.

### Organolithium



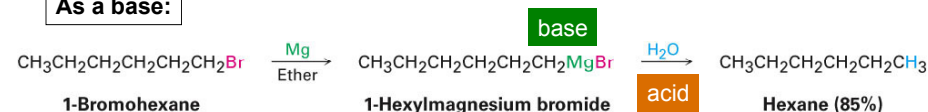
### Grignard (Organomagnesium)



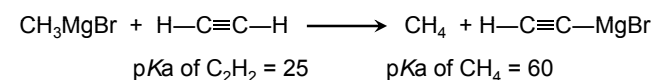
7-1

# Reactions of Grignard Reagents

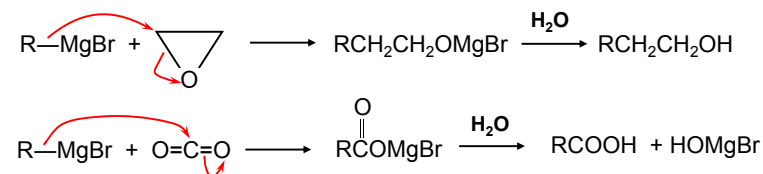
## As a base:



stronger base      stronger acid      weaker acid      weaker base

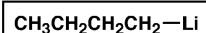


## As a nucleophile:



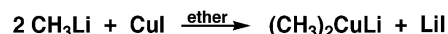
7-2

# Organometallic Coupling Reactions

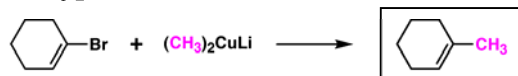


BuLi is also basic and nucleophilic, and reacts with acids and electrophiles.

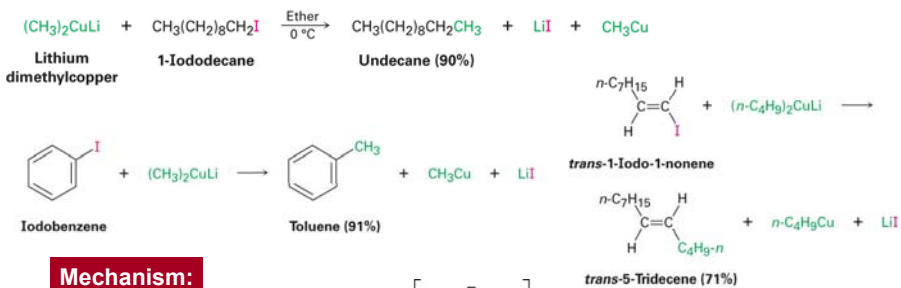
### Gilman reagents (Organocuprates)



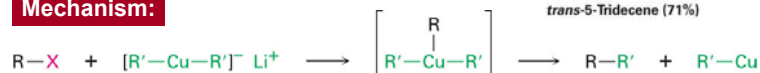
Gilman reagents enable C-C coupling reactions



transmetalation

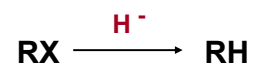


### Mechanism:



7-3

# Reduction of Alkyl Halides



1. Using LiAlH<sub>4</sub> (a strongly reductive reagent):

1. Suitable for 1° and 2° alkyl halides; elimination occurs with 3° halides;

2. Reaction requires anhydrous conditions:

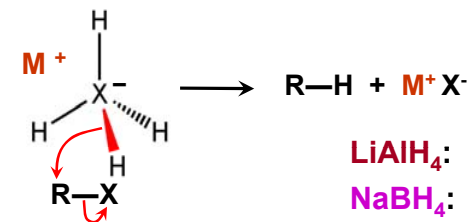


2. Using NaBH<sub>4</sub> (a less strongly reductive reagent than LiAlH<sub>4</sub>):

1. Suitable for 2° and 3° alkyl halides; not competent for 1° halides;

2. Reaction takes place in basic aqueous solution.

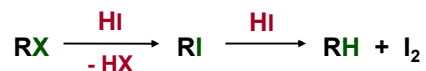
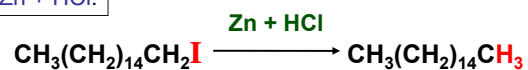
### Mechanism:



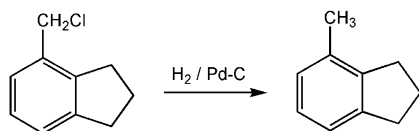
7-4

# Reduction of Alkyl Halides

Using HI or Zn + HCl:

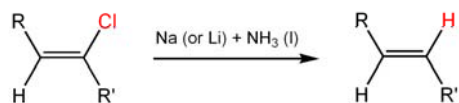


Using H<sub>2</sub>/Pd-C (hydrogenolysis):



\* Suitable for benzyl halides, not for aliphatic halides.

Using Na (or Li) / NH<sub>3</sub> (liquid):



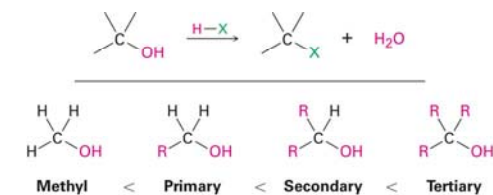
(configuration retention)

7-5

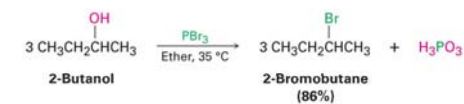
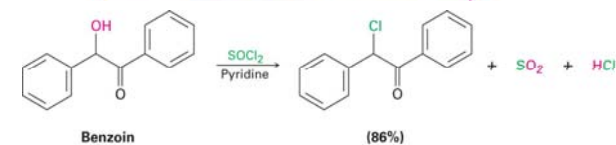
# Preparations of Alkyl Halides

➤ from alkanes: radical halogenation

➤ from alcohols:



for 1° and 2° alcohols, more commonly:



➤ from alkenes: subject of next chapter

7-6