

Functional Groups: Chemistry of Alkanes

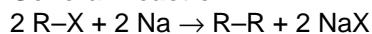
Wurtz Reaction and Halogenation

Alkanes are saturated hydrocarbons containing only carbon–carbon single bonds. Although they are generally less reactive, alkanes undergo some important chemical reactions under suitable conditions. Two significant reactions are the Wurtz reaction and halogenation.

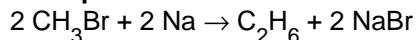
1. Wurtz Reaction

The Wurtz reaction is a method for the preparation of higher alkanes by treating alkyl halides with metallic sodium in dry ether. This reaction leads to the coupling of two alkyl groups.

General Reaction:



Example:



Reaction Mechanism:

- Sodium metal reacts with alkyl halide to form an alkyl sodium intermediate.
- Two alkyl radicals combine to form a higher alkane.
- The reaction proceeds via a free radical mechanism.

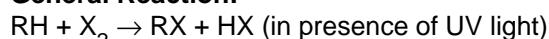
Limitations of Wurtz Reaction:

- It is suitable mainly for the preparation of symmetrical alkanes.
- Using two different alkyl halides gives a mixture of products.
- Secondary and tertiary alkyl halides often undergo side reactions.

2. Halogenation of Alkanes

Halogenation is a substitution reaction in which a hydrogen atom of an alkane is replaced by a halogen atom (fluorine, chlorine, bromine, or iodine) in the presence of sunlight or heat.

General Reaction:



Example:



Mechanism of Halogenation (Free Radical Mechanism):

- **Initiation:** Homolytic cleavage of halogen molecule under UV light to form free radicals.
- **Propagation:** Alkyl radical reacts with halogen to form alkyl halide and another radical.
- **Termination:** Combination of free radicals to form stable molecules.

Reactivity of Halogens:

- Fluorine: Extremely reactive and explosive.
- Chlorine: Moderate reactivity, commonly used.
- Bromine: Less reactive, requires heat.
- Iodine: Practically unreactive.

Importance of Halogenation:

Halogenation reactions are useful for preparing alkyl halides, which are important intermediates in organic synthesis.