

Alkyl halides

Alkyl Halides

- Alkyl halides, also known as haloalkanes or halogenoalkanes, are organic compounds containing one or more halogen atoms (fluorine, chlorine, bromine, or iodine) bonded to carbon atoms within an alkyl group.

They are versatile compounds with various industrial, pharmaceutical, and laboratory applications.

Types and Classification of Alkyl Halides

- Alkyl halides can be classified based on two main criteria: the number of halogen atoms in the compound and the type of carbon atom to which the halogen is bonded.

Based on the Number of Halogen Atoms:

- **Monohaloalkanes:** Contain one halogen atom.
 - Example: CH_3Cl
- **Dihaloalkanes:** Contain two halogen atoms.
 - Example: CH_2Cl_2
- **Trihaloalkanes:** Contain three halogen atoms.
 - Example: CHCl_3
- **Polyhaloalkanes:** Contain four or more halogen atoms.
 - Example: CCl_4

Based on the Type of Carbon Atom:

- **Primary (1°) Alkyl Halides:** The halogen is bonded to a primary carbon atom.
 - Example: CH_3Cl
- **Secondary (2°) Alkyl Halides:** The halogen is bonded to a secondary carbon atom.
 - Example: $\text{CH}_3\text{CHClCH}_3$
- **Tertiary (3°) Alkyl Halides:** The halogen is bonded to a tertiary carbon atom.
 - Example: $(\text{CH}_3)_3\text{CCl}$

Nomenclature

- The IUPAC nomenclature for alkyl halides follows a straightforward approach:
 - **Chain Selection:** Identify the longest carbon chain connected to the halogen.
 - **Numbering:** Number the carbon atoms starting from the end nearest to the halogen.
 - **Naming:** Combine the locant (position number), the halogen prefix (fluoro, chloro, bromo, or iodo), and the base name of the alkane.

Physical Properties

- **Boiling and Melting Points:** Higher than alkanes of similar molecular weight due to the polar carbon-halogen bond, increasing with halogen size.
- **Solubility:** Insoluble in water but soluble in organic solvents (e.g., chloroform, ether, alcohols).

Chemical Properties

1. **Nucleophilic Substitution:** Subject to SN1 and SN2 mechanisms, where the halogen is replaced by a nucleophile.
2. **Elimination Reactions:** Can form alkenes through E1 or E2 mechanisms by removing a halogen and a hydrogen from adjacent carbons.
3. **Reactivity with Metals:** React with metals (like magnesium) to form organometallic compounds (e.g., Grignard reagents).

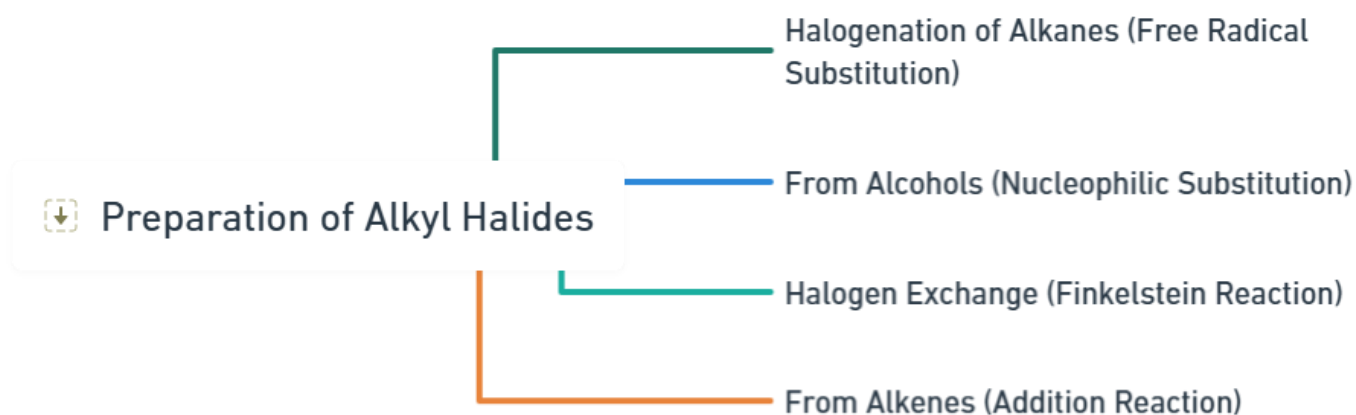
Applications of Alkyl Halides

1. **Solvents:** Used as solvents in chemical reactions, such as chloroform and methylene chloride.
2. **Refrigerants:** Some alkyl halides, like CFCs and HFCs, have been used as refrigerants (now restricted due to environmental concerns).
3. **Pharmaceuticals:** Serve as intermediates in the synthesis of pharmaceuticals and agrochemicals.
4. **Polymers:** Vinyl chloride is used in the production of polymers like PVC.

Preparation of Alkyl Halides

- The preparation of alkyl halides can be accomplished through various methods, each involving different reactants and mechanisms.

Below, these methods are organized and detailed for clarity:



1. Halogenation of Alkanes (Free Radical Substitution)

Process:

- This method involves the reaction of alkanes with halogens (Cl_2 or Br_2) in the presence of ultraviolet light or heat.

- The reaction proceeds through a free radical mechanism, leading to the formation of alkyl halides.

Example:

- Methane reacts with Chlorine under UV light or heat to produce chloromethane and hydrochloric acid.



2. From Alcohols (Nucleophilic Substitution)

Process:

- Alcohols can be converted into alkyl halides by reacting with hydrogen halides (HCl, HBr, or HI) or phosphorus halides (PCl₃, PCl₅, or PBr₃).
- This transformation occurs via a nucleophilic substitution mechanism.

Example with Hydrogen Halides:

- Ethanol reacts with hydrogen bromide to produce ethyl bromide and water.



Example with Phosphorus Halides:

- Ethanol reacts with phosphorus trichloride to yield ethyl chloride and phosphorous acid.



3. Halogen Exchange (Finkelstein Reaction)

Process:

- This technique involves converting one alkyl halide into another by reacting it with a sodium or potassium halide salt in a polar aprotic solvent.
- This reaction is driven by the precipitation of the less soluble halide salt.

Example:

- Bromoethane reacts with sodium iodide to produce iodoethane and sodium bromide.



4. From Alkenes (Addition Reaction)

Process:

- Alkenes can be converted to alkyl halides through the reaction with hydrogen halides (HCl, HBr, or HI).
- This process involves electrophilic addition, where the double bond of the alkene opens up to attach the halogen atom.

Example:

- Propene reacts with hydrogen chloride to form 2-chloropropane.



FREE PREVIEW

[Click here to visit our website](#)

PHARMACY PREMIUM NOTES

Complete subject
and semesters are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app



Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHopeNotes

Instagram

@firsthope.official

[Click here to follow >](#)

YouTube channel

FirstHope-Pharmacy / Live streams

[Click here to watch >](#)

WhatsApp channel

Follow FirstHope on WhatsApp

[Click here to join >](#)

FirstHope website

firsthopenotes.com

[Click here to visit >](#)

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.