

Cyclic Hydrocarbons and their Halogen Derivatives

1. Cyclic Hydrocarbons

Definition: Cyclic hydrocarbons are organic compounds in which the carbon atoms are linked to form one or more rings (closed chains). They are different from open-chain (acyclic) hydrocarbons.

Types:

1. Alicyclic hydrocarbons (non-aromatic): Rings resemble alkanes, alkenes, or alkynes but are non-aromatic. Examples: cyclohexane, cyclopentene.
2. Aromatic hydrocarbons: Contain conjugated π -electrons and follow Huckel's rule ($4n+2$ π -electrons). Examples: benzene, naphthalene.

2. Halogen Derivatives of Cyclic Hydrocarbons

When one or more hydrogen atoms in a cyclic hydrocarbon are replaced by halogen atoms (F, Cl, Br, I), we get halogen derivatives.

(a) From Alicyclic hydrocarbons:

- General formula similar to haloalkanes but ring-shaped.
 - Example: Cyclohexane $\rightarrow$ Chlorocyclohexane (by chlorination), Cyclopentane $\rightarrow$ Bromocyclopentane
- Reaction: $C_nH_{2n} + X_2 \rightarrow C_nH_{2n-1}X + HX$

(b) From Aromatic hydrocarbons:

- Called aryl halides (if halogen directly bonded to the aromatic ring).
 - Example: Benzene $\rightarrow$ Chlorobenzene, Bromobenzene.
- Preparation: By direct halogenation in presence of a catalyst ($FeCl_3$, $AlCl_3$).
- Reaction: $C_6H_6 + Cl_2 \rightarrow C_6H_5Cl + HCl$
- Types of derivatives: Monohalogen derivatives (Chlorobenzene, Bromobenzene); Polyhalogen derivatives (p-Dichlorobenzene, Hexachlorobenzene).

(c) General Properties:

- Physical: Insoluble in water, soluble in organic solvents, volatile liquids or crystalline solids.
- Chemical: Alicyclic halides behave like haloalkanes (nucleophilic substitution). Aromatic halides are less reactive towards nucleophilic substitution due to resonance but undergo electrophilic substitution.

Summary:

Cyclic hydrocarbons are hydrocarbons with carbon atoms arranged in rings. Their halogen derivatives are formed when hydrogen atoms are substituted by halogens. From alicyclic compounds $\rightarrow$ halo-cycloalkanes. From aromatic compounds $\rightarrow$ aryl halides (like chlorobenzene).