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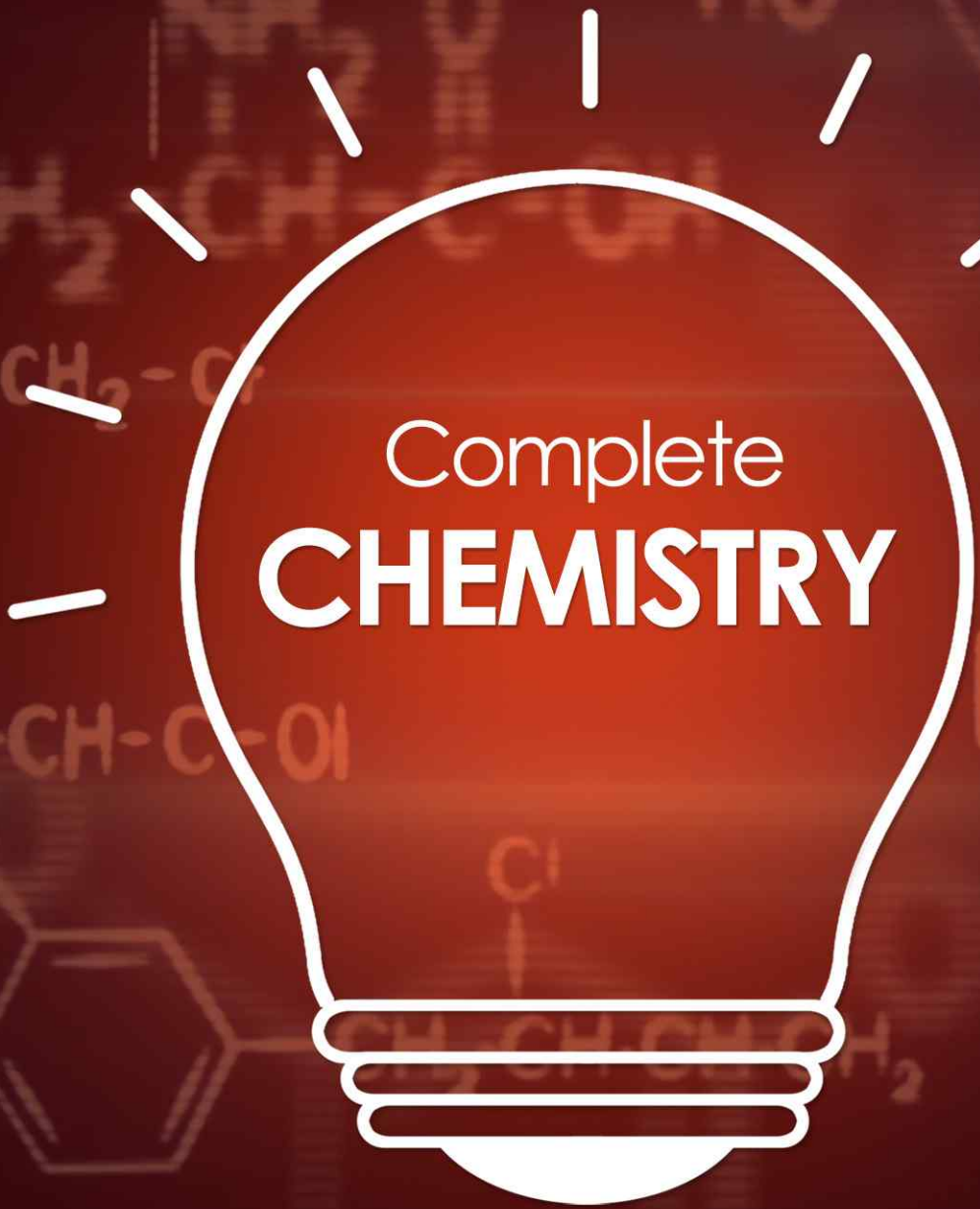

Complete CHEMISTRY

IIT-JEE · NEET · CBSE eBOOKS

CLASS 11&12th

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CLASS 12th

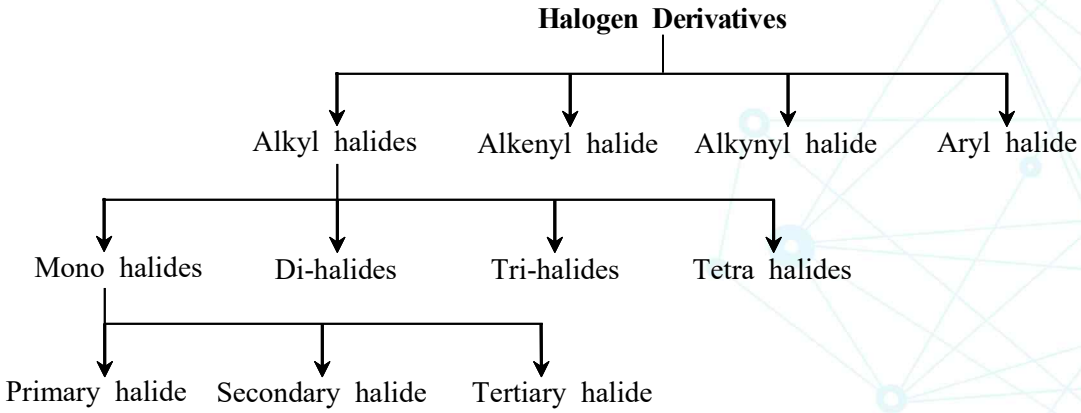
Haloalkanes & Haloarenes

01. Introduction

Compounds derived from hydrocarbons by replacement of one or more H-atoms by corresponding no. of halogen atoms are known as halogen derivatives.

Classification :

On the basis of nature of hydrocarbon from which they are obtained, hydrocarbon derivatives can be classified as :



(i) **Mono halides :** These involves replacement of one H-atom by halogen atom.
General formula $C_nH_{2n+1}X$, where X = F, Cl, Br, I.
Example : CH_3Cl Methyl chloride (Chloro methane)
CH_3CH_2Br Ethyl bromide (Bromo ethane)

(ii) **Dihalides :** Replacement of two H-atom by halogen atoms.
General formula $C_nH_{2n}X_2$,
Example :

CH_2X — CH_2X Ethylene dihalide or Vicinal dihalide

CH_3 — CHX_2 Ethyledene dihalide or geminal dihalide

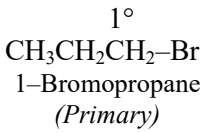
(iii) **Trihalides :** Replacement of three H-atoms by halogen atoms.
General formula $C_nH_{2n-1}X_3$.
Example : CHX_3 Trihalo methane or haloform

(iv) **Tetra halide and Perhalo compounds :** Replacement of 4 H-atoms by halogen atom (in $CH_4 \rightarrow CCl_4$) $\rightarrow$ Tetrahalides.

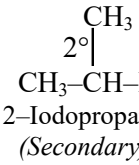
When all the H-atoms from an alkene are replaced by halogen atoms, then the compounds are called as perhalo compound.
General formula $C_nH_{2n-2}X_4$ (tetra halide).
$CH_4 \rightarrow CX_4$ (per halo methane)

02. IUPAC Nomenclature

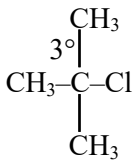
Classification of alkyl halides



1–Bromopropane
(Primary)

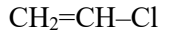


2–Iodopropane
(Secondary)

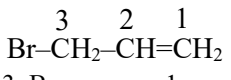


2–Chloro–2–methylpropane
(Tertiary)

Haloalkenes or Alkenyl halides

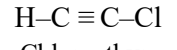


Chloroethene
(Vinyl chloride)

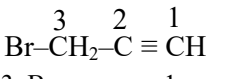


3–Bromoprop–1–ene
(Allyl bromide)

Haloalkynes or Alkynyl halides



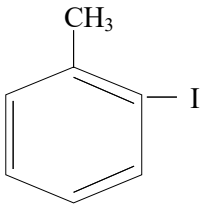
Chloroethyne
(Chloroacetylene)



3–Bromoprop–1–yne
(Propargyl bromide)

Aromatic halogen compounds

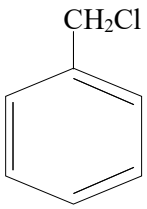
(i) Nuclear halogen derivatives



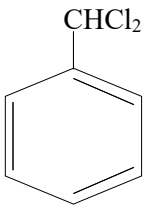
2—Iodo—1—methylbenzene or
2—Iodotoluene (*o–Iodotoluene*)

(ii) Side chain halogen derivatives

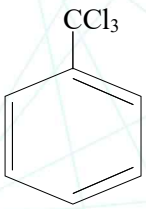
aralkyl halides :



1–chloro–1–phenylmethane
(Benzyl chloride)

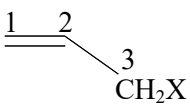


1,1–Dichloro–1–phenylmethane
(Benzal dichloride)

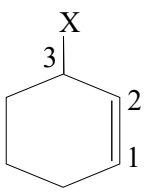


1,1,1–Trichloro–1–phenylmethane
(Benzotrichloride)

Allylic halides

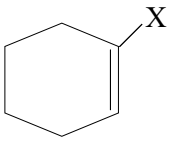


3-Haloprop-1-ene
(Allyl halide)



Vinylic halides

Haloethene
(Vinyl halide)



1-Halocyclohex-1-ene
(A Vinyl halide)

Alkylidene dihalides

CH_3CHBr_2
1,1–Dibromoethane
(Ethylidene dibromide)

$CH_3–CCl_2–CH_3$
2,2–Dichloropropane
(Isopropylidence dichloride)

Alkylene dihalides

$BrCH_2CH_2Br$
1,2–Dibromoethane
(Ethylene dibromide)

$CH_3–CHCl–CH_2Cl$
1,2–Dichloropropane
(Propylene dichloride)

Polyhaloalkanes

$CHCl_3$
Trichloromethane
(Chloroform)

CHI_3
Triiodomethane
(Iodoform)

CCl_4
Tetrachloromethane
(Carbon tetrachloride)

$CF_3–CF_2–CF_3$
Octafluoropropane
or Perfluoropropane

03. Nature of C–X Bond

Alkyl halides are generally more reactive than the corresponding alkanes due to the presence of polar covalent $\left(\overset{\overset{|}{\delta+}\ \delta-}{—C—X}\right)$ bond. So alkyl halides (R–X) undergo nucleophilic substitution reaction.

The center for attacking $\overset{\ominus}{Nu}$ is $—\overset{|}{\underset{|}{C^+}}$ atom.

Since the size of halogen atom increases as we move down the group in the periodic table, fluorine atom is the smallest and iodine the largest. Consequently, the carbon-halogen bond length increases and bond enthalpy decreases from C–F to C–I.

Further, as we move from F to I, the electronegativity of the halogen decreases, therefore, the polarity of the C–X bond and hence the dipole moment of the haloalkane should also decrease accordingly. But the dipole moment of CH_3F is slightly lower than that to CH_3Cl. The reason being that although the magnitude of –ve charge on the F atom is much higher than that on the Cl atom but due to small size of F as compared to Cl the C – F bond distance, i.e. dipole moment of CH_3F turns out to be slightly lower than that of CH_3Cl.