

# CHEMISTRY STUDY MATERIALS FOR CLASS 12 (NCERT BASED NOTES OF CHAPTER - 10) GANESH KUMAR                      DATE:- 08/09/2020

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## Haloalkanes and Haloarenes

These are compounds containing halogen atoms attached to an alkyl or aryl group. The general representation of **haloalkanes** is **R-X** and that of **haloarenes** is **Ar-X** [where X = F, Cl, Br, I].

### Classification

#### 1. On the basis of number of halogen atoms:

Based on this, haloalkanes and haloarenes are classified as mono, di or polyhalogen compounds. Monohalogen compounds contain only one halogen atom, dihalocompounds contain 2 halogen atoms and polyhalogen compounds contain more than 2 halogen atoms.

#### 2. Compounds containing $sp^3$ C-X bond: They include

➤ **Alkyl halides or haloalkanes (R-X):** Here the halogen atom is directly bonded to a  $sp^3$  hybridized C atom of an alkyl group. They are further classified as primary, secondary or tertiary according to the nature of carbon to which halogen atom is attached. Their general formula may be:

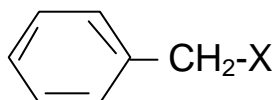
Primary haloalkane:  $R-CH_2-X$

Secondary haloalkane:  $R_2CH-X$

Tertiary haloalkane:  $R_3C-X$

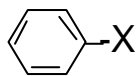
➤ **Allylic halides:** Here the halogen atom is bonded to a  $sp^3$  hybridized carbon atom next to a C = C bond. e.g.:  $CH_2=CH-CH_2X$

➤ **Benzylic halides:** These are compounds in which the halogen atom is bonded to a  $sp^3$  hybridized carbon atom next to an aromatic ring. e.g.:  $C_6H_5-CH_2-X$



### 3. Compounds having $sp^2$ C-X bond: They include

➤ **Vinylic halides:** Here the halogen atom is directly bonded to a  $sp^2$  hybridized carbon atom of a C=C bond. E.g.:  $CH_2=CH-X$

➤ **Aryl halides:** Here the halogen atom is directly bonded to a  $sp^2$  hybridized carbon atom of an aromatic ring. E.g. :  $C_6H_5-X$  / 

### Nomenclature

Common name of alkyl halides is obtained by adding -yl halide to the word root (i.e. word root + yl halide) and the IUPAC name is obtained by adding the prefix 'halo' to the name of the parent alkane (i.e. halo + alkane).

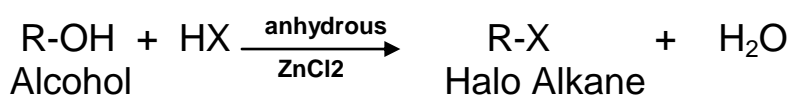
#### Some examples are:

| Compound                 | Common Name         | IUPAC Name                |
|--------------------------|---------------------|---------------------------|
| $CH_3-Cl$                | Methyl chloride     | Chloromethane             |
| $CH_3-CH_2-Br$           | Ethyl bromide       | Bromoethane               |
| $CH_3-CH_2-CH_2-Cl$      | n-Propyl chloride   | 1-Chloropropane           |
| $CH_3-CHCl-CH_3$         | Isopropyl chloride  | 2-Chloropropane           |
| $CH_3-CH_2-CH_2-CH_2-Br$ | N-Butyl bromide     | 1-Bromopropane            |
| $(CH_3)_3C-Cl$           | tert-butyl chloride | 2-Chloro-2-methyl propane |
| $C_6H_5-Cl$              | Chlorobenzene       | Chlorobenzene             |
| $C_6H_5-CH_2-I$          | Benzyl iodide       | Iodophenylmethane         |

### Methods of preparation:

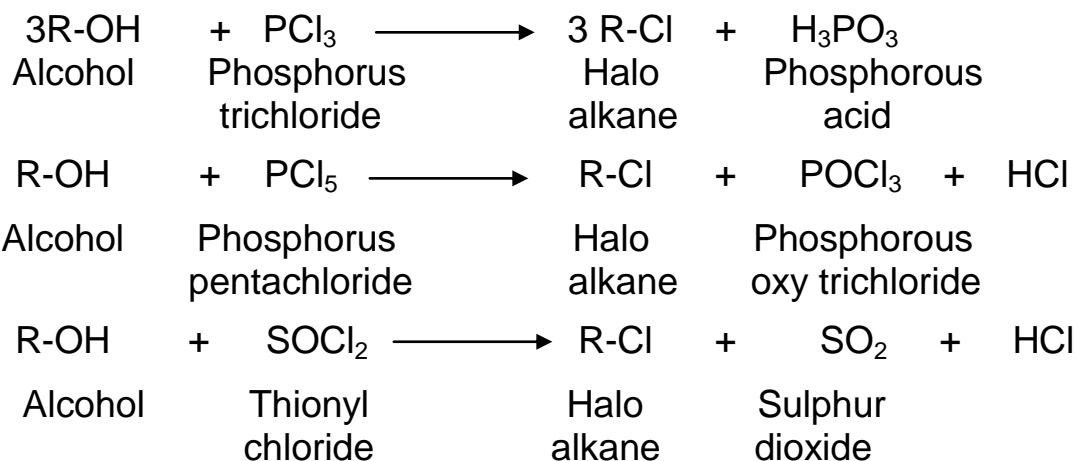
#### From alcohols:

a) By the action of concentrated halogen acids on alcohols in presence of anhydrous  $ZnCl_2$  as catalyst.



Reactions of primary and secondary alcohols with HI require the presence of anhydrous  $ZnCl_2$ , while tertiary alcohols do not require the catalyst.

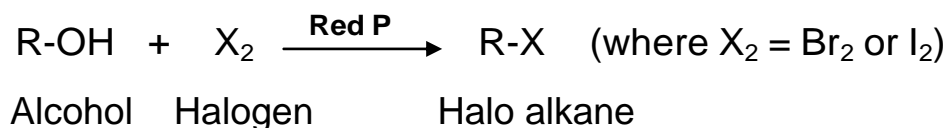
b) Alkyl chlorides are obtained by the action of  $\text{PCl}_3$ ,  $\text{PCl}_5$  or  $\text{SOCl}_2$  with alcohols.



R  $\rightarrow$  Alkyl group such as  $-\text{CH}_3$  (methyl group),  $-\text{CH}_2\text{CH}_3$  (ethyl group)

Among these methods, the reaction with thionyl chloride ( $\text{SOCl}_2$ ) is preferred, since the byproducts are gases and are easily escaped from the reaction medium.

For the preparation of alkyl bromides and iodides, alcohols are treated with bromine or iodine in presence of red phosphorus, since  $\text{PBr}_3$  and  $\text{PI}_3$  are unstable.



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