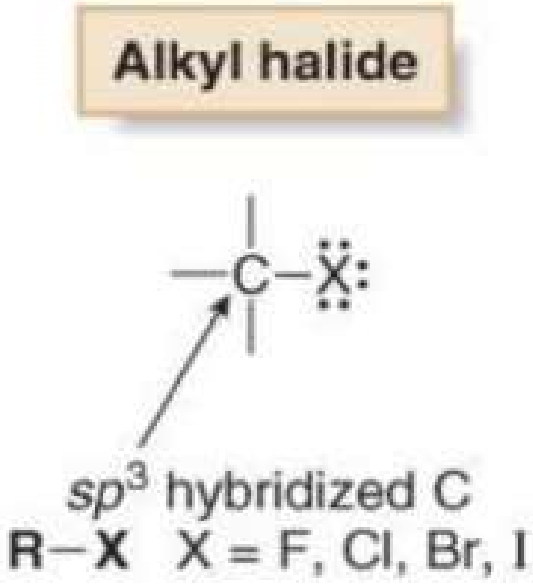
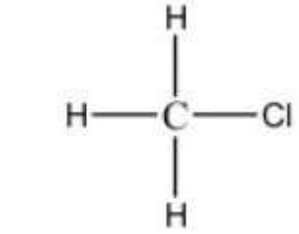
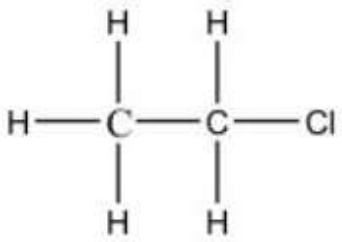
Alkyl Halide

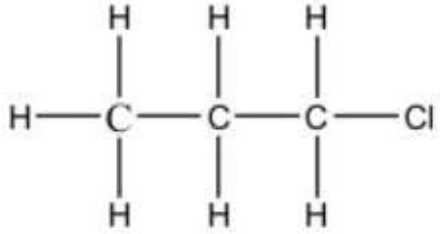
- *Alkyl halide are formed by the replacement of hydrogen atoms in an aliphatic hydrocarbon by halogen atoms (Fluorine, chlorine, bromine or iodine).*

- *In alkyl halide the halogen atoms (denoted by X) are bonded to an sp^3 hybridized carbon atom.*



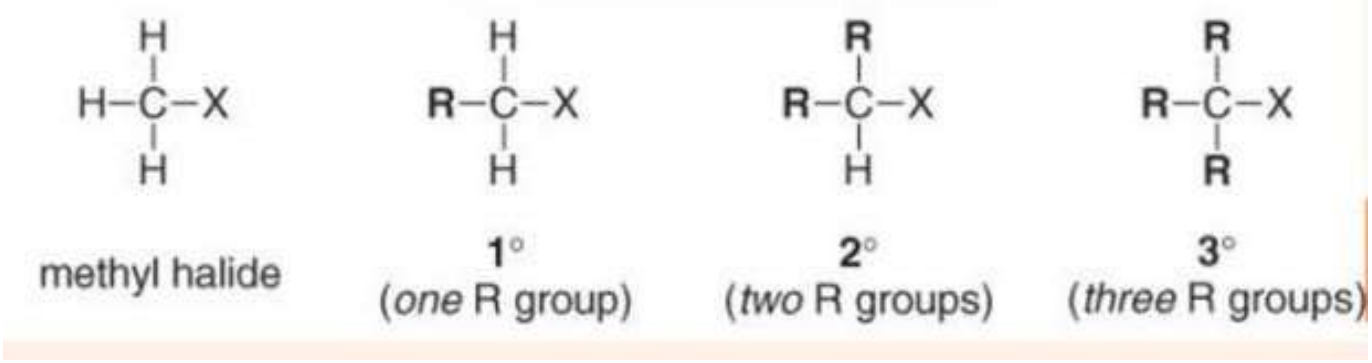

Methyl chloride


ethtyl chloride


propyl chloride

Classification of alkyl halides

- *Depending on the type of carbon atom the halogen is bonded to*



- *Depending on the number of halogen atoms*

1. ***Mono Haloalkane***- *Obtain by replacing one hydrogen atom of the hydrocarbon by one halogen atom*

Example: CH_3-CH_2-X

2. ***Di Haloalkane***- *Obtain by replacing two hydrogen atom of the hydrocarbon by two halogen atom*

Further classified as

- ***Vicinal Dihalides****- Two halogen atoms on neighbouring carbon atoms*

$ClCH_2CH_2Cl$
1,2 dichloroethane

CH_3-CH(Cl)-CH_2Cl
1,2 dichloropropane

- ***Geminal Dihalides****- Two halogen atoms are present on the same carbon atom*

CH_3CHBr_2
1,1- dibromoethane

CH_3-C(Br_2)-CH_3
2,2- dibromopropane

3. ***Tri Haloalkane****- Obtain by replacing three hydrogen atom of the hydrocarbon by three halogen atom*

$CHCl_3$
Trichloromethane
(Chloroform)

CHI_3
(Iodoform)

4. ***Tetra Haloalkane****- Obtain by replacing four hydrogen atom of the hydrocarbon by four halogen atom*

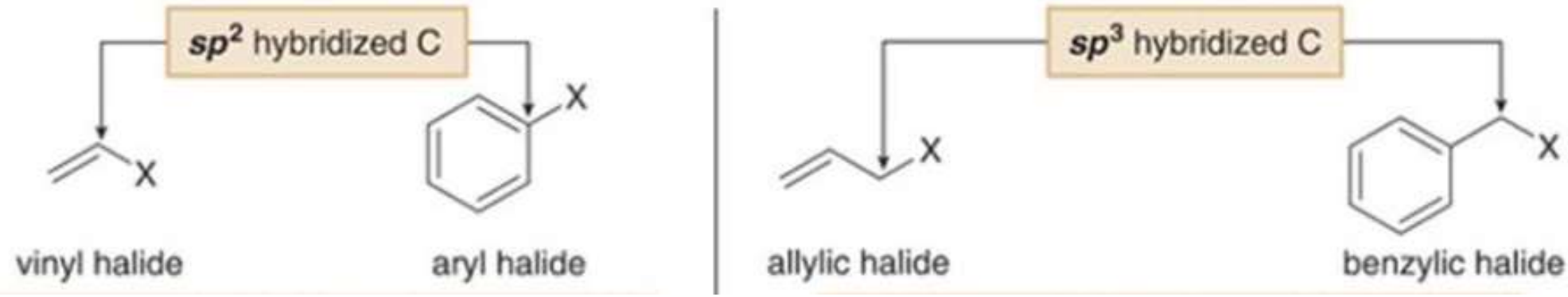
CCl_4

Tetra chloromethane
(Carbon tetrachloride)

CBr_4

Tetra bromomethane
(Carbon tetrabromide)

Four types of organic halides (RX) having X near a π bond



Properties of Alkyl halides

Physical Properties

- ✓ *Physical State- Some of the lower members (CH_3F, CH_3Cl, CH_3Br, C_2H_5Cl, C_2H_5Br) are colourless gases. All other alkyl halides upto C_{18} are sweet smelling oily liquids. Higher members are solids.*

Boiling Points

- ✓ *Haloalkanes have higher boiling points than alkanes containing the same number of carbons.*

Reasons-

- *Haloalkanes exhibit an increase in surface area due to the substitution of a halogen for hydrogen.*
- *The C-X bond is polar due to the electronegativity difference between carbon and halogen. Due to this Dipole-dipole interaction exist in alkylhalides which is absent in the corresponding alkanes.*

Both the factor contributes to the increase in the intermolecular forces of attraction between molecules leading to higher BP in haloalkanes.

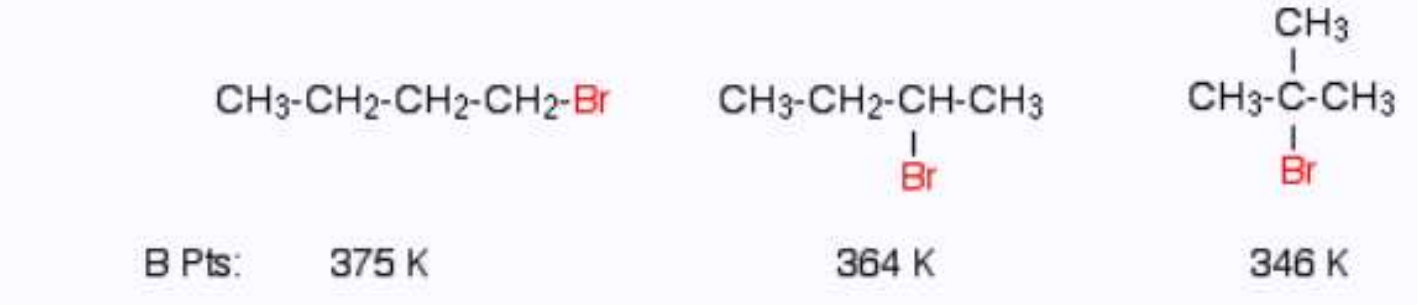
- *Keeping the alkyl group same, the BP increase with increase in the size of the halogen group.*

Halomethane	CH_3F	CH_3Cl	CH_3Br	CH_3I
b.pt – (K)	194.0	249.0	278.0	316.0

- *Keeping the halogen atom same, the BP increases with the increase in the size of the alkyl group.*

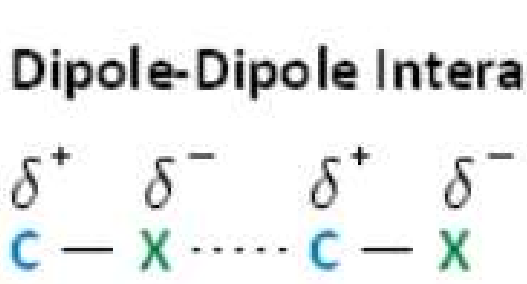
Chloro alkane	CH_3Cl	C_2H_5Cl	*n*- C_3H_7Cl	C_4H_9Cl
b.pt – (K)	249	287.5	320.0	351.5

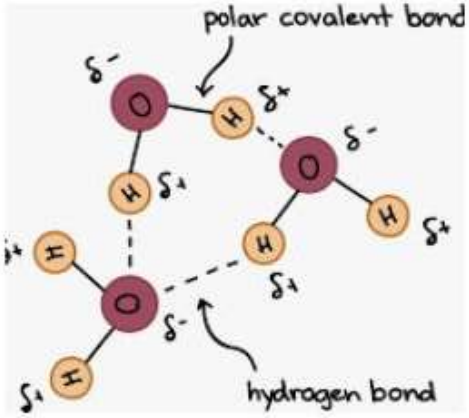
- *The BP decreases with an increase in branching in the alkyl group because with branching the molecule attains a spherical shape with less surface area*



Solubility

- ✓ *Inspite of the polarity of molecule, alkyl halides are insoluble in water. In order for a alkyl halide to dissolve in water, energy is required to overcome the attraction between the haloalkane molecules and break the hydrogen bonds between water molecules. Less energy is released when new attractions are set up between the haloalkane and the water molecules as these are not as strong as the original hydrogen bonds in water. As a result, the solubility of haloalkanes in water is low.*





Density

- ✓ *The alkyliodides and bromides are heavier than water, while the chlorides and fluorides are lighter than water.*

Chemical Properties of Alkyl halides

- ✓ *Alkyl halides are highly reactive because a halogen atom is a source of polarity.*