CHAPTER No. 12
HALOGENS

MAIN POINTS:

→ they are group VII A (7A) members
→ Halous → salt, gens → forming
→ exist in diatomic form.

Colour of Halogens:

① F_2 → gas → pale yellow
② Cl_2 → gas → green yellow
③ Br → liquid → red brown
④ I_2 → solid → shiney grey black
⑤ As → natural radioactive
⑥ TS → artificially made radioactive

VOLATILITY OF HALOGENS

as you move from top to bottom in a group, halogens become less volatile & become darker.

Reasons: We will discuss 3 reasons here

① shell increases
② Non-polar nature increases
③ instantaneous dipole / induce dipole forces increases.

BOND STRENGTH OF HALOGENS

as we move from top to bottom in group, the bond strength decreases, because of small size (but florine is an exeption)

→SLO-Based Question:

→Why florine is an exception to this?

Ans: Strong forces of attraction are present in 'F' florine. It has high electronegativity. It is smaller in size and is highly unstable therefore it is an exception.

REACTIVITY:-

It is the ability of halogens to gain electron and form halide ions.

general equation:

$$\underset{\text{(halogen)}}{X} + e^- \longrightarrow \underset{\text{(halide ion)}}{X^-} \quad \text{(where X = halogen)}$$

① $F + e^- \longrightarrow F^-$
(florine) (floride)

② $Cl + e^- \longrightarrow Cl^-$
(chlorine) (chloride)

③ $Br + e^- \longrightarrow Br^-$
(Bromine) (bromide)

④ $I + e^- \longrightarrow I^-$
(iodine) (iodide)

Among all these most reactive is florine as it has highest tendency to gain e^- and form halide ion (F^-) floride ion

group trend: reactivity decreases as we move from top to bottom in a group because of decrease in electron-negativity. It also decreases down the group.

→ **Electronegativity of Halogens:**

It decreases down the group. The electronegativity of halgens is as follows:-

Florine → F → 4.0
Chlorine → Cl → 3.16
Bromine → Br → 2.96
Iodine → I → 2.66

OXIDIZING POWER OF HALOGNS (group VII-A)

$F_2 > Cl_2 > Br_2 > I_2$

F_2 can displace all halogens.
Cl_2 can displace Br_2 and I_2 but can't F_2
Br_2 can displace I_2 but can't Cl_2 and F_2
I_2 can't displace any of the halogens.

REACTION OF HALOGENS WITH HYDROGEN (H_2)

General equation: $H_2 + X_2 \longrightarrow 2HX$
where X_2 = halogen. (F_2, Cl_2, Br_2, I_2)
trend: reactivity of halogens with hydrogen decreases as we move from top to bottom in group. because atomic size increases, weaker attraction b/w Hydrogen & halogen lead to less vigorous.

THERMAL STABILITY OF HYDROGEN-HALIDE (HX)

$HF > HCl > HBr > HI$

The strength of HX bond is related to electronegativity difference
(ΔE.N ∝ strength of bond)

→ HF is thermally strongest while HI is thermally weakest.

more strength → thermally strong → more heat will be absorbed to break the bond.

ORDER OF ACIDITY IN HYDROGEN-HALIDE (HX)

$HI \rightleftharpoons H^+ + I^-$

Because it can easily loose protons in aquas solution & is weak bond

$HI > HBr > HCl > HF$

REACTIVITY OF HALIDE-ION

The reducing power of anion depends on how it looses electrons, the reducing power of X^- increases down the group because of decrease in attraction between nucleus and valence electrons ease with which halide ion looses electron increases
[reducing order : I^-, Br^-, Cl^-, F^-]

Reaction with Sulphuric acid

① $NaF^{-1} + H_2SO_4^{+6} \longrightarrow NaHSO_4^{+6} + HF$
→ F^{-1} can't reduce sulphuric acid because it is a weak reducing agent.

② $NaCl^{-1} + H_2SO_4 \longrightarrow NaHSO_4 + HCl$
→ Cl^- can't reduce sulphuric acid because it is a weak reducing agent

③ $HBr^{-1} + H_2SO_4^{+6} \longrightarrow Br_2 + SO_2^{+4} + H_2O$
→ Br^{-1} is a mild reducing agent.