

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 fluorine is an exception)

→ SLO-Based Question:

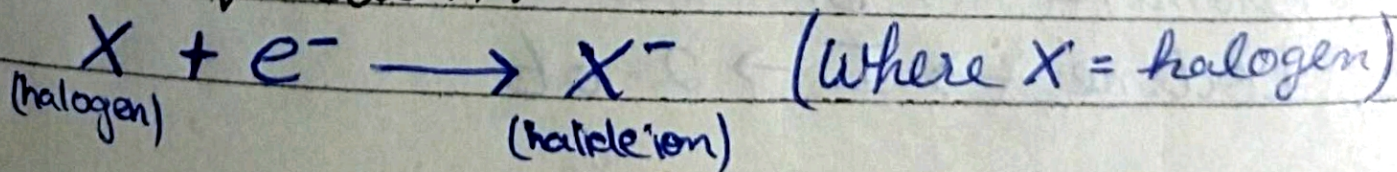
→ Why fluorine is an exception to this?

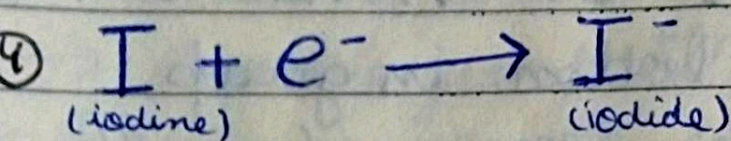
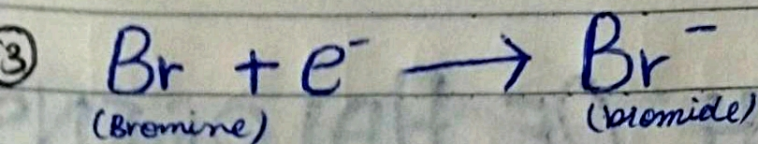
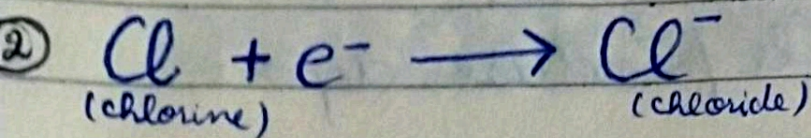
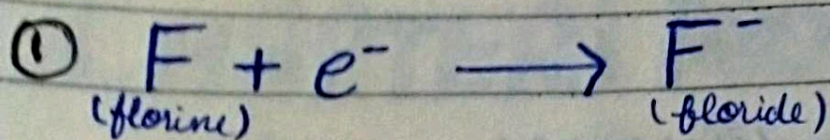
Ans: Strong forces of attraction are present in 'F' fluorine. It has high electronegativity. It is smaller in size and is highly unstable therefore it is an exception.

REACTIVITY:-

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

general equation:





Among all these most reactive is fluorine as it has highest tendency to gain e^- and form halide ion (F^-) fluoride 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 halogens is as follows:-

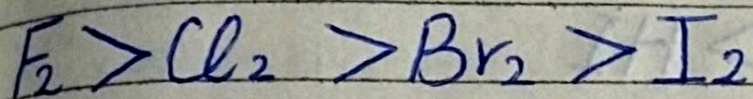
Fluorine $\rightarrow \text{F} \rightarrow 4.0$

Chlorine $\rightarrow \text{Cl} \rightarrow 3.16$

Bromine $\rightarrow \text{Br} \rightarrow 2.96$

Iodine $\rightarrow \text{I} \rightarrow 2.66$

OXIDIZING POWER OF HALOGENS (group VII-A)



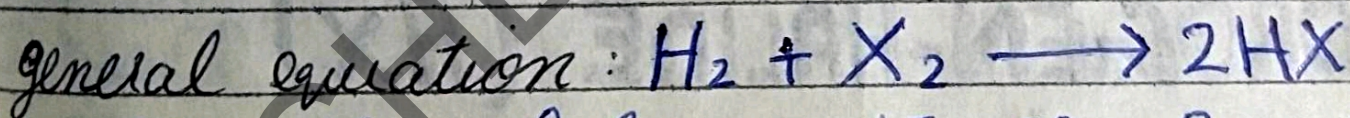
F_2 can displace all halogens.

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.

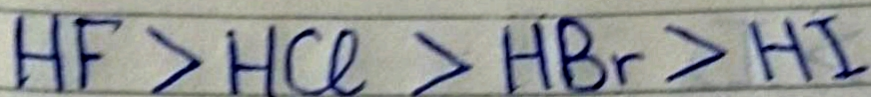
REACTION OF HALOGENS WITH HYDROGEN (H_2)



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)

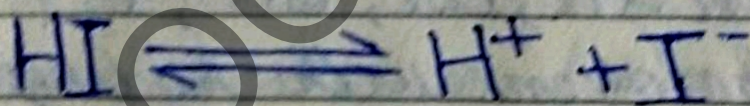


The strength of HX bond is related to electronegativity difference (ΔE.N ∝ strength of bond)

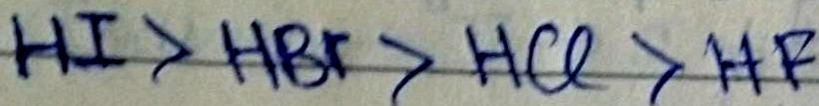
→ HF is thermally strongest while HI is thermally weakest.

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

ORDER OF ACIDITY IN HYDROGEN-HALIDE (HX)



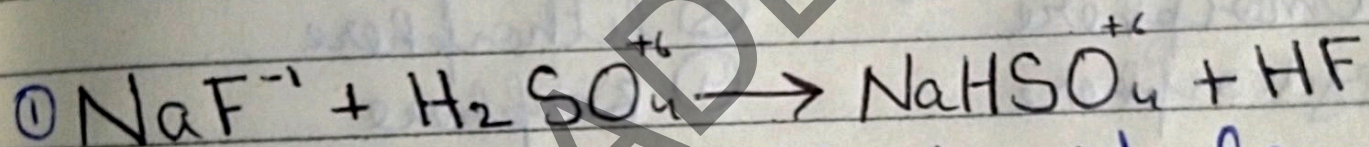
Because it can easily lose protons in aqueous solution & it is weak bond



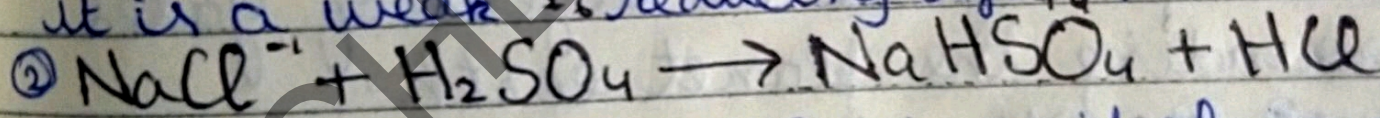
REACTIVITY OF HALIDE-ION

The reducing power of anion depends on how it loses 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 loses electron increases
[reducing order: I^- , Br^- , Cl^- , F^-]

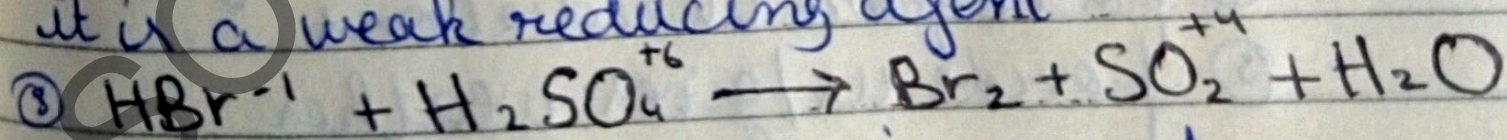
Reaction with Sulphuric acid



$\rightarrow F^{-1}$ can't reduce sulphuric acid because it is a weak reducing agent.



$\rightarrow Cl^{-1}$ can't reduce sulphuric acid because it is a weak reducing agent



$\rightarrow Br^{-1}$ is a mild reducing agent.