TDC Part I
Inorganic Chemistry

Department of Chemistry

L.S COLLEGE MUZAFFARPUR
B. R. A. BIHAR UNIVERSITY

Dr. Priyanka

TOPIC:- Group 17,General Trends

Group 17

The elements in this group are non-metallic in nature. The group comprises of fluorine, chlorine, bromine, iodine and astatine. The last element is radioactive. They are collectively known as halogens (Greek, halos + gen, salt former). The most common compound containing a halogen is sodium chloride (common salt), known since antiquity. Due to high reactivity, halogens do not occur free in nature but in form of salts (halides).

The elements have seven electrons in their outermost shell ($ns^2\ np^5$). They acquire noble gas configuration by either gaining an electron to form halide ion, or acquiring a share in one electron by forming a covalent bond. All natural halogens are diatomic. Some physical properties of halogens are summarized in Table 23.

Table 23: Physical properties of Group 17 elements

Property	F	Cl	Br	I
Atomic Number	9	17	35	53
Electronic Configuration	$[He]2s^2 2p^5$	$[Ne]3s^2 3p^5$	$[Ar]3d^{10}\ 4s^2 4p^5$	$[Kr]4d^{10}\ 5s^2 5p^5$
Covalent radius (pm)	64	99	114	133
Ionization Energy (I^{st}) ($KJmol^{-1}$)	1681	1251	1140	1008
Electron Affinity (KJ mol^{-1})	333	349	325	295
Electronegativity	4.19	2.87	2.68	2.36
Melting Point (^0C)	-218.6	-101.0	-7.25	113.6 *
Boiling Point (^0C)	-188.1	-34.0	59.5	185.2
ΔH dissociation (KJ mol^{-1})	158.6	242.6	192.8	151.1

* sublimes

General group Trends

The halogens are all coloured. Fluorine and chlorine are pale –yellow and yellowish –green gases respectively; bromine is a dark-red liquid and iodine a black, lustrous solid that readily sublimes giving a purple vapour.

The halogens are the smallest atoms in the respective periods of the periodic table and the size increases with increase in atomic number. The halogens have very high electronegativity values, which decrease with increase in size. Fluorine is the most electronegative element in the periodic table.

Halogens need one electron to complete the octet, thus the electron affinity values are high. The electron affinity decreases from chlorine to iodine. The electron affinity of fluorine is less than that of chlorine; this is because of the small size of the fluorine atom, which makes the incoming electron encounter a lot of electron – electron repulsion.

The X-X bond dissociation enthalpy decreases from Cl_2 to I_2. The value for F_2 is abnormally low and it is likely that the weakness of the F-F bond is largely a consequence of repulsions between the nonbonding electron pairs. The low bond enthalpy is responsible for the high reactivity of fluorine.