Group 17 / VIIA; Halogens

Basics

- Halogens are aggressive and dangerous gases or solids (iodine, I) that react with almost anything. Fluorine (F) is probably the element that forms the most compounds - even with some noble gases.
  - Fluorine is of immense importance in technology: without hydrofluoric acid (HF) there would be no semiconductor industry. Even exotic compounds like tungsten-hexa- fluoride (WF_6) are of importance.
    Fluoride or fluorspar (CaF_2) is the naturally occurring mineral for making fluorine but it is also used as "flux" in smelting metals.
  - Chlorine (Cl) is not only part of rock salt (NaCl) but one of the most important basic ingredients of chemistry, e.g. as hydrofluoric acid (HCl).
    Bromine (Br) and iodine (I) are know from medical applications but are not all that important anymore, Not so long ago, photography used "film" and for that you needed light sensitive chemicals containing those elements
    Astate is radioactive, does not occur in nature and thus of no interest.
- *Table of Basic Data*

Name ***(German)***	**Fluorine** *Fluor*	**Chlorine** *Chlor*	**Bromine** *Brom*	**Iodine** *Iod Jod*	**Astatine** *Astat*
Atomic number	9	17	35	53	85
Atomic mass [u]	19	35,45	79,90	126,90	209,99
Melting point [K]	53,53	172,17	265,9	386,65	575
Melting point [^oC]	-219,5	-100,8	-7	113,6	302
Melting point [^oF]					
Boiling point [K]	85,01	238,55	332,93	457,55	610
Density [g/cm^3]	$1{,}58 \cdot 10^{-3}$	$2{,}95 \cdot 10^{-3}$	3,14	4,94	?
Ionization energy [eV]	17,42	12,97	11,81	10,45	9,5
Electronegativitiy	4,1 (largest)	2,8	2,7	2,2	2,0
Atomic radius [pm]	70,9	99,4	114,5	133,1	?
Ionic radius [pm]	133	181	196	220	227
Oxidation numbers	-1	-1; 7,5,3,1	-1; 7,5,3,1	-1; 7,5,3,1	-1; 7,5,3,1
Lattice typ Transformation temp. [^oC]	?	tet	op	op	?
Lattice constant [Å] (a or c)	-	-	-	-	-
Young's - Modul us [GPa]	-	-	-	-	-
Therm. expansion coefficient α [$10^{-6}K^{-1}$]	-	-	-	-	-

- In case of doubt all numbers are for room temperatures
- fcc = face centered cubic; lattice const. = a
  bcc = body centered cubic
  sc = simple cubic
  hp = simple hexagonal
  hcp = hexagonal close packed; lattice constants a and c.
  op = simple orthorhombic, monoclinic, triclinic
  tp = simple tetragonal
  dia = diamond structure
  r = trigonal or rhomboedral trigonal