

Group 15 Elements

Electronic Configuration: ns^2np^3

Elements: ${}^7\text{N}, {}^{15}\text{P}, {}^{33}\text{As}, {}^{51}\text{Sb}, {}^{83}\text{Bi}$

Atomic and Ionic radii: Increases down the group

IE: Decreases down the group due to gradual increase in atomic size.

Electron-negativity: Decreases down the group with increase in atomic number.

Physical properties: Polyatomic, metallic character increases down the group. N and P are non-metals As and Sb metalloids and Bi metals. B.P increases top to bottom and M.P increases upto As and then decreases upto Bi. Except Ni all show allotropy

Chemical Properties: Common O.N: -3, +3 and +5.

Nitrogen shows anomalous behaviour

Dinitrogen Preparation:

In Laboratory:

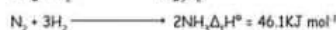


Thermal Decomposition:

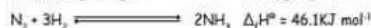
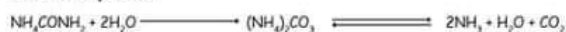


Properties:

Colourless, odourless, tasteless and non-toxic gas

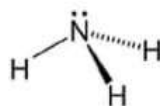
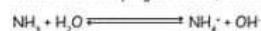


Ammonia Preparation

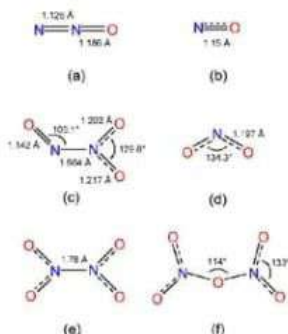


Properties

Colourless with pungent odour, soluble in water



Oxides of Nitrogen



Group 16 Elements

Electronic configuration: ns^2np^4

Atomic and Ionic radii: Increases down the group

IE: Decreases down the group

Electron gain Enthalpy: O has less -ve than S

Electron-Negativity: Decreases with increase in atomic number.

Physical Properties: O and S are non-metals, Se and Te metalloids whereas Po is a metal. All exhibit allotropy

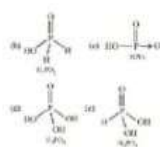
M.P. and B.P. : increases down the group

Chemical Properties: variable

Reactivity with Hydrogen: Stable hydrides

Reactivity with Halogens: $\text{F} > \text{Cl} > \text{Br} > \text{I}$

Oxoacids of S: $\text{H}_2\text{SO}_3 \longrightarrow \text{H}_2\text{SO}_4$



Dioxygen (O_2)



Properties: colourless and odourless gas



Group 17 Elements

Occurrence: F and Cl are fairly abundant while Br and I less so

Electronic Configuration: ns^2np^5

Atomic Radii: Smallest in periods but increases from F to I

IE: Decreases down the group

Electron Gain Enthalpy: Less -ve down the group

Electron-Negativity: High, decreases down the group

Physical Properties: F and Cl are gases, Br is liquid and I solid

M.P. and B.P. : Increases with atomic number

Chemical Properties:

• All exhibit -1 oxidation state Cl, Br and I exhibit +1, +3, +5 and +7 O.N

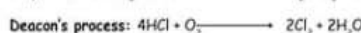
• Reactivity towards hydrogen: $\text{H-F} > \text{H-Cl} > \text{H-Br} > \text{H-I}$

• Reactivity towards oxygen: F forms OF_2 (stable) and O_2F_2

• Reactivity towards metals: $\text{MF} > \text{MCl} > \text{MBr} > \text{MI}$

• Reactivity towards other halogens: Forms XX' , XX'_2 , XX'_3 and XX'_4

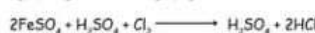
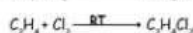
Chlorine



Properties: Greenish yellow with pungent and suffocating odour. Heavier than air.



(Cold and dilute)



Inter-halogen compounds: XX' - sp^3 (linear), XX'_2 - sp^3d (T-Shaped),

XX'_3 - sp^3d^2 (square pyramidal), XX'_4 - sp^3d^2 (Pentagonal bipyramidal)

Group 18 Elements

Occurrence : All except radon occur in atmosphere

Electronic configuration: ns^2np^6 except He

IE: Increases down the group

Electron gain Enthalpy: Largely positive

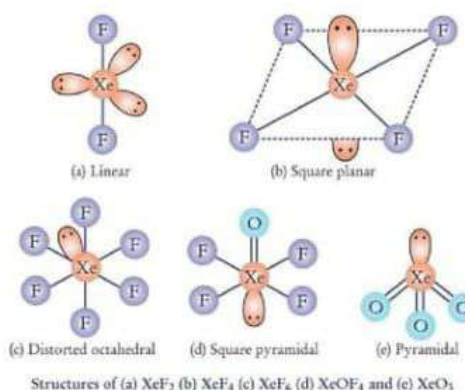
Electron-Negativity: Decreases with increase in atomic number.

Physical Properties: monoatomic, colourless, odourless and tasteless. Sparingly soluble in water.

M.P. and B.P. : Low

Chemical Properties: Least reactive xenon compound: XeF_2 , XeF_4 and XeF_6

Xenone oxygen compound: XeO_3 , XeOF_4 , XeOF_6



Structures of (a) XeF_2 (b) XeF_4 (c) XeF_6 (d) XeOF_4 and (e) XeO_3