THE P-BLOCK CLASS 12th

Oxygen & Halogen family

P-BLOCK CLASS 12th NCERT BASED

LECTURE 1 …… GROUP 16 (Oxygen Family)

OXYGEN FAMILY Grp 16 & HALOGEN Grp 17

FOR ASPIRANTS OF IIT-JEE, NEET & CBSE

Strategy

- Course contain 7-8 lectures
- Each lecture duration 12-15 min
- Cover grp 16 & 17
- Fully based on NCERT
- Cover some important quest also.

General instruction

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Group 16 Elements

1.They have ns^2np^4 general electronic configuration.

2.The elements of this group have lower ionisation enthalpy values compared to those of Group15 in the corresponding periods.

This is due to the fact that Group 15 elements have extra stable half-filled *p* orbital electronic configurations.

3.Because of the compact nature of oxygen atom, it has less negative electron gain enthalpy than sulphur.

4.Next to fluorine, oxygen has the highest electronegativity value amongst the elements.

5.Oxygen and sulphur are non-metals, selenium and tellurium metalloids, whereas polonium is a metal. Polonium is radioactive and is short lived (Half-life 13.8 days).

6.The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of their atomicity; oxygen exists as diatomic molecule (O_2) whereas sulphur exists as polyatomic molecule (S_8).

Oxidation states and trends in chemical reactivity:-

1. Since electronegativity of oxygen is very high, it shows only negative oxidation state as –2 except in the case of OF_2 where its oxidation state is + 2

2.The stability of + 6 oxidation state decreases down the group and stability of + 4 oxidation state increase (inert pair effect) unacademy

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Anomalous behaviour of oxygen:-

1.The anomalous behaviour of oxygen, like other members of *p*-block present in second period is due to its small size and high electronegativity. One typical example of effects of small size and high electronegativity is the presence of strong hydrogen bonding in H_2O which is not found in H_2S.

2.The absence of *d* orbitals in oxygen limits its covalency to four and in practice, rarely exceeds two. On the other hand, in case of other elements of the group, the valence shells can be xpanded and covalence exceeds four.

***Reactivity with hydrogen*:**

- All the elements of Group 16 form hydrides of the type H_2E (E =O, S, Se, Te, Po)
- H_2O H_2S H_2Se H_2Te

  BDE Decreases

Stability decreases

Acidity increases

Reducing nature increases

Reactivity with oxygen:

- All these elements form oxides of the EO_2 and EO_3 types where E = S, Se, Te or Po.
- Ozone (O_3) and sulphur dioxide (SO_2) are gases while selenium dioxide (SeO_2) is solid.
- Reducing property of dioxide decreases from SO_2 to TeO_2; SO_2 is reducing while TeO_2 is an oxidising agent
- Both types of oxides are acidic in nature.

Reactivity towards the halogens.

- The stability of the halides decreases in the order $F^- > Cl^- > Br^- > I^-$.
- Amongst hexahalides, hexafluorides are the only stable halides.
- They have octahedral structure.
- Sulphurhexafluoride, SF_6 is exceptionally stable for steric reasons.

Tetrafluorides, have sp^3d hybridisation and thus, have trigonal bipyramidal structures in which one of the equatorial positions is occupied by a lone pair of electrons. This geometry is also regarded as *see-saw* geometry.

- *Dihalides have sp*3 hybridisation and thus, have tetrahedral structure.
- The well known monohalides are dimeric in nature. Examples are S_2F_2, S_2Cl_2, S_2Br_2, Se_2Cl_2 and Se_2Br_2.
- These dimeric halides undergo disproportionation as given below:

$$2Se_2Cl_2 \rightarrow SeCl_4 + 3Se$$

Question:-

1.H_2S is less acidic than H_2Te. Why?

Due to the decrease in bond (E–H) dissociation enthalpy down the group, acidic character increases.

2. Why is H_2O a liquid and H_2S a gas ?

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Element	Symbol	Atomic No.	Electronic Configuration	Abundance In Earth's Crust (in ppm)
Oxygen	O	8	[He] $2s^2 2p^4$	4.66×10^5
Sulphur	S	16	[Ne] $3s^2 3p^4$	5.20×10^2
Selenium	Se	34	[Ar] $3d^{10} 4s^2 4p^4$	9.0×10^{-2}
Tellurium	Te	52	[Kr] $4d^{10} 5s^2 5p^4$	9.0×10^{-2}
Polonium			[Xe] $4f^{14} 5d^{10} 6s^2 6p^4$	2×10^{-3}