

d In
d In
d Te

Inert pair effect.

group oxi state :-

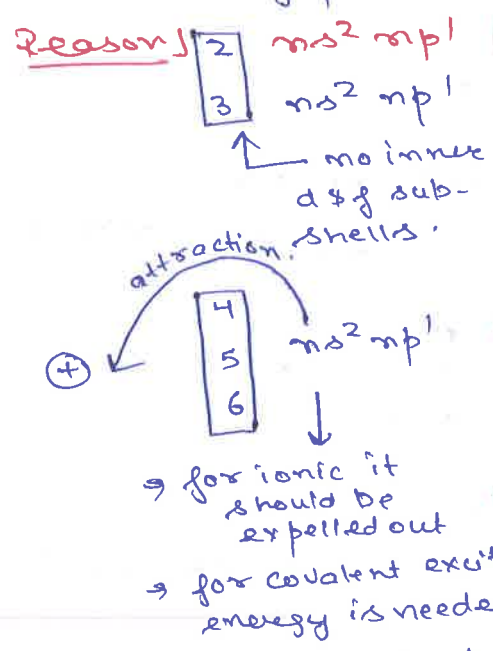
↓
means all elements exhibits this oxi. state
(most stable oxi. state for all group member generally)

	Group - 13	Group - 14	Group - 15
	$ns^2 np^1$ +3	$ns^2 np^2$ +4	$ns^2 np^3$ +5
Period			
2	B +3	C +4	N +5
3	Al +3	Si +4	P +5
4 →	Ga +3 > 1 → +3	Ge +4 > 2	As +5 > +3
5 →	In +3 > +1 → +3	Sn +4 > +2	Sb +5 > +3
6 →	Tl +3 > +1 → +3	Pb +4 > +2	Bi +5 > +3

Shielding effect multiply along the period.

* As we move down the group, there is progressively increase in (Group oxi. state - 2) oxi. state. For last element table turns [+1 > +3]; [+2 > +4]; [+3 > +5]

Remember → Inert pair effect starts with 4th period and there is progressively less in less than 2 group oxi. state down the group. For last elements less than 2 group oxi. state is most stable (only for last elements)



Down the group, d & f orbitals comes into existence (Zeff ↑)

as we move down the group tendency to loose ns^2 becomes more & more difficult.

Note → $+3, +4, +5$ state compounds are more stable than $+2$ state compounds. But stable compound is more than higher oxi. state.

→ For last member stability of lower oxi. state is more than higher oxi. state.

Inert pair effect

→ This effect is caused due to the inertness of outermost s-electrons (ns^2) of heavier p-block elements.

→ As we move down the group no. 13, 14, 15 there is a presence of f-electrons in inner shells, which have poor shielding effect hence z_{eff} increases.

→ As a result the ns^2 electron pair becomes more tightly held by the nucleus and becomes difficult to participate in bonding.

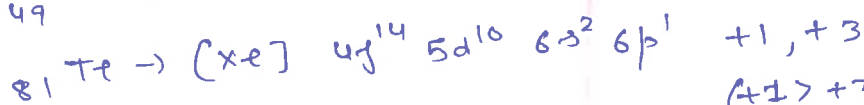
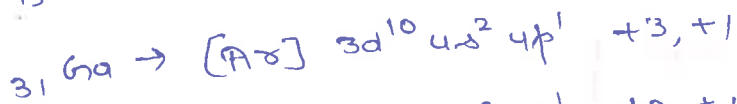
→ This effect is generally shown by heavier elements of grp 13, 14, 15 of p-block.

→ Due to this effect heavier members shows an oxi. state which is two unit less than grp oxi. state.

→ While moving down the group the stability of lower oxi state increases for last element of the group.

★ → For last element group oxi. state is highly oxidising in nature (NCERT)

Example → 13th group | Boron family.



(+1) > (+3) → stability

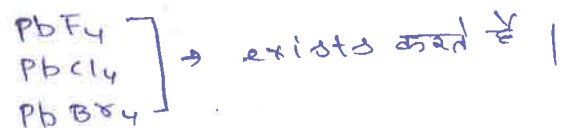
Problems

1) why PbI_4 doesn't exist?

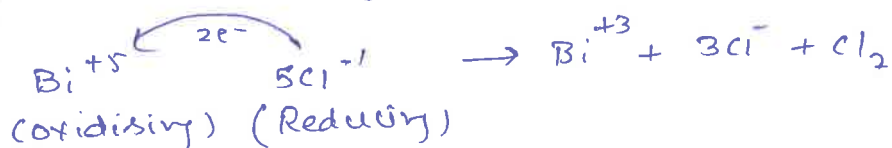
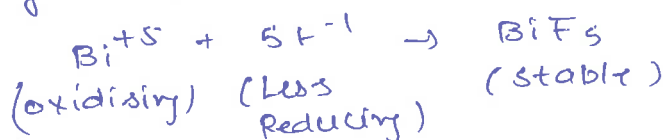


[Pb^{+4} acts as an oxi. agent & I^- acts as R.A.],

(Reason → order of Reducing nature $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$)



2) only BiF_5 exists but BiCl_5 doesn't?

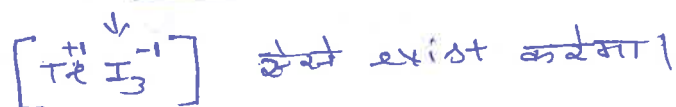
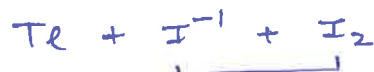
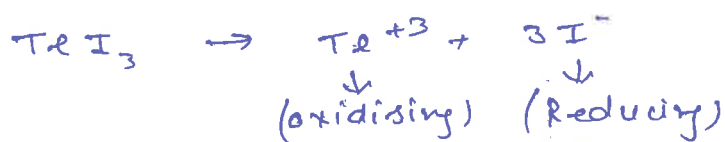


3] $PbCl_2$ is more stable than $PbCl_4$.



↳ Inert pair effect.

4] Thallium (III) Iodide doesn't exist -



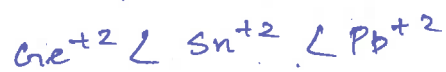
5] The stability of +1 oxi. state among Al, Ga, In & Tl increases in the sequence.



Reason → Down the group lower oxi state ↑.

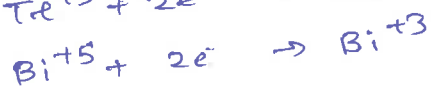
Ans → 4

Q] Correct order of stability



Applications

- Compds in which Pb is present in +4, Te in +3, and Bi in +5 oxi state act as good oxi agent.



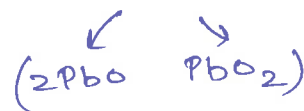
Eg: NaBiO_3



Q) which of the following oxide of Pb act as good oxi agent.

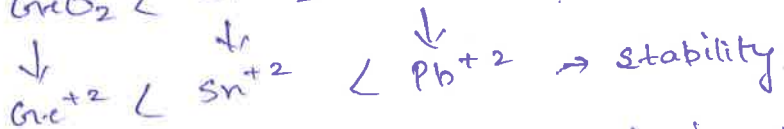


mixed oxide.

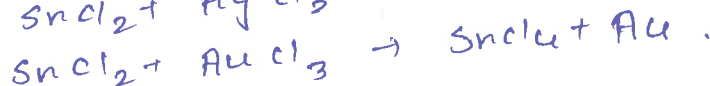
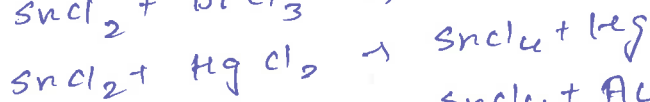
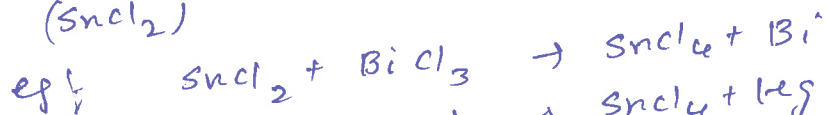
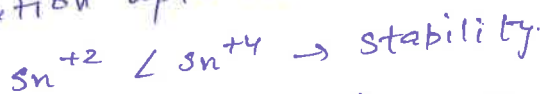


Ans $\rightarrow$ B, C, D.

Q) write correct order of oxidising strength!



- Compds in which Sn is present in +2 oxi. state act as good R. agent that why SnCl_2 easily reduces metal cation upto their elemental form.



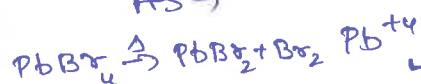
Q) which of the following doesn't exist at room temp.



Stability order



As $\rightarrow$



oxi. agent



reducer

good

R. agent

R. power of halides

