

p-Block Elements: one-page cheat sheet

NEET Chemistry · Unit 10 · Inorganic Chemistry

Weightage: 3–4 questions · 12–16 marks

1 · Group 13 (boron family)

- Inert pair** +1 gains stability down the group: $Tl^+ > Tl^{3+}$, so $TlI > TlI_3$
 $BF_3 < BCl_3 < BBr_3 < BI_3$ (Lewis acidity)
- Back-bonding ($2p\pi-2p\pi$) is strongest in BF_3 , so it is the weakest acid.
- Diborane** B_2H_6 : two 3c–2e bridges, four 2c–2e terminal bonds, B is sp^3
- Boric acid** $B(OH)_3 + 2H_2O \rightarrow [B(OH)_4]^- + H_3O^+$ (Lewis acid, not a proton donor)
- Others** borax $Na_2B_4O_7 \cdot 10H_2O$; borazine $B_3N_3H_6$

2 · Group 14 (carbon family)

- $C \gg Si > Ge \approx Sn \gg Pb$ (catenation)
- Allotropes** diamond sp^3 ; graphite sp^2 ; fullerene C_{60} sp^2
- Inert pair** $PbCl_2$ is stable, $PbCl_4$ is not
- Covalency** C max 4; Si can reach 6 (SiF_6^{2-}) using d -orbitals
- Silicones** $(R_2SiO)_n$ from R_2SiCl_2 hydrolysis
- CO** binds Hb about 300 times more strongly than O_2

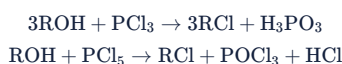
3 · Group 15 (nitrogen family)

- N** only $2s, 2p$: no $d\pi-p\pi$ bonding; forms $p\pi-p\pi$ ($N \equiv N$)
- $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$ (stability, basicity)
- Boiling point: NH_3 highest (H-bonding), then $SbH_3 > AsH_3 > PH_3$.

Acid	O.S.	Basicity	P–H
H_3PO_2	+1	1	2
H_3PO_3	+3	2	1
H_3PO_4	+5	3	0
$H_4P_2O_7$	+5	4	0

Only those with P–H bonds (H_3PO_2, H_3PO_3) are reducing.

4 · Phosphorus halides with ROH



5 · Group 16 (oxygen family)

- O states** $-2; -1 (H_2O_2); +1 (O_2F_2); +2 (OF_2)$
- Hydrides** acidity $H_2O < H_2S < H_2Se < H_2Te$; bp $H_2S < H_2Se < H_2Te < H_2O$
- O₃** bent, diamagnetic; oxidises I^- to I_2

Oxoacid	Formula	Feature
Sulphurous	H_2SO_3	S–OH $\times 2$, S=O $\times 1$
Sulphuric	H_2SO_4	S–OH $\times 2$, S=O $\times 2$
Pyrosulphuric	$H_2S_2O_7$	S–O–S bridge
Peroxodisulphuric	$H_2S_2O_8$	S–O–O–S bridge

Contact process: $SO_2 \rightarrow SO_3$ over V_2O_5 ; SO_3 in H_2SO_4 gives oleum.

Six traps to remember

- Oxygen is not always -2 : $+2$ in OF_2 , $+1$ in O_2F_2 , -1 in peroxides.
- Nitrogen cannot form $d\pi-p\pi$ bonds: it has no d -orbitals.
- Boron in diborane is sp^3 , not sp^2 .

6 · Group 17 (halogens)

- $F_2 > Cl_2 > Br_2 > I_2$ (oxidising power)
- Bond enthalpy** $Cl_2 > Br_2 > F_2 > I_2$
- Hydrides** acidity $HF < HCl < HBr < HI$; bp HF highest
- Oxoacids** $HOCl < HClO_2 < HClO_3 < HClO_4$ (acid strength)
- Cold dil. NaOH** $X_2 \rightarrow X^- + OX^-$
- Hot conc. NaOH** $X_2 \rightarrow X^- + XO_3^-$
- Shapes** ClF_3 T-shaped (sp^3d , 2 lp); BrF_5 square pyramidal; IF_7 pentagonal bipyramidal

7 · Group 18 (noble gases)



Species	lp	Hybrid.	Shape
XeF_2	3	sp^3d	linear
XeF_4	2	sp^3d^2	square planar
XeF_6	1	sp^3d^3	distorted octahedral
XeO_3	1	sp^3	pyramidal
$XeOF_4$	1	sp^3d^2	square pyramidal



Seen in NEET 2023

Stability: $TiCl_3$ vs $TiCl$, InI_3 vs InI , TlI vs TlI_3 ?
 Inert pair: Tl^+ is more stable than Tl^{3+} , so **$TlI > TlI_3$** .

8 · Nitrogen chemistry

- Haber** $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (Fe, about 700 K, 200 atm)
- Ostwald** $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ (Pt/Rh)
 $2NO + O_2 \rightarrow 2NO_2$; $3NO_2 + H_2O \rightarrow 2HNO_3 + NO$
- Cu + HNO₃** conc. gives NO_2 ; dilute gives NO
- PCl₅** solid is $[PCl_4]^+[PCl_6]^-$

Seen in NEET 2026

ClF_3 : Cl has 3 bond pairs and 2 lone pairs (sp^3d).
 Lone pairs sit equatorial, so the shape is **bent T-shaped**.

Seen in NEET 2022

Diborane: each B is sp^3 . Two sp^3 orbitals make terminal 2c–2e bonds, two make bridge 3c–2e bonds.

- BF_3 is the **weakest** Lewis acid of the boron trihalides.
- $PCl_3 + ROH$ gives H_3PO_3 ; $PCl_5 + ROH$ gives $POCl_3$.
- Carboxyhaemoglobin is about 300 times **more** stable than oxyhaemoglobin.