



Complete
CHEMISTRY

IIT-JEE · NEET · CBSE eBOOKS

CLASS 11 & 12th



Learning Inquiry
8929 803 804

CLASS 12th

P-Block Elements

misostudy



01. Nitrogen Family

The general electronic configuration is [noble gas] ns^2np^3 .

- (i) **Atomic and Ionic radii** : Covalent radius : $N < P < As < Sb < Bi$
- (ii) **Ionization enthalpies** : $N > P > As > Sb > Bi$ (IE_1 values)
- (iii) **Electronegativity** : $N > P > As > Sb = Bi$
- (iv) **Catenation** : The group 15 elements also show catenation property but to much smaller extent than carbon. Among group 15 elements P has the maximum tendency for catenation forming cyclic as well as open chain compounds consisting of many phosphorous atoms.
- (v) **Valency and oxidation number** : Gen. configuration : ns^2np^3 . Valency = 3.

02. Compounds of V-A Group

Formation of Hydrides

- (i) Hydrides formed have YH_3 formula - $\{NH_3, PH_3, AsH_3, SbH_3, BiH_3\}$
- (ii) NH_3 neutralises protic acids as well as aprotic acids (Lewis Acid) so ammonia is strong base.
- (iii) NH_3 will have high boiling point due to H-bond.
- (iv) Tendency of H-bonding and B.P. $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$.
- (v) NH_3 cannot acts as a reducing agent and BiH_3 is strongest reducing agent.
- (vi) N_3^- is called Azide Ion \rightarrow Has 4 lone pair
e.g. $Ba^{+2}N_3^- \rightarrow$ Barium Azide $[Ba(N_3)_2]$

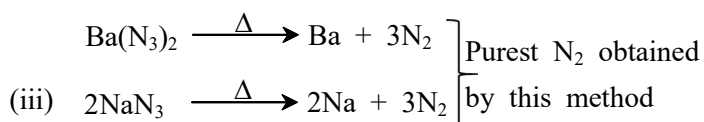
03. Formation of Halides

- (i) **Tri Halides** : All possible trihalides of all these elements are known except NCl_3 , NBr_3 , and NI_3 Because :
 - (a) Low polarity of the N – X bond.
 - (b) Weakness of N – X bond due to large size difference.
- (ii) **Penta Halides** :
 - (a) Except N and Bi all forms pentahalides, N does not form due to absence of d-orbital Bi does not form due to inert pair effect.
 - (b) PCl_5 acts as an effective chlorinating Agent so it decomposes into $PCl_5 \rightarrow PCl_3 + Cl_2$

04. Nitrogen (N_2)

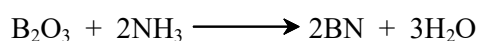
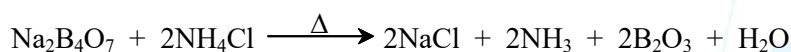
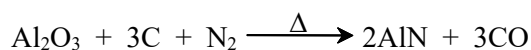
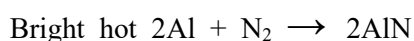
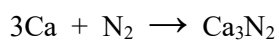
Preparation of N_2 :

- (i) $(NH_4)_2 Cr_2O_7 \xrightarrow{\Delta} N_2 + 4H_2O + Cr_2O_3$
- (ii) $2NH_3 + 3NaOCl \rightarrow N_2 + 3NaCl + H_2O$

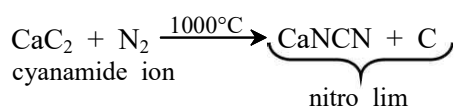


Properties of N₂ :

(i) It is absorbed by hot metal like Ca, Mg, Al etc.



(ii) N₂ can be absorbed by calcium carbide at the temp around 1000°C CaC₂



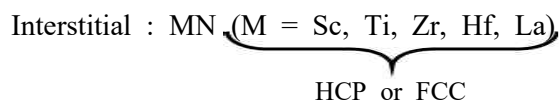
It is a very good fertilizer.

Types of Nitride :

(i) Salt like or ionic : Li₃N, Na₃N, K₃N(?), Ca₃N₂, Mg₃N₂, Be₃N₂

(ii) Covalent : AlN, BN, Si₃N₄, Ge₃N₄, Sn₃N₄

(iii)

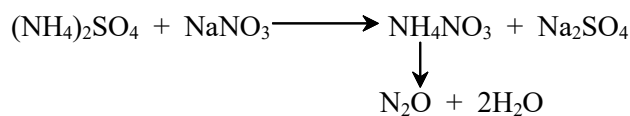


05. Oxides of Nitrogen

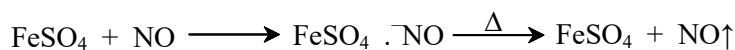
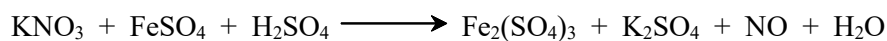
Oxides of nitrogen	Structure	Physical state	Colour of gas
N ₂ O	$\overset{-}{\text{N}} = \overset{+}{\text{N}} = \text{O}$	Gas	Colourless
NO	$:\ddot{\text{N}} = \ddot{\text{O}}:$ or $:\text{N} \equiv \text{O}:$	Gas	Colourless
N ₂ O ₃	$\begin{array}{c} \text{O} \quad \quad \text{O} \\ \diagdown \quad \diagup \\ \text{N} - \text{N} \\ \diagup \quad \diagdown \\ \text{O} \quad \quad \text{O} \end{array}; \text{O} = \text{N} - \text{O} - \text{N} \begin{array}{c} \diagup \\ \text{O} \end{array}$		Blue liquid (-30°C)
NO ₂	$2\text{N} \begin{array}{c} \diagup \text{O} \\ \diagdown \text{O} \end{array} \rightleftharpoons \begin{array}{c} \text{O} \quad \quad \text{O} \\ \diagdown \quad \diagup \\ \text{N} - \text{N} \\ \diagup \quad \diagdown \\ \text{O} \quad \quad \text{O} \end{array}$	Gas	Brown
N ₂ O ₅	$\begin{array}{c} \text{O} \quad \quad \text{O} \\ \diagdown \quad \diagup \\ \text{N} - \text{O} - \text{N} \\ \diagup \quad \diagdown \\ \text{O} \quad \quad \text{O} \end{array}$	Colourless solid	-(no existence in gas phase)

Preparation :

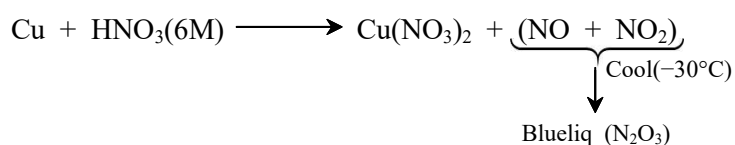
N₂O



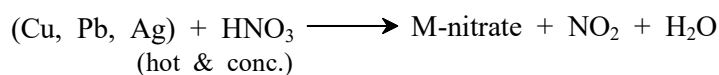
NO



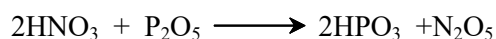
N₂O₃



NO₂



N₂O₅



Reaction with H₂O & NaOH

	H ₂ O	NaOH
(i)	N ₂ O : Fairly soluble in water and produces neutral solution	-----
(ii)	NO : Sparingly soluble in water and produces neutral sol ⁿ .	-----
(iii)	N ₂ O ₃ : 2HNO ₂ Hence it is known as anhydride of HNO ₂	NaNO ₂
(iv)	NO ₂ : HNO ₂ + HNO ₃ called as mixed anhydride	NaNO ₂ + NaNO ₃
(v)	N ₂ O ₅ : 2HNO ₃ called as anhydride of HNO ₃	NaNO ₃

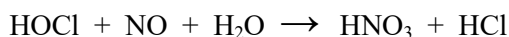
Other properties :

N₂O



NO

It is having reducing property.



NO₂



N₂O₅

