

15<sup>th</sup> group

N }  
P } — non metal

As }  
Sb } metalloids

Bi → metal

①  $\text{Conf} = ns^2 np^3$

② Atomic size ↑ down group



③ IE ↓ down the group



④ Catenation prop.  $\propto$  B.E

$$B.E \propto \frac{1}{\text{Size}}$$

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2p-1p rep.

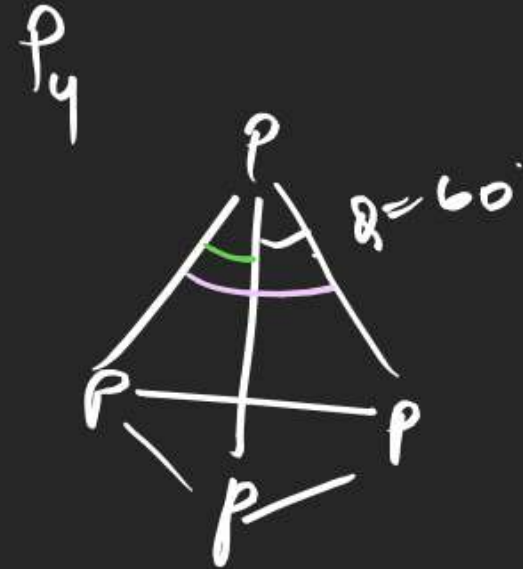
(only for 2nd period)



So N has lower catenation prop.

than P that is why N exist as  $N_2$  and P exist as  $P_4$

atomicity = no of atoms in a molecule



## ① Physical prop.

- ① all atoms are exist as polyatomic molecule  
except N it exist as diatomic molecule



$\text{P} \equiv \text{P}$  does not exist why.

due to large size

P does not form  $3p_{\pi} - 3p_{\pi}$  bonding

②

③ Metallic prop  $\uparrow$  down the group

④ B.P  $\uparrow$  down the group, but m.p  $\uparrow$  up to  
As then  $\downarrow$  bottom  
due to diff crystalline structure

⑤ allotrope  $\rightarrow$  Except N all atoms  
show allotropy

Chemical prop.① Oxidation State → Common O.S. -3 +3 +5

-3 O.S. Stability ↓ down the group because  
Metallic ch. ↑

$$\begin{array}{l} \text{HNO}_3 \\ 1 + x + 3(-2) = 0 \\ x = +5 \end{array}$$

$$\begin{array}{l} \text{N}_2\text{O}_5 \\ 2x + 5(-2) = 0 \\ 2x = 10 \\ x = 5 \end{array}$$



$$P = 2 - 12$$

$$H = 2 - 10$$



down the group  $+5$  o.s  $\downarrow$  only  $\text{BiF}_5$  exist in  
 $+5$  o.s

$N = +1 \quad +2 \quad +4$  show

+3 O.S. unstable



Reactivity with  $H_2$



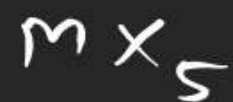
Stability of Hydride



Reducing Power



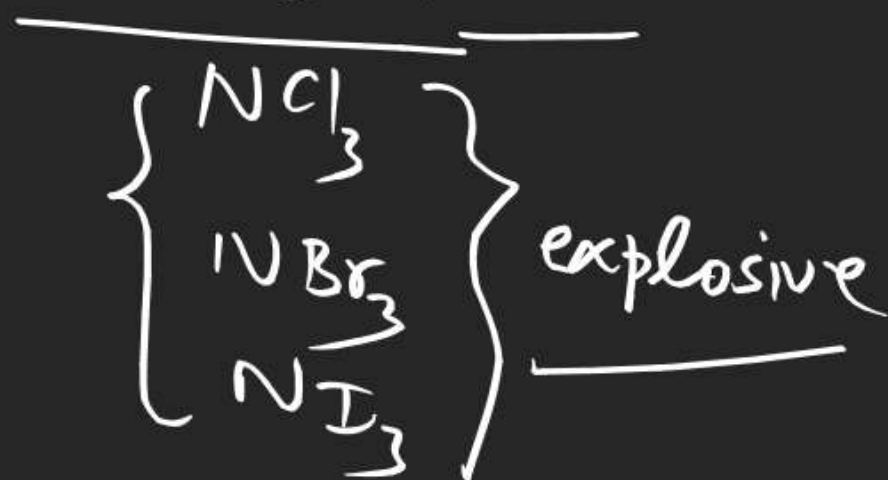
## Reaction with Halogen

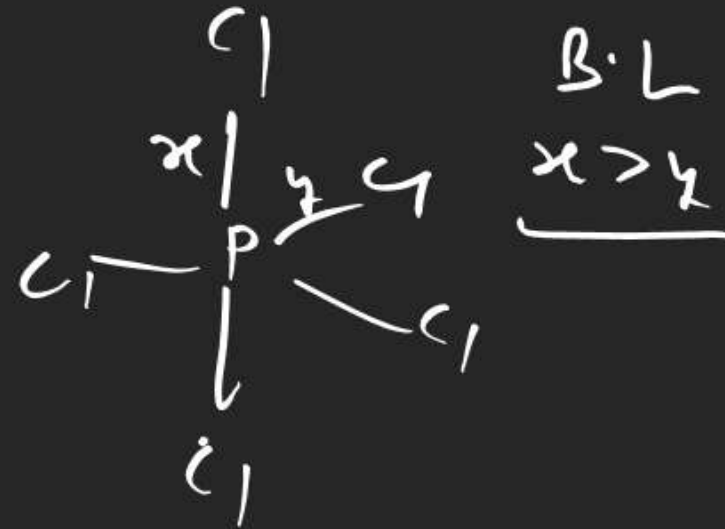


$NX_5$  — does not exist



because N has 3 covalency





In tri Halides

all Halides are covalent except



Oxides

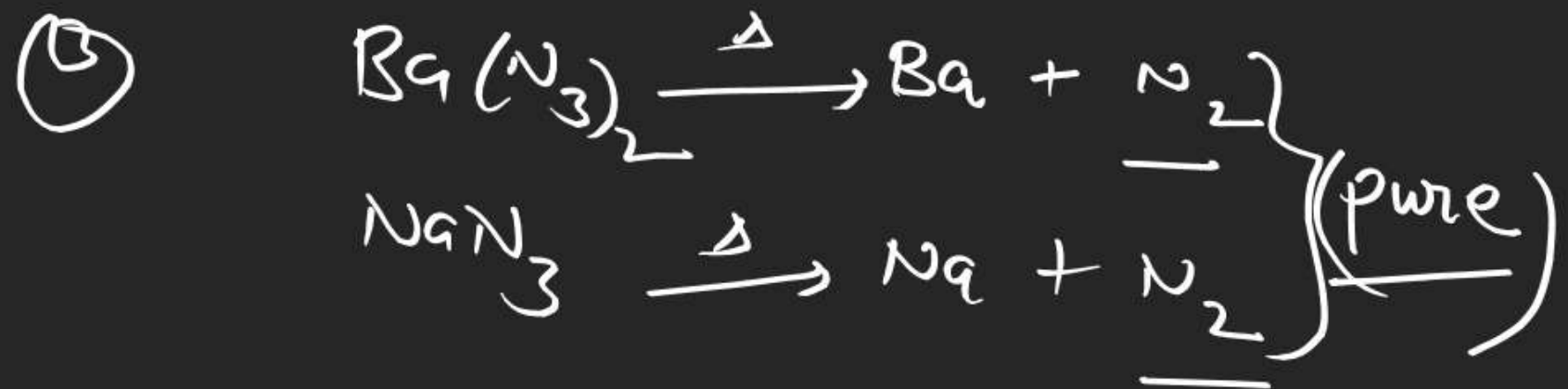
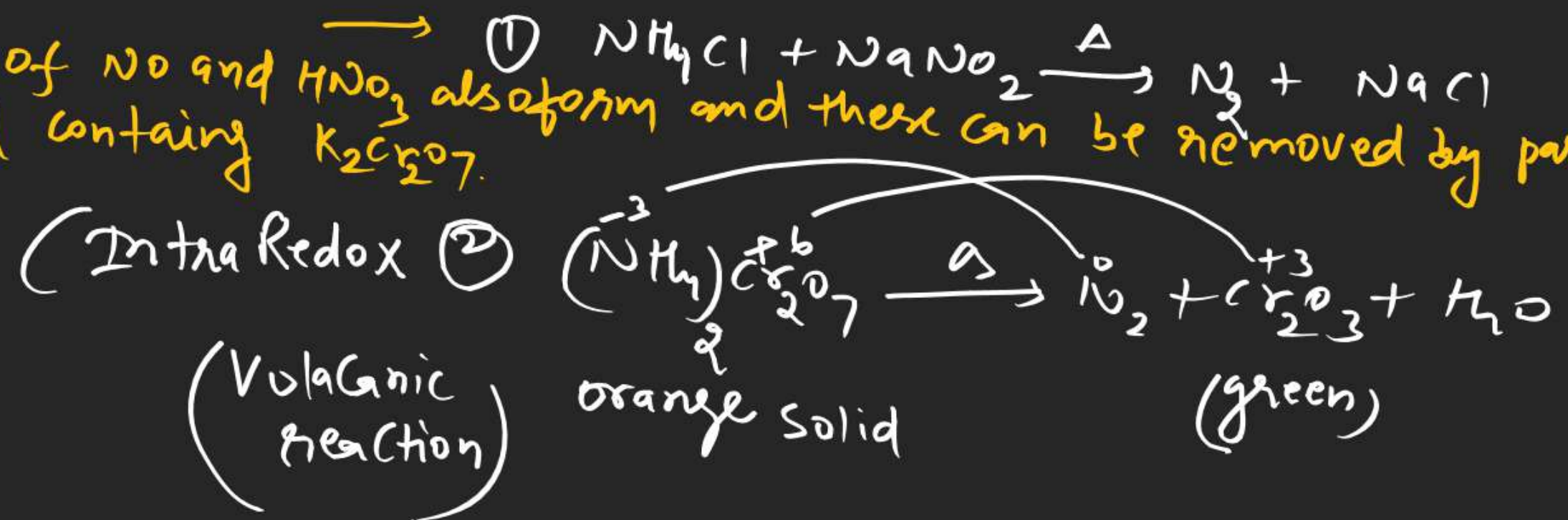


Tri oxide



# Prep. of $N_2$

Small amount of NO and  $HNO_3$  also form and these can be removed by passing them through sulphuric acid containing  $K_2Cr_2O_7$ .



More Covalent

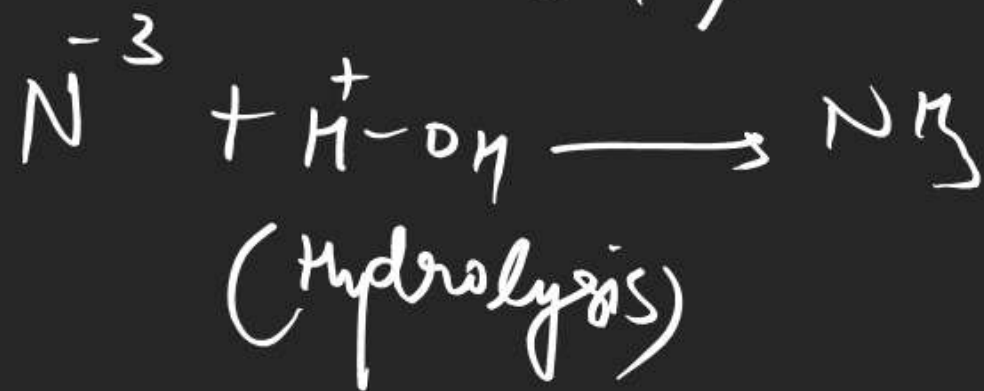
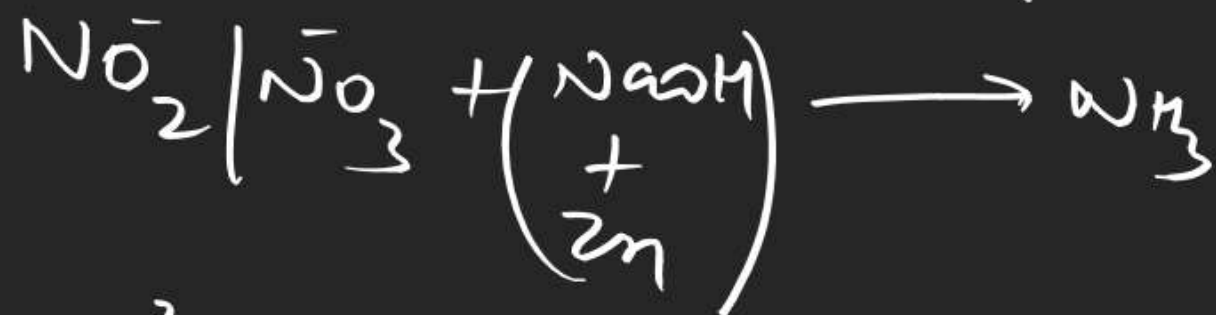
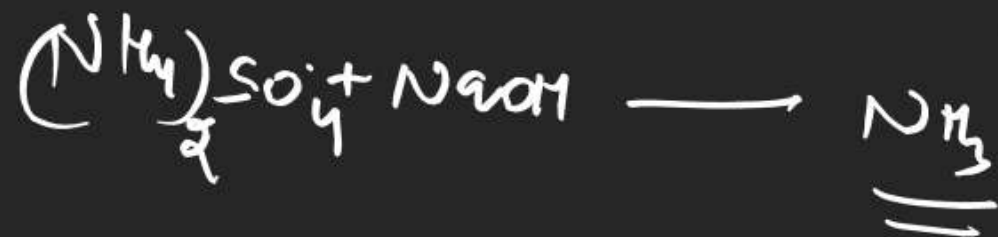
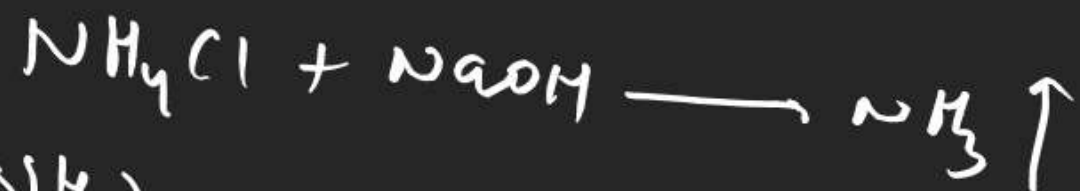


least polar bond,

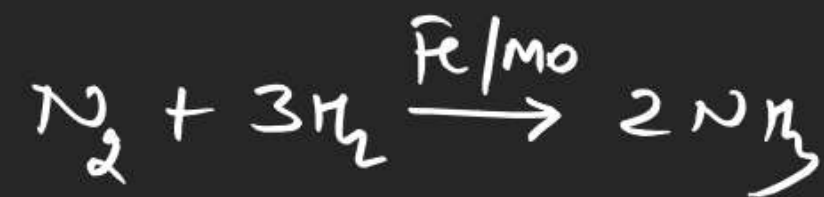


## Prop. of $N_2$

- ① Colourless / odourless
- ② N has two isotopes  $\begin{cases} N^{14} \\ N^{15} \end{cases}$
- ③ it is less soluble in water
- ④ it is use in refrigerant / fertilizer



## Haber process



$\Delta H = \text{-ive}$   
exothermic

Fe = Catalyst

Mo = Promoter [ it increases activity of Catalyst ]

Note :- Now-a-days iron oxide with small amount of  $\text{Al}_2\text{O}_3$  and  $\text{K}_2\text{O}$  is use as a Catalyst

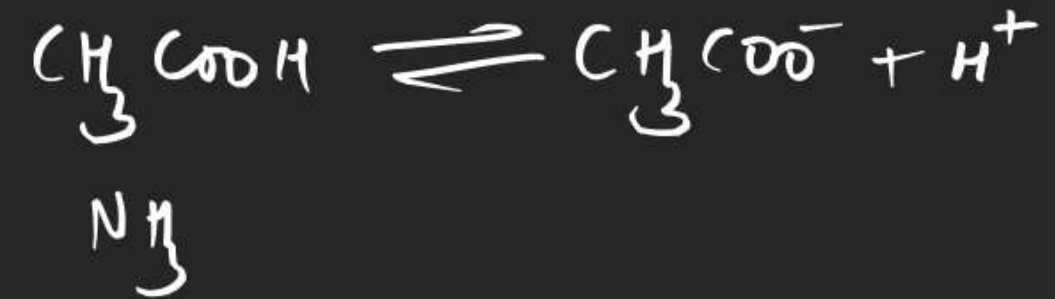
Prop:

- ①  $\text{NH}_3$  colourless gas, pungent smell
- ②  $\text{NH}_3$  basic (weak)
- ③  $\text{NH}_3$  soluble in  $\text{H}_2\text{O}$
- ④  $\text{NH}_3$  is used as refrigerant.

$\text{CH}_3\text{COOH}$  acid is a weak acid but

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In presence of  $\text{NH}_3$  it is act as  
Strong acid



# oxides of N



neutral

Prep.

(nitrous oxide)

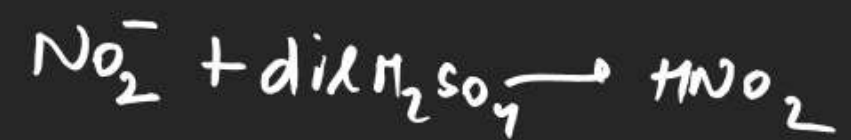


(Laughing gas)

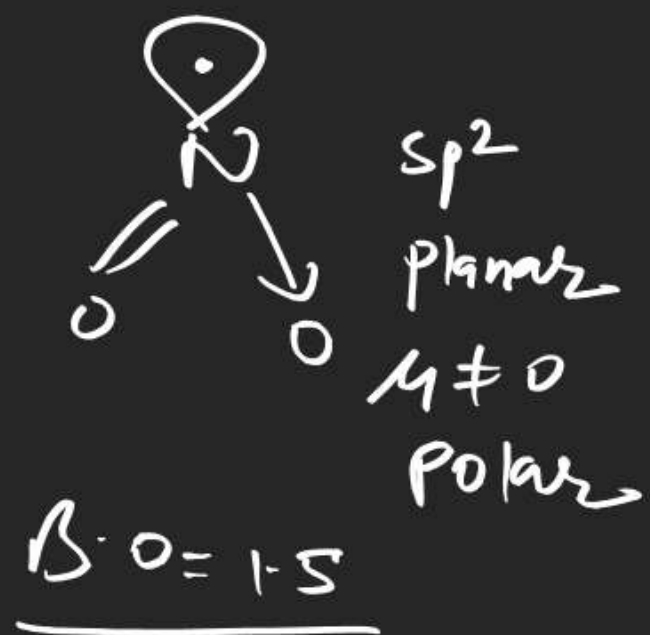


NO  
nitric oxide

neutral

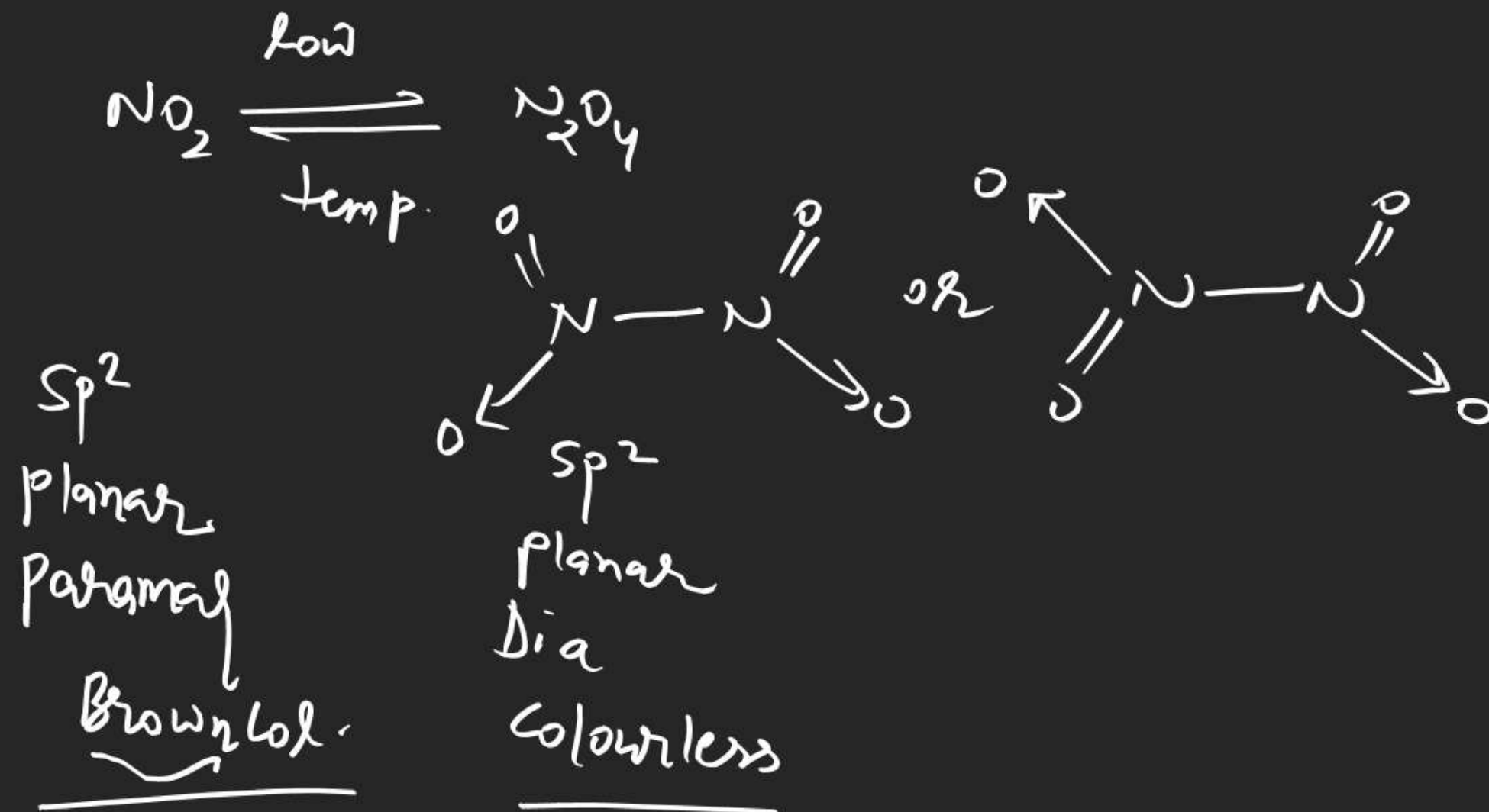
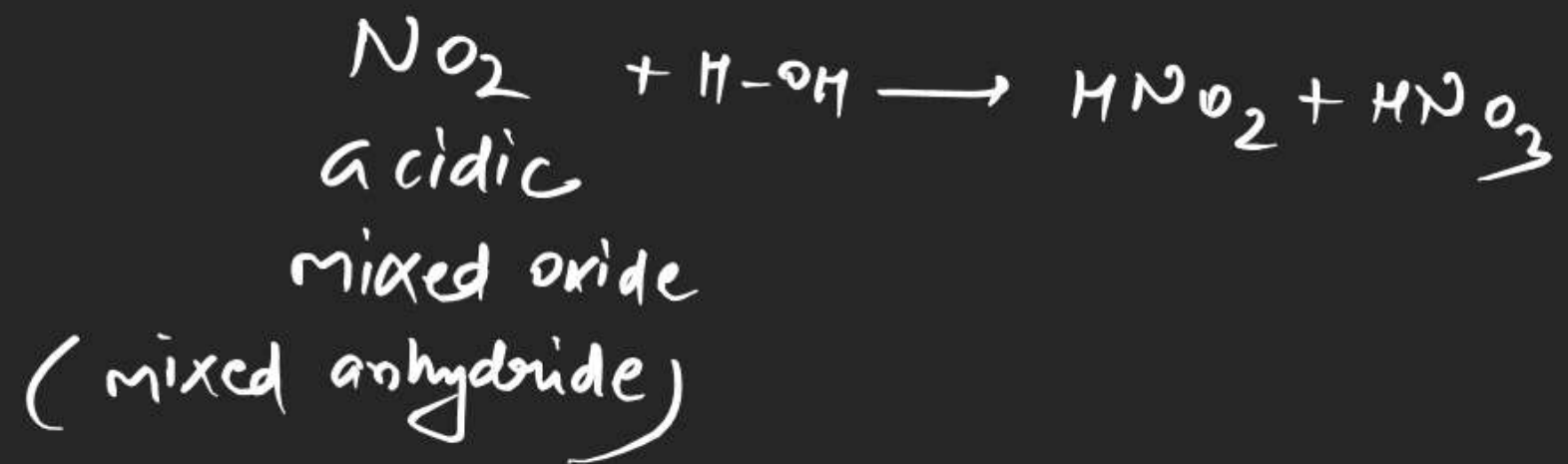


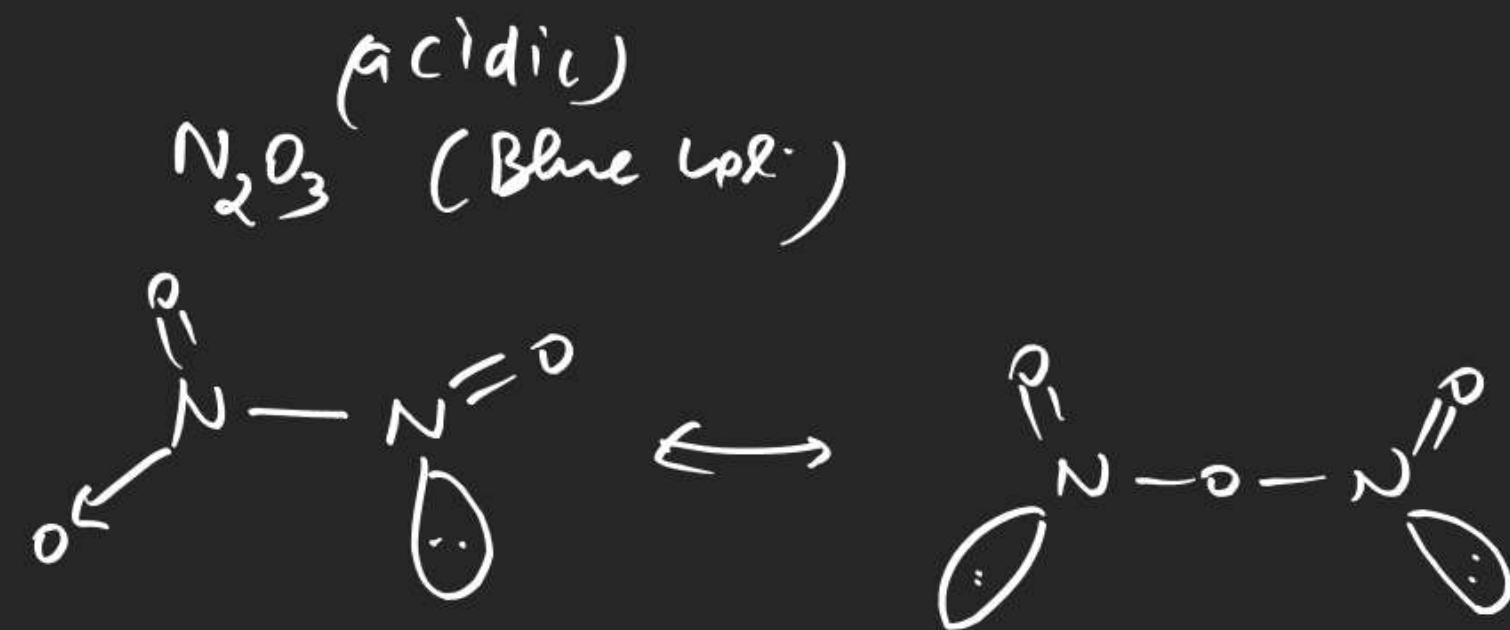
$$\underline{\text{B.O} = 3.5}$$



Prep.







(acidic) Colourless solid  
 $N_2O_5$

