

PROSPERITY ACADEMY

**AS CHEMISTRY 9701**

**Crash Course**

RUHAB IQBAL

**NITROGEN &**

**SULFUR**

**COMPLETE NOTES**



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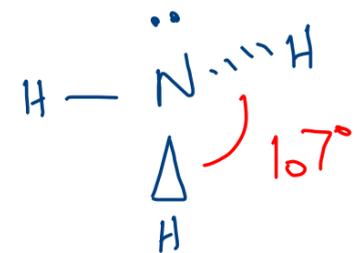
# Nitrogen and Sulfur :-

Nitrogen's lack of reactivity:-  $N_2$  has a  $N \equiv N$  which is very strong and hard to break ( $N \equiv N: 944 \text{ kJ mol}^{-1}$ )

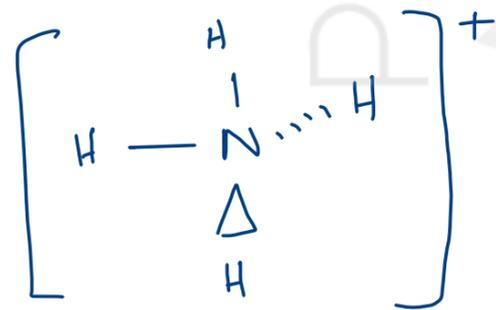
Some examples of nitrogen reacting:-

- 1) During lightning  $\longrightarrow$  NO and  $NO_2$
- 2) In internal combustion engines  $\longrightarrow$  NO and  $NO_2$
- 3) Haber process  $\longrightarrow$   $NH_3$

Ammonia ( $NH_3$ ):- Ammonia is a weak base, it can accept an  $H^+$  by datively bonding to it.



Ammonia  
trigonal pyramidal



Ammonium ion  
tetrahedral

- Ammonia reacts with acids to produce ammonium salts:  $NH_3 + HCl \longrightarrow NH_4Cl$

- Ammonia can be displaced from its salt using strong base:  $NH_4Cl + NaOH \longrightarrow NaCl + H_2O + NH_3$

use damp red litmus paper  $\rightarrow$  turns blue  $\leftarrow$   
bring a glass rod dipped in conc HCl near  $\rightarrow$  steamy fumes  $\leftarrow$   
of  $NH_4Cl$  observed

## Uses of nitrogen:-

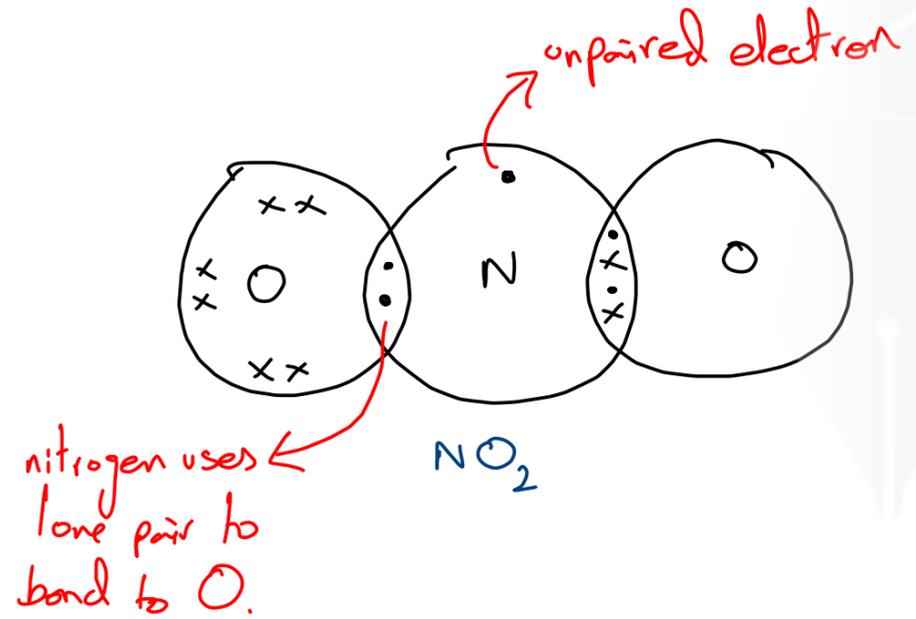
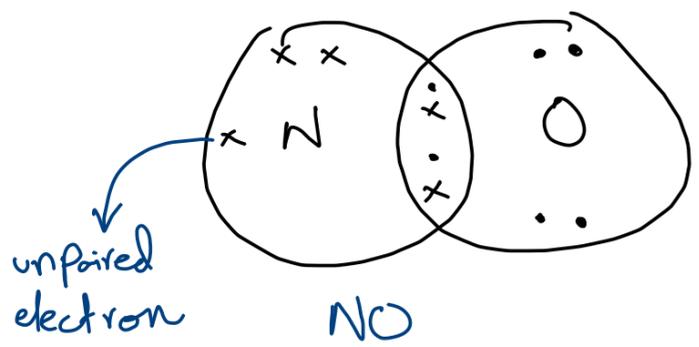
- 1) Ammonia is used to make fertilizers
- 2) Ammonia can also be used to make nitric acid → - used to make TNT  
- used to make detergents, paints, dyes  
- used to make nylon

## Environmental Consequences of nitrogen:-

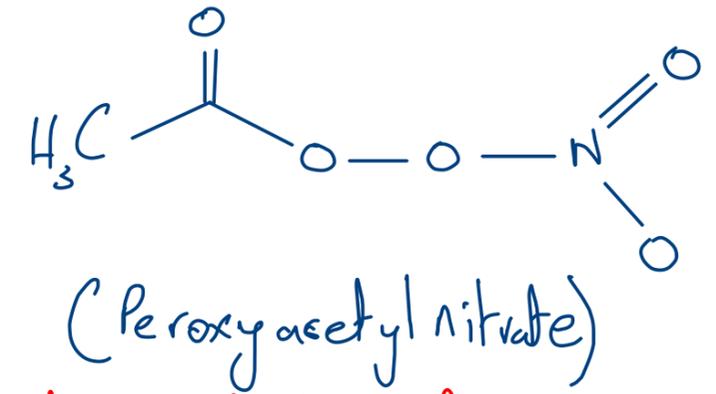
- Fertilizers contain nitrates which are soluble in water. They get washed to water bodies during rain. They promote the growth of algae

↳ block sunlight → underwater plants die → bacteria decompose plants and use up  $O_2$   
This is known as Eutrophication ←  $O_2$  levels deplete and fish die ←

## - NO and $NO_2$ :-



1) They can react with hydrocarbons to form PAN

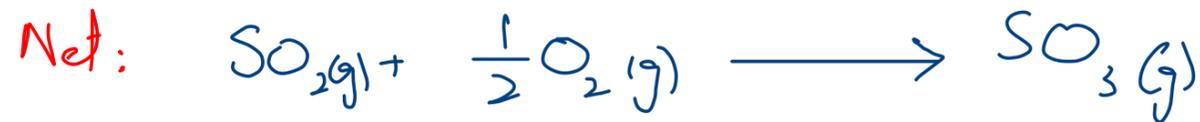
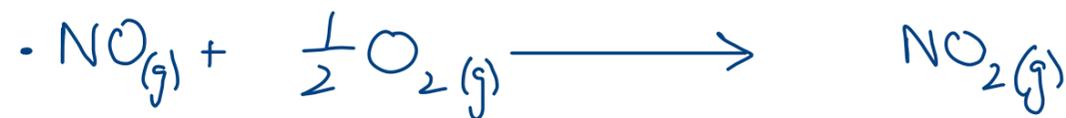


→ component of photochemical smog  
- irritates eyes, breathing problems

2) NO and NO<sub>2</sub> can deplete the ozone layer as they are free radicals (Catalyse depletion of ozone)



3) NO and NO<sub>2</sub> can also catalyse the formation of SO<sub>3</sub> from SO<sub>2</sub>



4) SO<sub>3</sub> and NO<sub>2</sub> dissolve in water to form acid rain



- Acid rain washes out nutrients in soil preventing plant growth.
- Acid rain destroys the waxy layer on plant leaves making them less resistant to pests and diseases
- increases pH of water bodies and soil which kills life



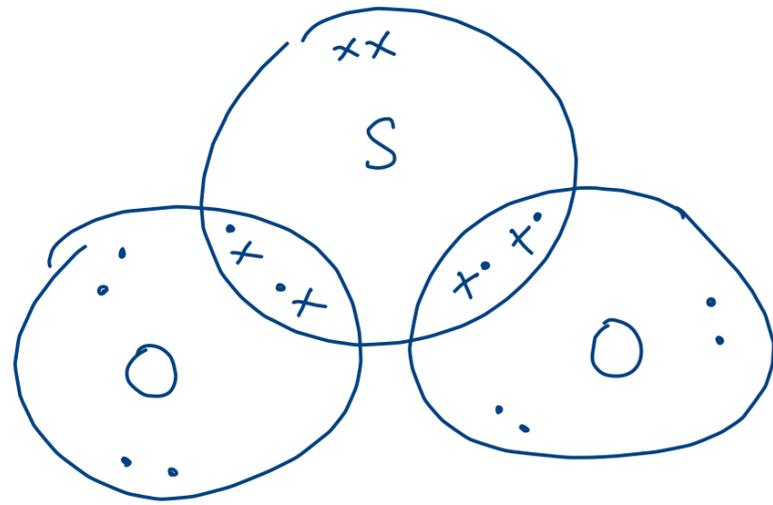
Oxides of nitrogen act as homogenous catalysts

Use catalytic converter to reduce NO and NO<sub>2</sub> emission from engines

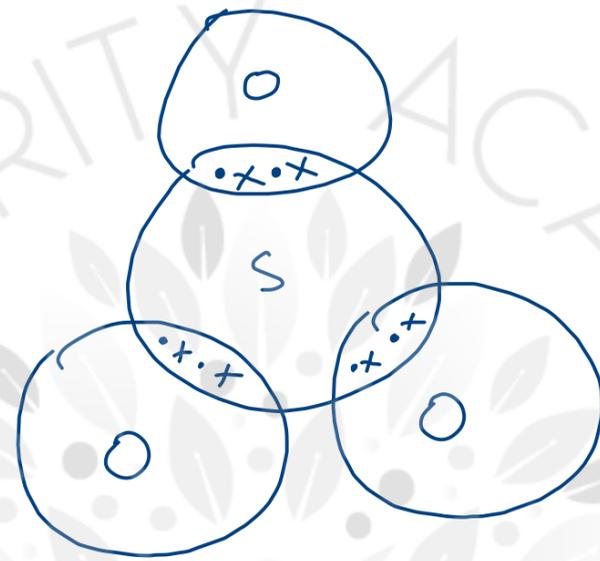


Catalytic converters contain platinum, rhodium, palladium in a honeycomb → S.A.T structure that catalyse reactions turning harmful pollutants harmless

Structures of  $\text{SO}_2$  and  $\text{SO}_3$  :-



$\text{SO}_2$   
Bond angle  $\approx 120^\circ$



$\text{SO}_3$   
Bond angle =  $120^\circ$   
trigonal planar

2 Nitrogen is frequently used as an inert atmosphere because it is an unreactive gas.

Which is the best explanation of this unreactivity?

- A Its molecule contains a triple bond.
- B The bond energy of the molecule is high ( $994 \text{ kJ mol}^{-1}$ ).
- C The bond in its molecule is very short (0.110 nm).
- D The three p orbitals of nitrogen are half-filled.

5 Which reagent, when mixed and heated with ammonium sulphate, liberates ammonia?

- A aqueous bromine
- B dilute hydrochloric acid
- C limewater
- D acidified potassium dichromate(VI)

16 Nitrogenous fertilisers are used extensively in modern farming. If rainwater washes excess fertiliser into a nearby lake, a process called eutrophication may occur.

Three of the stages of eutrophication are described below.

- P Water plants growing on the lake bed die due to lack of sunlight.
- Q An excessive growth of algae occurs.
- R Excessive bacterial activity causes a reduction in oxygen levels.

In which order do these three stages occur?

- A  $P \rightarrow Q \rightarrow R$
- B  $P \rightarrow R \rightarrow Q$
- C  $Q \rightarrow P \rightarrow R$
- D  $Q \rightarrow R \rightarrow P$

23 Sulfur trioxide is manufactured from sulfur dioxide and oxygen, using the Contact process.

Which condition affects the value of the equilibrium constant,  $K_c$ ?

- A adjusting the temperature
- B increasing the pressure
- C removing  $\text{SO}_3$  from the equilibrium mixture
- D using a catalyst

39 Which reaction **does not** contribute to the problem of acid rain?

- A the combustion of fossil fuels
- B the oxidation of sulfur dioxide to sulfur trioxide catalysed by nitrogen dioxide
- C the reaction between nitrogen monoxide and carbon monoxide in a catalytic converter
- D the reaction of sulfur trioxide with water

43 Which statement does **not** describe an effect of acid rain on the environment?

- A Acid rain causes erosion of stone buildings.
- B Acid rain causes ozone depletion.
- C Acid rain increases the corrosion of some metals.
- D Acid rain increases the leaching away of essential nutrients and minerals from soils.