

CHAPTER NO. - 4 (CLASS II-YEAR) (1)

GROUP V-A & VI-A ELEMENTS.

A - GROUP V-A ELEMENTS.

Group V-A of the periodic table comprises

Nitrogen $N = 1s^2 2s^2 2p^3$
 Phosphorus $P = 1s^2 2s^2 2p^6 3s^2 3p^3$
 Arsenic $As = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$
 Antimony $Sb = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^3$
 Bismuth $Bi = 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6 6s^2 4f^{14} 5d^{10} 6p^3$

(PROPERTIES OF V-A GROUP)

PROPERTIES	N	P	As	Sb	Bi
ATOMIC NUMBER	7	15	33	51	83
ELECTRONIC CONFIG.	$[He] 2s^2 2p^3$	$[Ne] 3s^2 3p^3$	$[Ar] 4s^2 4p^3$	$[Kr] 5s^2 5p^3$	$[Xe] 6s^2 6p^3$
PHYSICAL APPEARANCE	CONDUCTOR G.P.S.	BLACK SOLID	METALLIC SOLID	METALLIC SOLID	METALLIC SOLID
MELTING POINT °C	-210	44 red.	815	630	271
BOILING POINT	-196	281 red.	613	1635	1560
ELECTRONEGATIVITY	3.0	2.0	2.0	1.9	1.9
IONIZATION ENERGY	1402	1012	950	830	700
PRINCIPAL OXIDATION STATES	3+, 5+	3+, 5+	3+, 5+	3+, 5+	3+, 5+

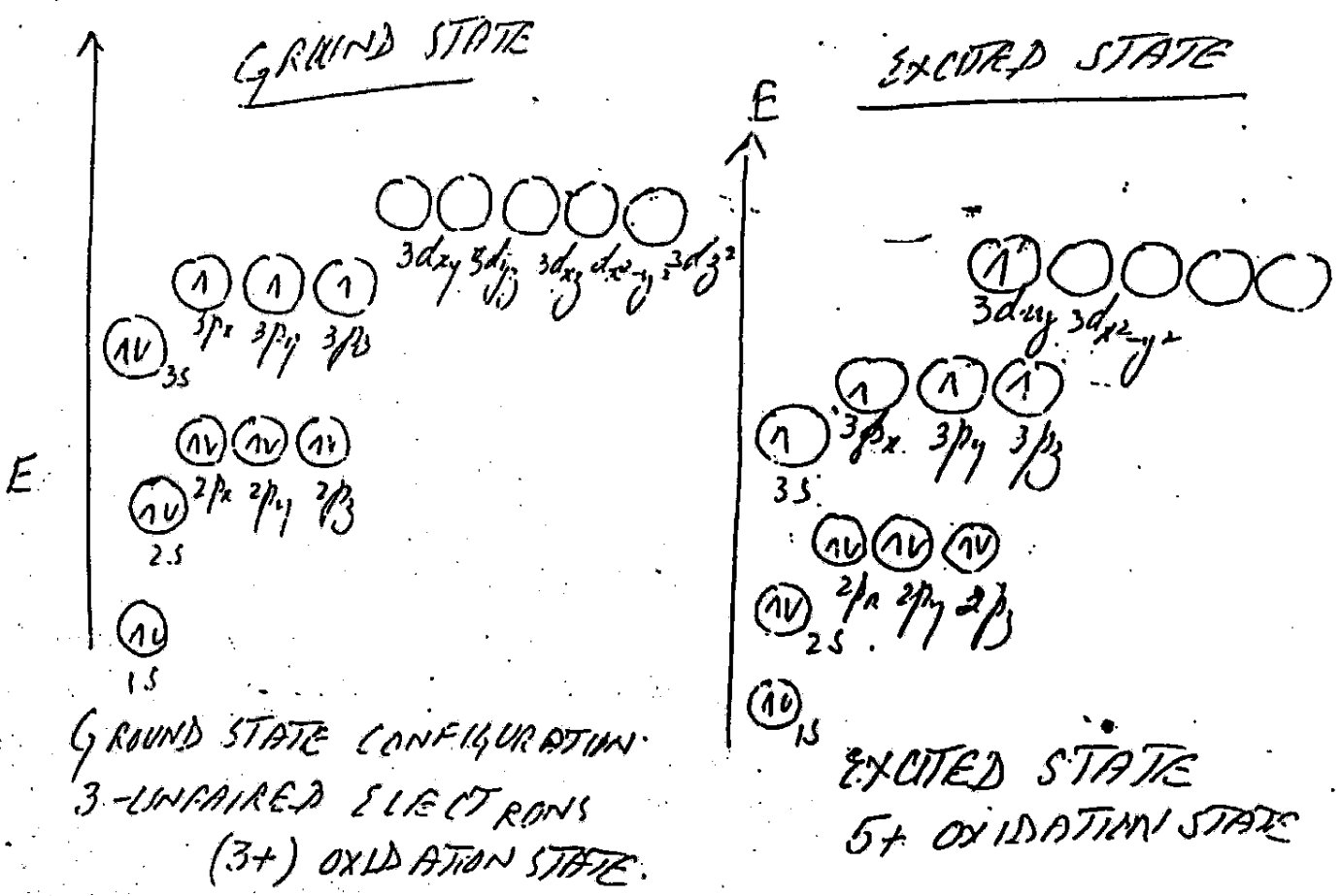
GENERAL CHARACTERISTICS.

- PERIODICITY OF METALLIC CHARACTER -
NON METALS :- Nitrogen and phosphorus are non metals. They are non conductors and give acidic oxides. Their compounds are predominantly covalent.
METALLOIDS :- Arsenic and antimony are metalloids.
METALS :- Bismuth is metallic and its oxides are basic. Thus it is concluded that metallic character increases down the group.
- COVALENCY & ELECTROVALENCY Covalency decreases down the group and electrovalency increases down the group. Electronegativity decreases down the group.
- ALLOTROPY Phosphorus, "Sb", "As" show Allotropy. Red and white phosphorus are important allotropic forms of phosphorus.

VARIABLE OXIDATION STATE / "EXPANSION OF OCTET" ²

Phosphorus and other elements of group V show 3+ and 5+ oxidation states. The energy of (n-1)d orbital is not much greater than ns and np orbitals. Thus these elements can use (n-1)d orbital in bonding.

In phosphorus an electron is promoted from 3s orbital to vacant 3d orbital. Thus there are five unpaired electrons in excited state. Thus in ground state phosphorus can form three bonds while in excited state it can form five bonds.



NITROGEN AND ITS COMPOUNDS

OCCURRENCE OF NITROGEN.

Nitrogen is the first member of group, V-A elements. It occurs both free and combined state.

IN FREE STATE nitrogen is present in air (78% by volume). It is less reactive gas compared to oxygen.

IN COMBINED STATE nitrogen is present in living things including animals and plants. In living matter it is found in the form of proteins, urea and amino acids.

Inorganic comp. of nitrogen are not commonly as minerals.

COMPOUNDS OF NITROGEN.

A. OXIDES OF NITROGEN.

Nitrogen forms several oxides with oxygen. Common oxides of nitrogen are N_2O , NO , NO_2 . It also forms N_2O_3 and N_2O_5 .

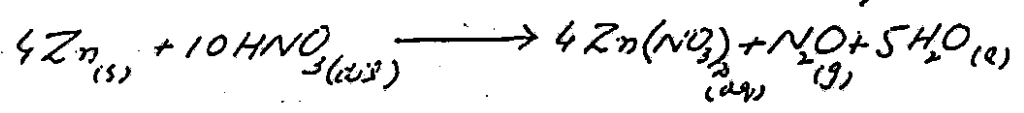
NAME	FORMULA	OXIDATION No.
DINITROGEN OXIDE. (Nitrous oxide)	N_2O	+1
NITROGEN OXIDE. (Nitric oxide)	NO	2+
DINITROGEN TRIOXIDE. (Nitric anhydride)	N_2O_3	3+
NITROGEN DIOXIDE. (Nitrogen peroxide)	NO_2	4+
DINITROGEN PENTOXIDE. (Nitric anhydride)	N_2O_5	5+

Table: OXIDES OF NITROGEN

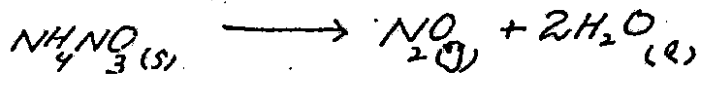
1. DINITROGEN OXIDE. (N₂O) (Nitrous oxide).

PREPARATION.

(i) By action of HNO₃ on metallic Zn
Dinitrogen oxide can be prepared by the action of dil. HNO₃ on metallic zinc.



(ii) By decomposition of NH₄NO₃.
Dinitrogen oxide is usually prepared by heating ammonium nitrate to about 200°C.



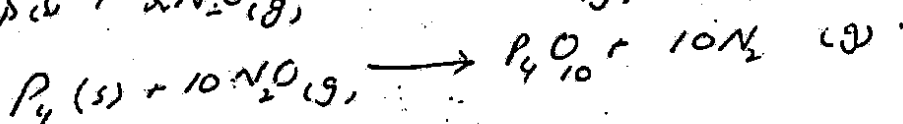
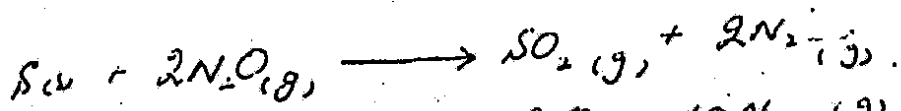
Reaction may produce explosion, to avoid this NH₄NO₃ is replaced by mixture of NaNO₃ + (NH₄)₂SO₄.

PROPERTIES OF N₂O

1. It is a colourless gas
2. Dinitrogen oxide has faint, pleasant smell and a sweetish taste.
3. It is soluble in cold water.
4. It is known as "LAUGHING GAS" as it produces hysterical laughter when its mixture with oxygen is inhaled for long time.

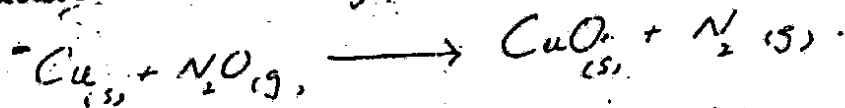
REACTIONS OF N₂O.

It is not combustible but supports combustion of burning substances such as Phosphorus Sulphur. It is used in cylinder containing S, Petr.



N₂O as OXIDIZING AGENT.

When N₂O is passed over red hot-copper, it is reduced to nitrogen.

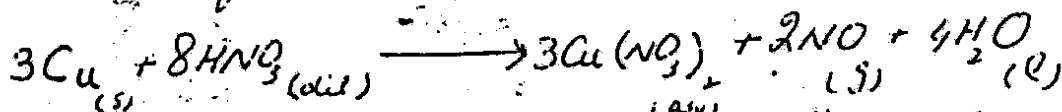


2. NITROGEN OXIDE. (NO) (Nitric oxide).

PREPARATION.

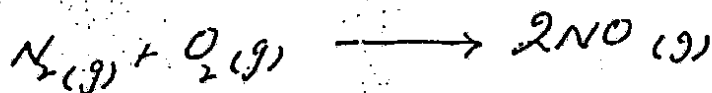
1. FROM COPPER "Cu"

Nitric oxide "NO" can be prepared by the action of dil. HNO₃ on copper.



2. BY PASSING AIR THROUGH ^{an arc} ELECTRIC ARC.

It can also be prepared by passing air through an electric arc.



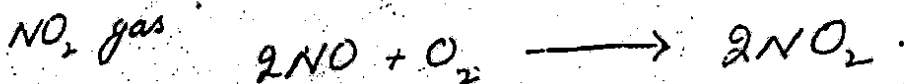
PROPERTIES OF NITROGEN OXIDE.

- i - Nitrogen oxide is a colourless gas.
- ii - It is heavier than air.
- iii - It is sparingly soluble in water.

REACTIONS OF NO.

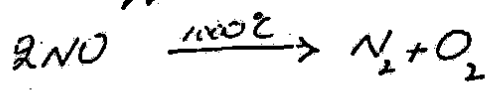
(i) REACTION WITH OXYGEN (O₂)

With oxygen it forms reddish brown



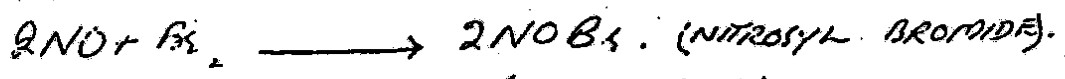
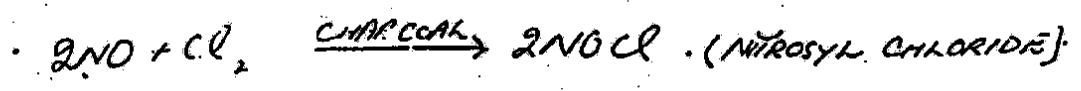
ii - DECOMPOSITION.

It decomposes into N₂ and O₂ at about 1000°C and supports combustion.



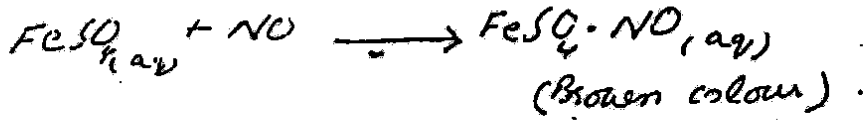
iii - REACTION WITH HALOGENS.

It reacts with Cl₂ and Br₂ to form nitrosyl chloride and nitrosyl bromide respectively in presence of charcoal.



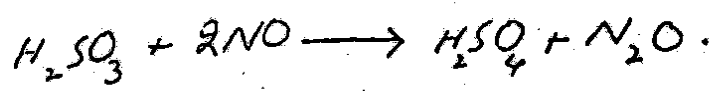
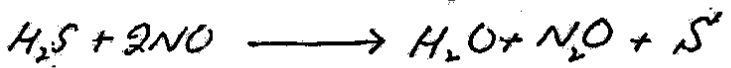
iv REACTION WITH FeSO₄ (RING TEST)

NO forms brown coloured compound with FeSO₄. This test is used to confirm the presence of nitrates.



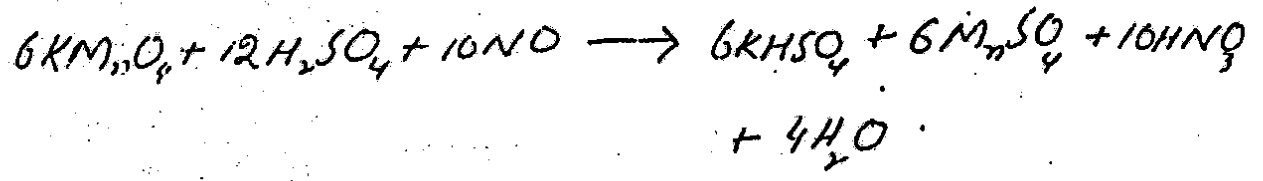
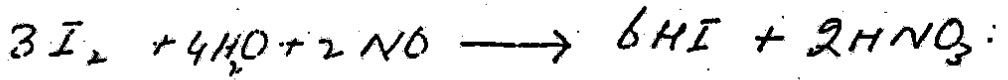
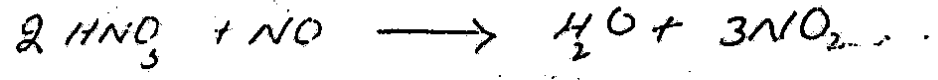
v - REACTION WITH REDUCING AGENTS.

With reducing agents, it is reduced to nitrous oxide (N₂O) or nitrogen.



vi - REACTION WITH OXIDIZING AGENTS.

It is oxidized to NO₂ or HNO₃ with oxidizing agents

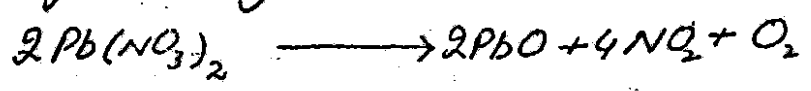


3- NITROGEN DIOXIDE (NO₂)

PREPARATION.

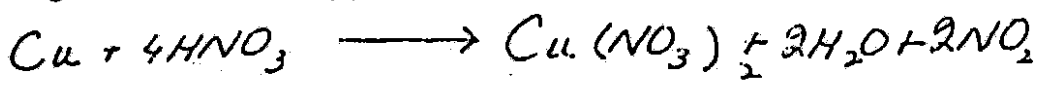
i. FROM LEAD NITRATE.

NO₂ can be prepared in small quantities by heating lead nitrate.



ii- BY THE REACTION OF CU WITH HNO₃.

It can also be prepared by reacting conc. HNO₃ with copper.



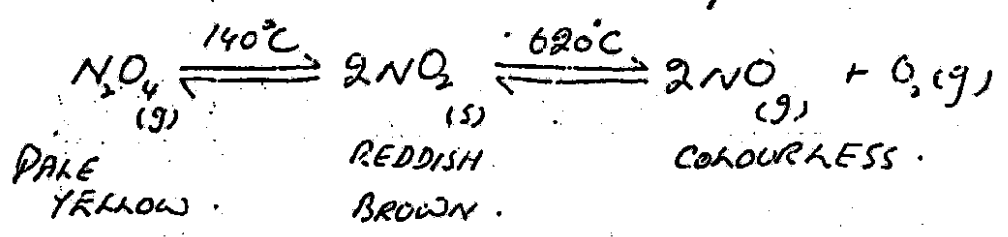
PROPERTIES OF NITROGEN DIOXIDE.

- i- NO₂ is a reddish brown gas.
- ii- It has pungent smell.
- iii- It dissolves readily in water to form a blue acidic solution.

REACTIONS OF NITROGEN DIOXIDE.

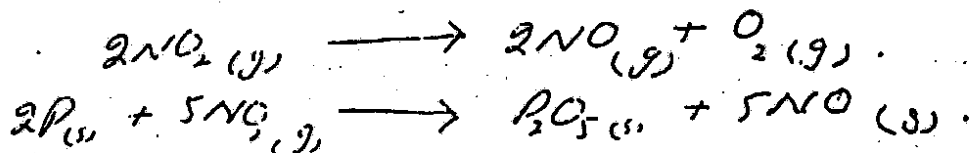
i- EFFECT OF HEAT

On cooling NO₂ is converted into a yellow liquid. It can be frozen to a colourless solid N₂O₄. N₂O₄ on heating to 140°C it gives mixture of NO₂ and NO. Above 140°C NO₂ is converted to NO and O₂. This decomposition is complete at 620°C.



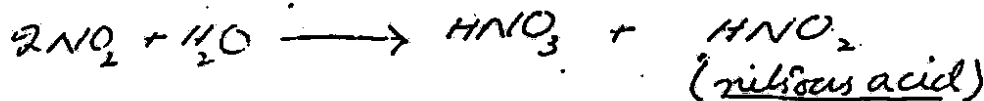
ii- BURNING OF PHOSPHORUS, C, K etc

Elements like P, C, K continue burning in NO₂. NO₂ helps burning as it yields O₂ on decomposition.

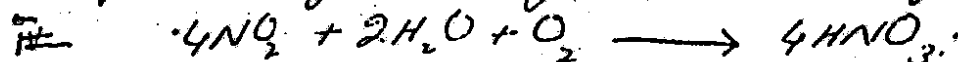


III - FORMATION OF NITRIC ACID

In absence of air it dissolves in H_2O to form nitric and nitrous acid.

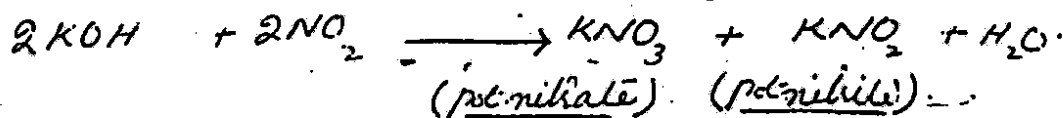
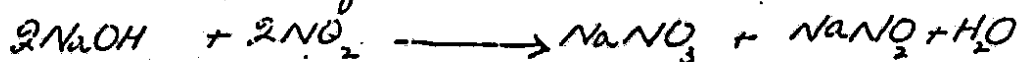


In presence of air only HNO_3 is the final product.



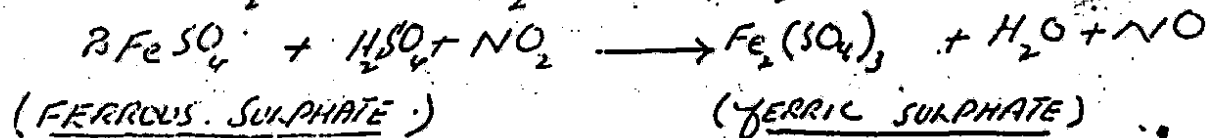
IV - REACTION WITH ALKALIES

On reaction with strong alkalies it forms mixture of nitrate and nitrite.



V - REACTION AS OXIDIZING AGENT

It is a strong acid oxidizing agent and oxidizes H_2S to sulphur, FeSO_4 to $\text{Fe}_2(\text{SO}_4)_3$ (ferric sulphate) and $\text{KI} \rightarrow \text{I}_2$.



B. OXYACIDS OF NITROGEN

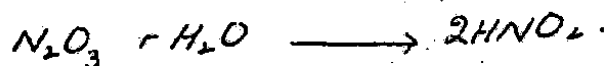
There are two important oxyacids of nitrogen



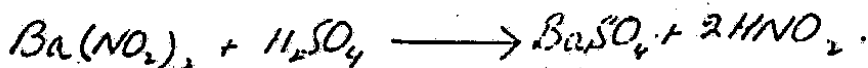
NITROUS ACID. (HNO₂)

PREPARATION OF NITROUS ACID.

It can be prepared by dissolving dinitrogen trioxide in water at 0°C



Pure nitrous acid solution can be prepared by reaction b/w ice cold barium nitrite solution and ice cold dilute sulphuric acid.



PROPERTIES OF NITROUS ACID.

- 1 - Nitrous acid is found only in the form of its salts.
- 2 - It is to some extent stable in dilute solution.

REACTIONS OF NITROUS ACID.

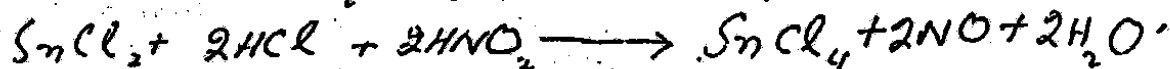
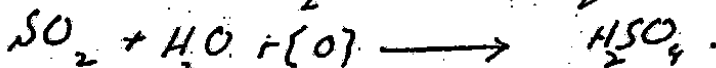
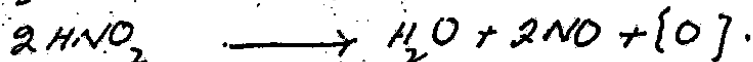
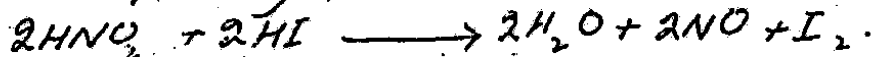
i - DECOMPOSITION OF NITROUS ACID.

Nitrous acid is quite unstable. It begins to decompose as soon as it is formed even at ordinary temperature.



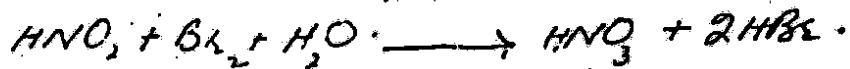
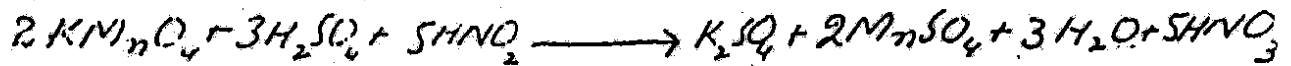
ii - NITROUS ACID AS AN OXIDIZING AGENT.

Nitrous acid acts as an oxidizing agent and oxidizes HI, SO₂ and SnCl₂ into I₂, H₂SO₄ and SnCl₄ respectively.



iii. NITROUS ACID AS A REDUCING AGENT.

Nitrous acid also behaves as a reducing agent. It decolorizes acidified $KMnO_4$ and bromine water and readily gets oxidized to nitric acid.



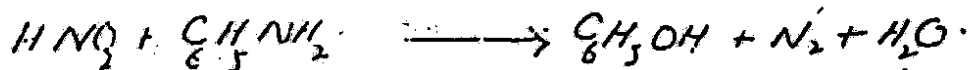
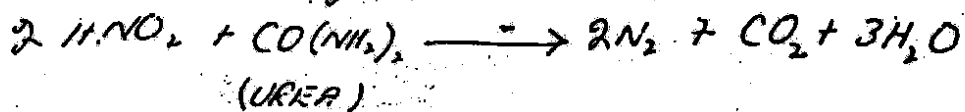
iv - REACTION WITH ALKALIES.

Nitrous acid as an acid reacts with alkalis producing salts.



v - REACTION WITH ORGANIC COMP. HAVING $-NH_2$ GROUP.

Nitrous acid reacts with organic compounds containing $-NH_2$ group and produces nitrogen.



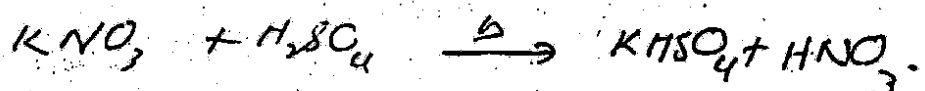
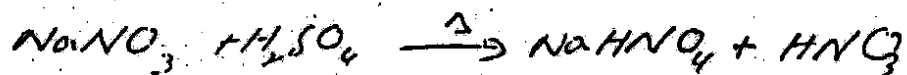
(AMINO BENZENE) (PHENOL)

NITRIC ACID (HNO_3).

PREPARATION OF NITRIC ACID.

1- Laboratory method.

Nitric acid is prepared in laboratory by action of sulphuric acid on sodium nitrate or potassium nitrate.



COMMERCIAL METHOD OF PREPARATION.

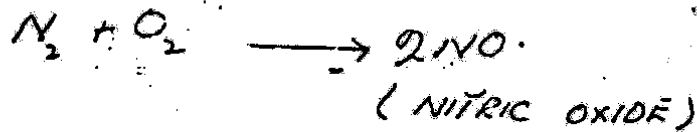
BRIXLAND EYDE'S PROCESS.

The process involves following steps.

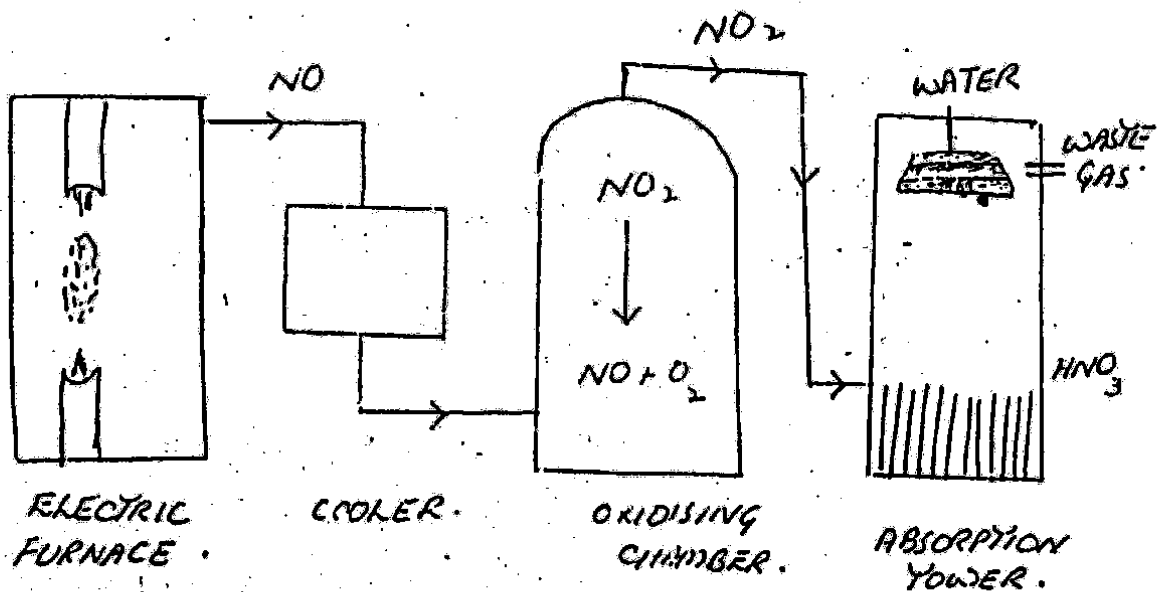
- i - FORMATION OF NITRIC OXIDE.
- ii - FORMATION OF NO TO NO₂.
- iii - FORMATION OF HNO₂.
- iv - FORMATION OF HNO₃ FROM HNO₂.

STEP-1

Atmospheric nitrogen and oxygen are combined to give nitric oxide in an electric arc (3000°C).



NO formed is cooled quickly to 1000°C at which it does not decompose.



MANUFACTURE OF NITRIC ACID.

PHOSPHORUS AND ITS COMPOUNDS.

PHOSPHORUS: (LIGHT BEARING).

OCCURRENCE:-

Phosphorus is the second member of group V.A. It does not occur in free state in nature.

In combined state it is found in phosphate rocks, i.e. in pure $\text{Ca}_3(\text{PO}_4)_2$ and apatite $\text{Ca}_5\text{F}(\text{PO}_4)_3$. It is essential for growth of plants and animals. It occurs especially in seeds, yolk of eggs, brain, nerves, bone masses, in the form of lecithins. Calcium phosphate is essential constituent of bones. Bone ash is an important source of phosphorus (80% Calcium phosphate).

ALLOTROPES OF PHOSPHORUS.

Phosphorus exists in three allotropic forms. Three important allotropes of phosphorus are as

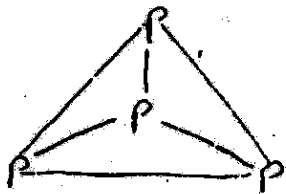
- 1 - WHITE PHOSPHORUS.
- 2 - RED PHOSPHORUS.
- 3 - BLACK PHOSPHORUS.

1 - WHITE PHOSPHORUS.

White phosphorus is very reactive. It is poisonous, volatile, waxy substance. It is yellowish white in colour. It is soluble in benzene and CS_2 .

White phosphorus exists in the form of tetra atomic molecule (P_4).

It has tetrahedral structure.



WHITE PHOSPHORUS.

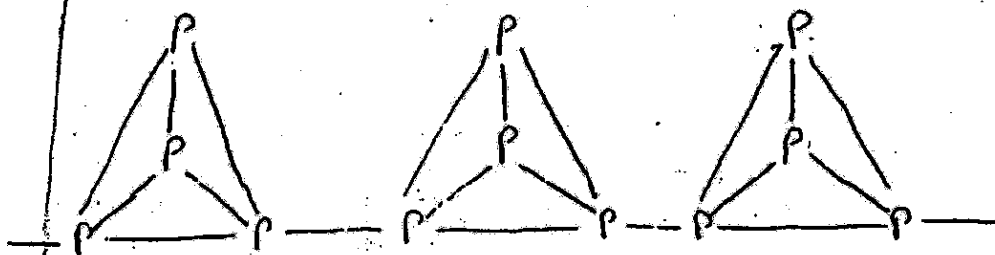
Its B.P is 280°C . At 700°C it dissociates to form P_2 molecules.

RED PHOSPHORUS.

Red phosphorus is less reactive and poisonous than white phosphorus.

It is prepared by heating white phosphorus up to 250°C in vacuum in presence of iodine or S catalyst.

Tetraatomic molecules of white phosphorus combine to form macromolecules called "RED PHOSPHORUS".



RED PHOSPHORUS.

BLACK PHOSPHORUS.

It is the third most stable form of phosphorus. It is prepared by heating red phosphorus to high temperature and pressure.

COMPOUNDS OF PHOSPHORUS.

(1) - HALIDES OF PHOSPHORUS.

(a) -

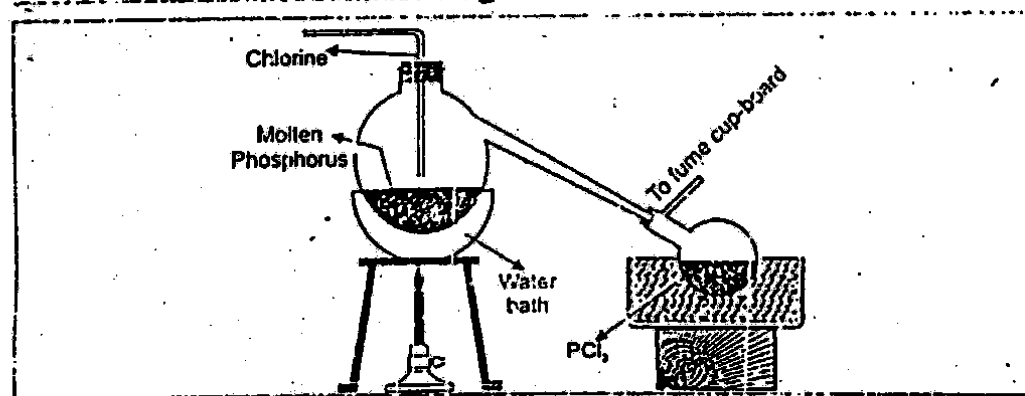
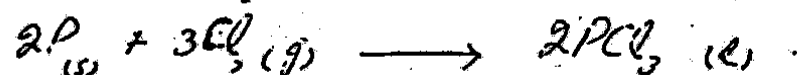
PHOSPHORUS TRICHLORIDE. PCl_3 .

PREPARATION.

Phosphorus trichloride can be prepared by following methods

(i) - FROM WHITE PHOSPHORUS.

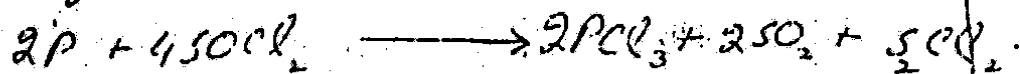
PCl_3 can be prepared by melting white phosphorus in an inert atmosphere and dried chlorine is passed over it. Vapours of PCl_3 are collected in flask placed in ice bath.



ii -

FROM THIONYL CHLORIDE AND PHOSPHORUS.

PCl_3 can also be prepared by the action of phosphorus with thionyl chloride ($SOCl_2$)



PROPERTIES :-

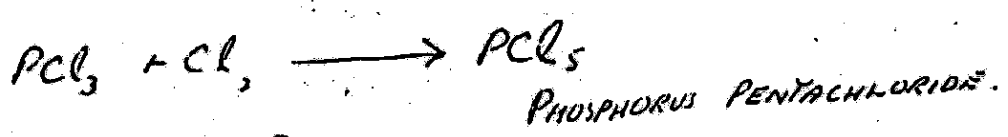
PCl_3 is colourless fuming liquid.

Its B.P is $76^\circ C$ and F.P = $-112^\circ C$

REACTIONS OF PCl₃

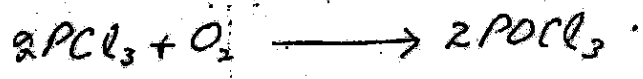
i) - REACTION WITH Cl₂

It combines with Cl₂ to form PCl₅.



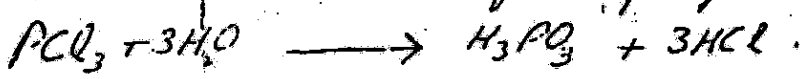
ii - REACTION WITH O₂

It combines with atmospheric oxygen slowly to form phosphorus oxychloride.



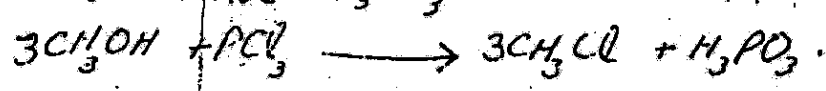
iii - REACTION WITH WATER.

It is soluble in organic solvents, but readily reacts with water to form phosphorous acid.



iv - REACTION WITH ALCOHOL.

It reacts with alcohol forming the chloro derivative and H₃PO₃.



v -



PHOSPHORUS PENTACHLORIDE (PCl₅)

PREPARATION OF PCl₅

PCl₅ can be prepared by following methods
i) - FROM PHOSPHORUS TRICHLORIDE.

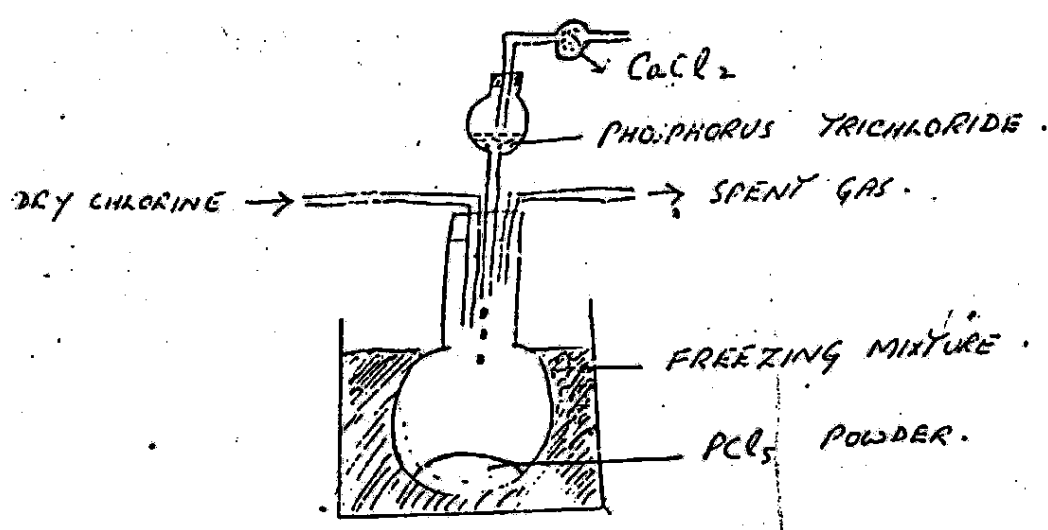
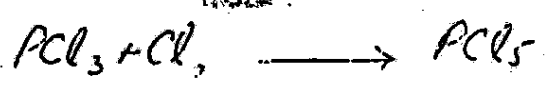
iii (BY REACTION OF Cl₂ WITH PCl₃)

(ii) - FROM WHITE PHOSPHORUS

(BY REACTION OF Cl₂ AND P.)

(i) - FROM PCl₃

PCl₅ can be prepared by passing dry chlorine through PCl₃.



FROM PHOSPHORUS.

It may also be prepared by passing dry chlorine in a well cooled solution of phosphorus in carbon disulphide.



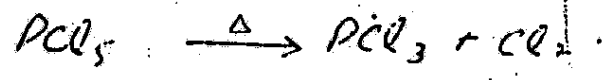
PROPERTIES OF PCl5.

- i - PCl5 is a yellowish white crystalline solid.
- ii - It sublimes at about 100°C.
- iii - It gives fumes in moist air with an irritating smell.

REACTIONS OF PCl5.

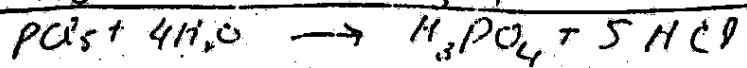
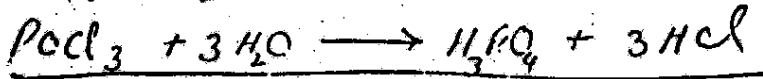
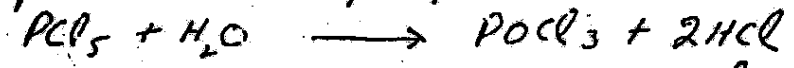
i - DECOMPOSITION.

PCl5 decomposes on heating producing PCl3 and chlorine.



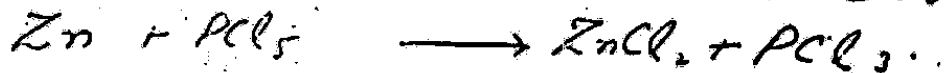
ii - REACTION WITH WATER.

It gets decomposed by water forming phosphorus oxychloride which further reacts with water to produce ortho phosphoric acid.

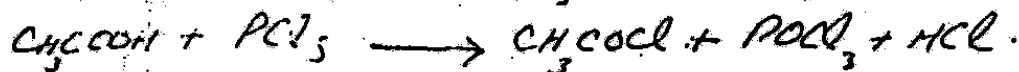
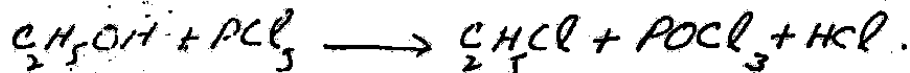


iii. REACTION WITH METALS.

It converts metals into their chlorides.



iv. REACTION WITH ALCOHOLS AND CARBOXYLIC ACIDS



OXIDES OF PHOSPHORUS.

i - PHOSPHORUS TRIOXIDE. P_2O_3 (P_4O_6).

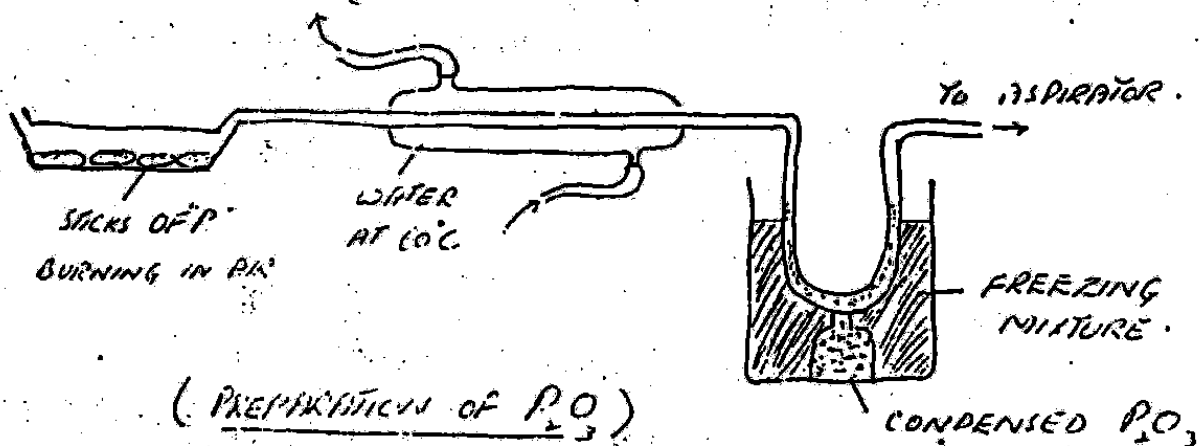
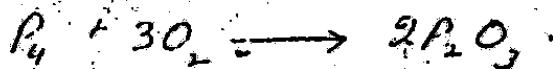
ii - PHOSPHORUS PENTOXIDE. P_2O_5 (P_4O_{10}).

i - PHOSPHORUS TRIOXIDE

(P_2O_3).

PREPARATION OF P_2O_3 .

It can be prepared by burning white phosphorus in a limited supply of air.



PROPERTIES OF P_2O_3 .

i - It is white waxy solid with garlic like odour.

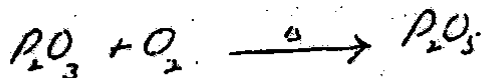
ii - Its M.P is 22.8°C and BP is 173°C

iii - It is highly poisonous in nature.

REACTIONS OF P_2O_3

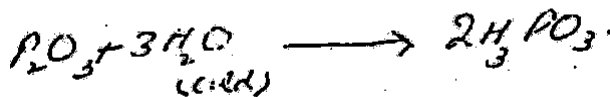
1 - REACTION WITH OXYGEN

When heated in presence of air or O_2 , P_2O_3 is converted into P_2O_5

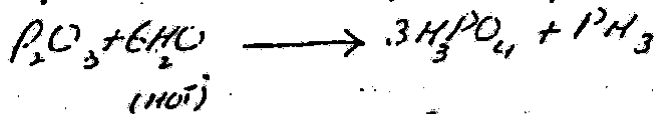


2 - REACTION WITH WATER

It reacts with cold water to give H_3PO_3 (Phosphorous acid)



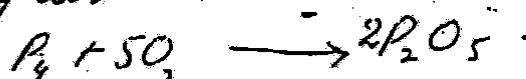
With hot water it forms phosphine and phosphoric acid



PHOSPHORUS PENTOXIDE (P_2O_5)

PREPARATION OF P_2O_5 (P_4O_{10})

It is prepared by burning phosphorus in excess of dry air.



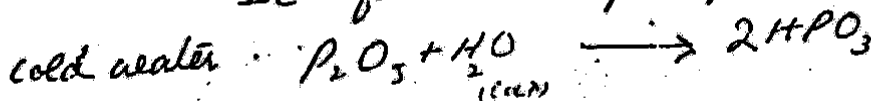
PROPERTIES OF P_2O_5

- 1 - It is white hygroscopic powder
- 2 - It has faint, garlic like odour due to traces of P_2O_3 present in it.
- 3 - It sublimes at $360^\circ C$.

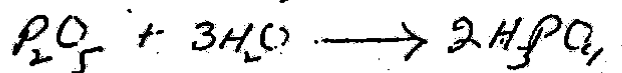
REACTIONS

1 - REACTION WITH WATER

It forms metaphosphoric acid ^{on reaction}

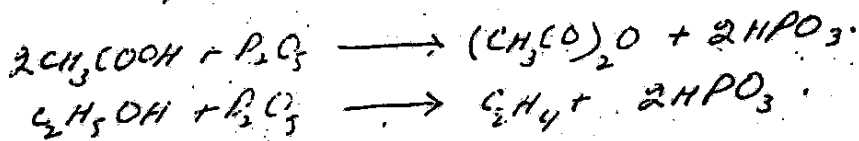
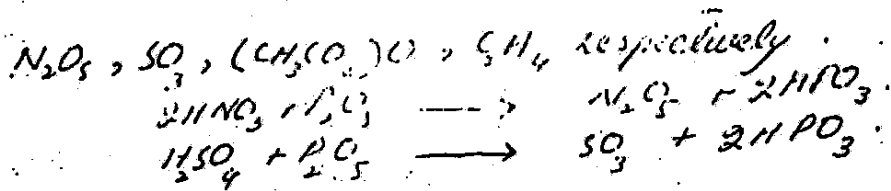


with hot water it forms ortho phosphoric acid



2 - P_2O_5 AS DEHYDRATING AGENT

It is a powerful dehydrating agent and with HNO_3 , H_2SO_4 , CH_3COOH , and C_2H_5OH , it gives



OXYACIDS OF PHOSPHORUS.

Oxyacids of phosphorus are as follows.

1 - PHOSPHOROUS ACID (H_3PO_3)

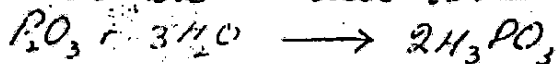
2 - ORTHOPHOSPHORIC ACID (H_3PO_4)

1 - PHOSPHOROUS ACID (H_3PO_3)

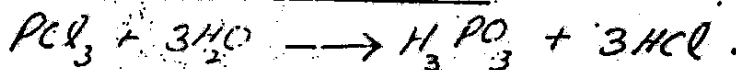
PREPARATION:-

(i) FROM P_2O_3 .

Phosphorous acid is prepared by dissolving phosphorous trioxide in cold water.



(ii) FROM HYDROLYSIS OF PCl_3 .



PROPERTIES:-

1 - It is a white crystalline solid.

2 - It melts at $-73.6^\circ C$.

REACTIONS:-

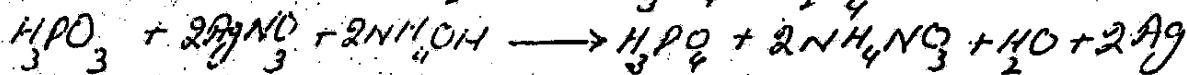
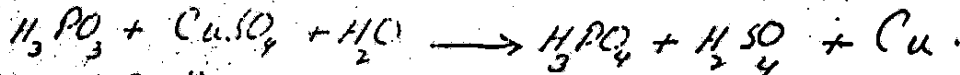
(1) - DECOMPOSITION.

It decomposes into phosphine and orthophosphoric acid on heating.

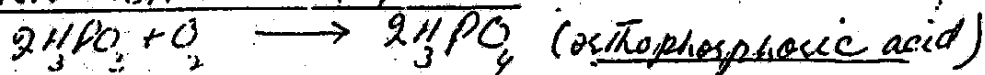


(2) - AS REDUCING AGENT.

It is a powerful reducing agent. It reduces $CuSO_4, AgNO_3$ etc. to the metallic state.



(3) - REACTION WITH OXYGEN.



(4) REACTION WITH Zn/HCl.
 Zn/HCl produce nascent hydrogen.
 It reduces H_3PO_3 to PH_3 (PHOSPHINE).
 $H_3PO_3 + 4[H] \longrightarrow PH_3 + 3H_2O$

ORTHOPHOSPHORIC ACID. (H_3PO_4).

PREPARATION:-

(1) FROM P_2O_5 .

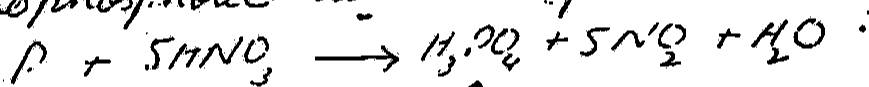
(2) FROM HYDROLYSIS OF PHOSPHORUS.

1 - FROM P_2O_5 .

It is prepared by dissolving P_2O_5 in hot water.
 $P_2O_5 + 3H_2O \longrightarrow 2H_3PO_4$

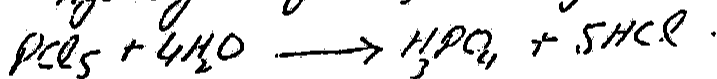
2 - FROM ^{RED} PHOSPHORUS.

On heating red phosphorus with conc. HNO_3 orthophosphoric acid is produced.



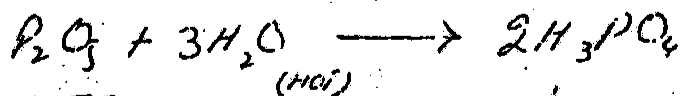
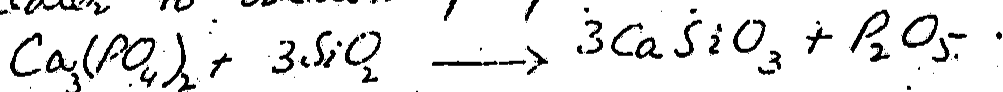
3 - BY HYDROLYSIS OF PCl_5 .

Hydrolysis of PCl_5 also gives H_3PO_4 .



4 - INDUSTRIAL PREP.

On large scale orthophosphoric acid is prepared by heating mixture of sand and phosphoric (BONE ASH) in electric furnace. In this case P_2O_5 is formed. It is treated with hot water to obtain phosphoric acid.



PROPERTIES:-

It is colourless crystalline solid.

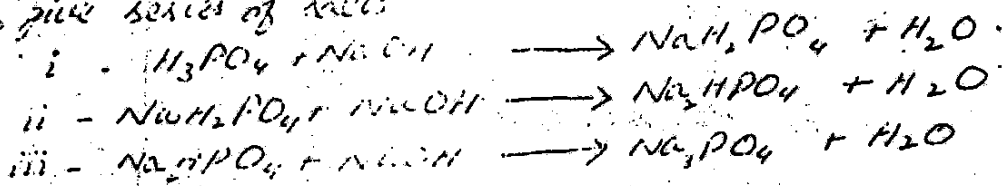
Its M.P is $41^\circ C$

It is soluble in water.

REACTIONS:-

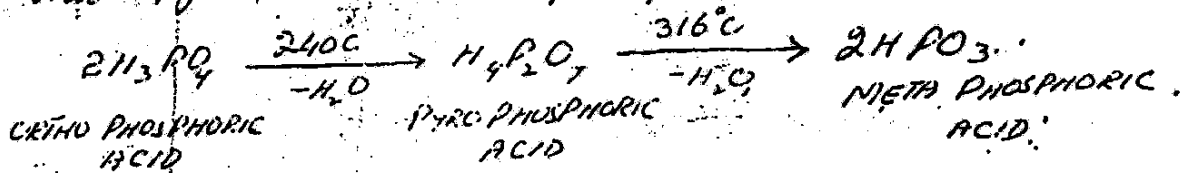
1. REACTION WITH NaOH.

It is a weak acid. It reacts with NaOH to give series of salts:



2. EFFECT OF TEMPERATURE.

On heating it loses water and converted into Pyro and meta phosphoric acid.



GROUP VI-A ELEMENTS.

INTRODUCTION.

Group VI-A includes following elements.

Oxygen	O
Sulphur	S
Selenium	Se
Tellurium	Te
Polonium	Po

PHYSICAL PROPERTIES	O	S	Se	Te	Po
ATOMIC NO.	8	16	34	52	84
OUTER ELECTRONIC CONFIGURATION	$[\text{He}]2s^2 2p^4$	$[\text{Ne}]3s^2 3p^4$	$[\text{Ar}]4s^2 4p^4$	$[\text{Kr}]5s^2 5p^4$	$[\text{Xe}]6s^2 6p^4$
DENSITY (g/cm^3)	1.27	2.06	4.8	6.24	9.5
M. POINT ($^\circ\text{C}$)	-219	222	220	452.5	254
B. POINT ($^\circ\text{C}$)	-183	444.6	685	1390	962
AT. RADII (pm)	74	104	114	137	152
ELECTRONEGATIVITY	3.44	2.58	2.55	2.16	2.0
IONIZATION ENERGY	1314	1000	941	869	818

GENERAL CHARACTERISTICS.

1. NON METALS.

All the elements of group VI-A are non metals except Po. Po is a radioactive metal.

2. PHYSICAL PROPERTIES.

Atomic Radii, density, m.p., B.P. generally increase with atomic number down the group.

3. IONIZATION ENERGIES.

Group VI-A elements have high ionization energies. Generally these elements do not lose electrons.

4. ALLOTROPY.

All the elements of VI-A group show allotropy e.g.

OXYGEN.	O_2 and O_3	TWO FORMS.
SULPHUR.	α, β, γ	THREE
SELENIUM.	RED, GREY.	TWO
TELLURIUM.	METALLIC, NONMETALLIC	TWO.

5. CATENATION.

VI-A group elements show catenation. This property decreases down the group.

6. POLYMERIC NATURE.

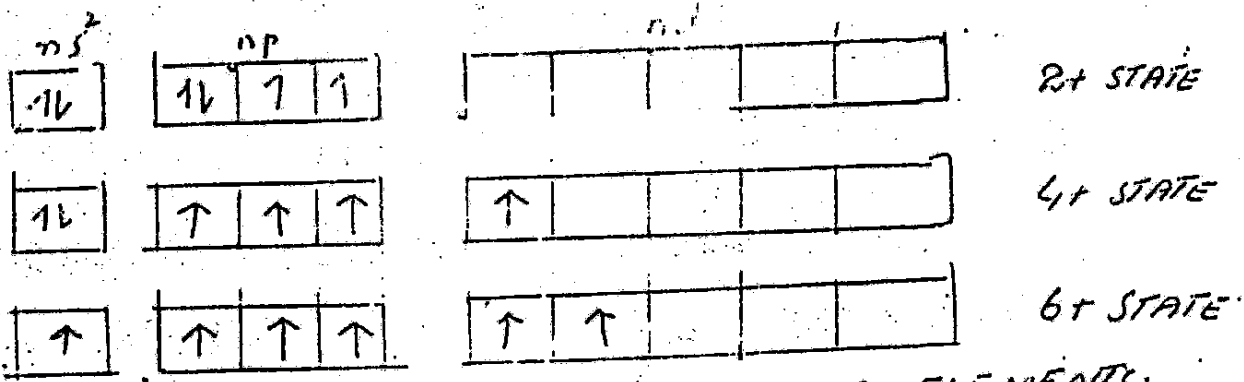
All elements form polyatomic molecules. So these are polymeric in nature.

7. NOBLE GAS CONFIGURATION.

They attain the electronic config. of the nearest noble gas by gaining 2 electrons and form O^{2-} , S^{2-} , Se^{2-} etc.

8. VARIABLE OXIDATION STATES.

Except oxygen other members show variable oxidation states and show covalency of 2+
4+, 6+ e.g. SO_2 , SO_3 , SO_6 . 2+ oxidation state is shown due to 2 unpaired e^- in p-orb. +4 and +6 oxidation states are as follows



OXIDATION STATES OF VI-A ELEMENTS.

OCCURRENCE.

OXYGEN.

Oxygen is the most common of all the elements (50% of earth crust). one-fourth of atmospheric air consists of free oxygen. Water contains 98% of combined oxygen. $CaCO_3$ (CHALK, LIMESTONE) contain 48% oxygen. Silica (FLINT, QUARTZ) contain 53% oxygen by weight.

SULPHUR.

Sulphur occurs both as free and in combined form. imp. metallic ores are sulphides e.g.

- GALENA PbS
- ZINC BLEND ZnS
- CINNABAR HgS
- STIBNITE Sb_2S_3
- COPPER PYRITE Cu_2S, Fe_2S_3
- IRON PYRITE FeS_2

imp. sulphates are Gypsum ($CaSO_4$) and heavy spar ($BaSO_4$) etc.

It also occurs in organic comp. like onions, garlic, mustard, hair, oils, eggs, Protein etc. It also occurs as a constituent of coal and petroleum.

Q.
 WRITE DOWN A COMPARISON OF THE
 PROPERTIES OF OXYGEN AND SULPHUR.

1.1.3 Comparison of Oxygen and Sulphur

Similarities:

1. Both oxygen and sulphur have same outer electronic configuration of $ns^2 np^4$.
2. Both oxygen and sulphur are usually divalent.
3. Both oxygen and sulphur exhibit allotropic forms.
4. Both have polyatomic molecules. oxygen has diatomic O_2 while sulphur has S_8 and S_2 molecules.
5. Both combine with metals in the form of O^{2-} and S^{2-} with oxidation state -2.
6. Both combine with non-metals and form covalent compounds, e.g. H_2O and H_2S , CO , and CS_2 , etc.
7. Both are typical non-metals.
8. Both are found in free and combined states on earth.

Dissimilarities

1. There are two allotropic forms of oxygen - O_2 and O_3 .
2. It is gas at ordinary temperature.
3. Oxygen is sparingly soluble in water.
4. Oxygen helps in combustion.
5. It is paramagnetic in nature.
6. It does not react with water.

7. It does not react with acids.

8. It does not react with alkalis.

9. It shows -2 oxidation states.

There are 3 allotropic forms of sulphur, rhombic monoclinic and plastic.

It is solid at ordinary temperature.

Sulphur is not soluble in water.

Sulphur is itself combustible.

It is diamagnetic in nature.

When steam is passed through boiling sulphur a little hydrogen sulphide and sulphur dioxide are formed.

It is readily oxidized by conc. sulphuric

acid or nitric acid.

It reacts with alkali solution and forms sulphides and thiosulphate.

It shows oxidation states of -2, +2, +4 and +6