2nd Year CHEMISTRY CHAPTER 04 (Group VA and VIA Elements)

Short And Simple Questions And Answer:

Q1:Stify that conc. H2SO4 is a dehydrating agent.

Ans: H_2SO_4 has a great affinity for water because of high polarity, so it acts as dehydrating agent andeliminates water from different compounds.

(i) With **oxalic acid** it forms CO_2 and Co.

$$\begin{matrix} COOH \\ | \\ COOH \end{matrix} \xrightarrow{conc.H_2SO_4} CO_2(g) + CO(g) + H_2O(l)$$

(ii) With **formic acid**, Co is formed.

$$HCOOH(aq) \xrightarrow{conc.H_2SO_4} CO(g) + H2O(l)$$

(iii) With **ethyl alcohol** it forms ethylene.

$$C_2H_5OH \xrightarrow[100^oC]{conc.H_2SO_4} C_2H_4 + H_2O$$

(iv) With **wood, paper, sugar** and **starch** it forms carbon and water.

$$C_6H_{12}O_6 \xrightarrow{conc.H_2SO_4} 6C + 6H_2O$$

$$C_{12}H_{22}O_{11} \xrightarrow{conc.H_2SO_4} 12C + 11H_2O$$

$$(C_6H_{10}O_5)n \xrightarrow{conc.H_2SO_4} 6nC + 5nH_2O$$

2. Name three allotropic forms of phosphorus.

Ans: The three allotropes of phosphorus

areWhite phosphorus

Red *phosphorus*

Black phosphorus

3. How does aqua regia dissolve gold?

Ans: When one volume of concentrated HNO3 is mixed with 3 volumes of concentrated HCl, aqua regia is formed. It is employed to dissolve gold and platinum (Nobel metals).It contains nitrosyl chloride andchlorine gas.

$$HNO3(conc.) + 3HCl(conc.) \longrightarrow NOCl(aq) + Cl2(g) + 2H2O(l)$$

NOCl formed is decomposed giving NO and nascent Cl

$$NOCl \longrightarrow NO(g) + [Cl](g)$$

This liberated chlorine converts metals such as gold and platinum into their water soluble chlorides.

$$Au(s) + 3[Cl](aq) \longrightarrow 2AuCl3(aq)$$

4. How NO2 is prepared from: a. Lead nitrate b. Cu+HNO3

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

$$2Pb(NO3)2(s) \longrightarrow 2PbO(s) + 4NO2(g) + O2(g)$$

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

$$Cu(s) + 4HNO3\ (conc.) \longrightarrow Cu(NO3)2(aq) + 2H2O(l) + 2NO2(g)$$

5. How does HNO2 act as reducing agent?

Nitrous acid decolourizes acidified KMnO4 and bromine water. It readily gets oxidized to nitric acid, so it also behaves as a reducing agent.

$$2KMnO4(aq) + 3H2SO4(aq) + 5HNO2(aq) \longrightarrow K2SO4(aq) + 2MnSO4(aq) + 3H2O(l) + 5HNO2(aq)$$

$$HNO2(aq) + Br2(aq) + H2O(l) \longrightarrow HNO3(aq) + 2HBr(aq)$$

6. How does P2O5 react with water in cold and hot state?

With cold water phosphorus pentoxide forms metaphosporic acid.

$$P2O5(s) + H2O(l) \longrightarrow 2HPO3(aq)$$

With hot water, it forms orthophosphoric acid

$$P2O5(s) + 3H2O(l) \longrightarrow 2H3PO4(aq)$$

7. Why SO3 is dissolved in sulphuric acid and not in water?

When SO3 is dissolved in 98% H2SO4, we obtain Pyrosulphuric acid or (Oleum).

$$H2SO4\ (aq) + SO3\ (g) \longrightarrow H2S2O7\ (l)$$

Oleum can be converted to sulphuric acid of any required concentration by adding water.

$$H2S2O7\ (l) + H2O\ (I) \longrightarrow 2H2SO4\ (aq)$$

If SO3 is dissolved in water directly, a highly exothermic reaction occurs in which heat energy is released and it vaporizes suphuric acid to make mist or fog. This fog does not condense easily.

8. Give two reactions which show oxidizing behaviour of NO.

$$H2S(g) + 2NO(g) \longrightarrow H2O(g) + N2O(g) + S(s)$$

$$H2SO3(aq) + 2NO(g) \longrightarrow H2SO4(aq) + N2O(g)$$

9. Give two methods for the preparation of PCl3.

a. It is usually prepared by melting white phosphorus in a retort in an inert atmosphere of CO2 and current of dried chlorine is passed over it. The vapours of PCl3 are collected in a flask kept in ice-bath.

$$2P(s) + 3Cl_2(g) \longrightarrow 2PCl_3(l)$$

b. It may also be prepared by the action of phosphorus with thionyl chloride.

$$2P(g) + 4SOCl_2(l) \longrightarrow 2PCl_3(l) + 2SO_2(g) + S_2Cl_2(s)$$

10.Write two points of dissimilarities of oxygen and sulphur.

Oxygen	Sulphur
Oxygen helps in combustion.	Sulphur is itself combustible.
It is paramagnetic in nature.	It is diamagnetic in nature.

11.Why the elements of VIA other than oxygen show more than two oxidation states?

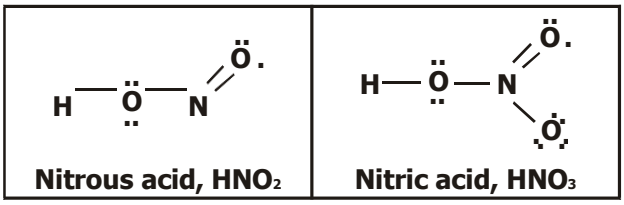
Show more than two oxidation states like -2, +2, +4 and +6 because they have also d-subshells in their valence shells.

12.Give the names of four elements which do not react with nitric acid.

Gold, platinum, iridium and titanium do not react as they are noble metals and are not oxidized by nitric acid.

13.Explain the structure of HNO_2 and HNO_3.

The two important oxyacids of nitrogen, nitrous acid and nitric acid.



Nitrous acid, HNO_2 | **Nitric acid, HNO_3**

14.P_2O_5 is powerful dehydrating agent. Give two examples.

$$H_2SO_4(aq) + P_2O_5(s) \longrightarrow SO_3(g) + 2HPO_3(aq)$$

$$2CH_3COOH(aq) + P_2O_5(s) \longrightarrow (CH_3CO)_2O(l) + 2HPO_3(aq)$$

Acetic anhydride

15.Write any four uses of Nitric acid.

It is used:

1. as a laboratory reagent.
2. in the manufacture of nitrogen fertilizers.
3. in the manufacture of explosives.
4. for making varnishes and organic dyes.

16. What happens when NO2 is dissolved in water?

In the absence of air, it dissolves in water to form nitric and nitrous acids.

$$2NO_2(g) + H_2O(l) \longrightarrow HNO_3(aq) + HNO_2(aq)$$

However in the presence of air or oxygen, nitric acid is the final product.

$$4NO_2(g) + 2H_2O(l) + O_2(g) \longrightarrow 4HNO_3(aq)$$

17. Write two reactions of preparation of nitrous acid.

It can be prepared by dissolving dinitrogen trioxide in water at 0oC.

$$N_2O_3(g) + H_2O(l) \longrightarrow 2HNO_2(aq)$$

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

$$Ba(NO_2)2(aq) + H_2SO_4(aq) \longrightarrow BaSO_4(aq) + 2HNO_2(aq)$$

18. What is the action of heat on orthophosphoric acid? Write chemical equation also.

On heating, it loses water and converted into pyro and metaphosphoric acid.

$$2H_3PO_4 \xrightarrow{-H_2O} H_4P_2O_7 \xrightarrow{-H_2O} 2HPO_3$$

Orthophosphoric acid — Pyrophosphoric acid — Metaphosphoric acid

19. Write any four properties of sulphuric acid.

Properties of sulphuric acid are

(i) Pure sulphuric acid is a colourless oily liquid without an odour.
(ii) It dissolves in water liberating a lot of heat which raises the temperature of the mixture up to 120oC. H_2SO_4 should always be poured in water in a thin stream to avoid any accident.
(iii) Pure acid is a nonconductor of electricity but the addition of a little water makes it a good conductor.
(iv) It is extremely corrosive to skin and causes very serious burns to all the tissues.

20. NO2 is a strong oxidizing agent. Prove with the help of two examples.

It is a strong oxidizing agent and oxidizes H_2S to sulphur, ferrous sulphate to ferric sulphate etc.

$$H_2S(g) + NO_2(g) \longrightarrow H_2O(l) + S(s) + NO(g)$$

$$2FeSO_4(aq) + H_2SO_4(aq) + NO_2(g) \longrightarrow Fe_2(SO_4)3(aq) + H_2O(l) + NO(g)$$

21. Give two reactions of sulphuric acid which show its oxidizing behaviour.

H_2SO_4 acts as strong oxidizing agent.

(i) It oxidizes C and S giving CO_2 and SO_2, respectively.

$$C(s) + 2H_2SO_4(aq) \longrightarrow CO_2(g) + 2SO_2(g) + 2H_2O(g)$$

$$S(s) + 2H_2SO_4(aq) \longrightarrow 3SO_2(g) + 2H_2O(l)$$

(ii) H_2S is oxidized to S.

$$H_2(s) + H_2SO_4(aq) \longrightarrow S(s) + SO_2(g) + 2H_2O(g)$$

22. Give four dissimilarities of oxygen and sulphur.

DISSIMILARITIES

		Oxygen	Sulphur
1.	Allotropic forms	There are two allotropic form of oxygen $O_2$and O_3	There are 3 allotropic forms of sulphur i.e. rhombic, monoclinic and plastic sulphur.
2.	Physical states	It is gas at ordinary temperature.	It is solid at ordinary temperature.
3.	Water solubility	Oxygen is sparingly soluble in water.	Sulphur is not soluble in water.
4.	Reaction with water	It does not react with water.	When stem is passed through boiling sulphur a little hydrogen sulphide and sulphur dioxide are formed.

23. What is aqua regia?

Aqua regia is a mixture of 3 parts of conc. HCl and one part of conc. HNO_3. Metals like gold and platinum can dissolve in aqua regia by the formation of their chlorides

$$3HCl + HNO_3 \longrightarrow NOCl + Cl_2 + 2H_2O$$

$$2NOCl \longrightarrow 2NO + Cl_2$$

This liberated chlorine converts noble metals to their chlorides.

$$2Au + 3Cl_2 \longrightarrow 2AuCl_3$$

Over all reaction is as follows:

$$2Al + 3HCl + HNO_3 \longrightarrow AuCl_3 + NO + 2H_2O$$

24. Justify that sulphuric acid is king of chemicals.

It is called king of acid because of its direct and indirect applications in manufacture of many chemicals including fertilisers. Sulphuric acid is used to clean up rust from steel rolls and soap. It also dissolves its own compounds. It replaces salts from weaker acids. It is ideal to call sulphuric acid as king of chemicals .It is corrosive acts as good dehydrant.

25. Justify that NO acts as an oxidizing agent?

$H_2S(g) + 2NO(g) \longrightarrow H_2O(g) + N_2O(g) + S(s)$

$H_2SO_3(aq) + 2NO(g) \longrightarrow H_2SO_4(aq) + N_2O(g)$

26. How does HNO_2 act as reducing agent?

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

$2KMnO_4(aq) + 3H_2SO_4(aq) + 5HNO_2(aq) \longrightarrow K_2SO_4(aq) + 2MnSO_4(aq) + 3H_2O(l) + 5HNO_2(aq)$

$HNO_2(aq) + Br_2(aq) + H_2O(l) \longrightarrow HNO_3(aq) + 2HBr(aq)$

27. Write down two chemical reactions which show that sulphuric acid is a dehydrating agent?

$C_2H_5OH \xrightarrow[100^oC]{conc.H_2SO_4} C_2H_4 + H_2O$

$C_6H_{12}O_6 \xrightarrow{conc.H_2SO_4} 6C + 6H_2O$

28. Complete and balance the following chemical equation. KMnO4+ FeSO4+ H2SO4

$2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$