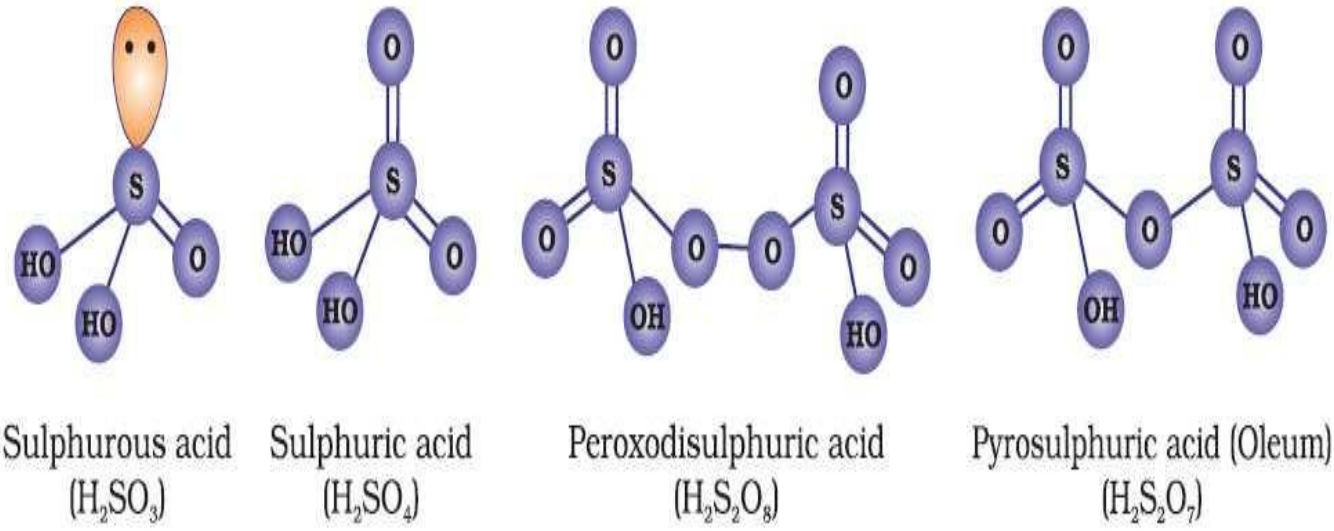
The p-Block Elements

Oxoacids of sulphur

Sulphur forms a large no. of oxoacids like Sulphurous acid (H_2SO_3), Dithionous acid ($H_2S_2O_4$), Sulphuric acid (H_2SO_4), Pyrosulphuric acid (Oleum, $H_2S_2O_7$), Peroxomonosulphuric acid (Caro's acid, H_2SO_5), Peroxodisulphuric acid (Marshell's acid, $H_2S_2O_8$) etc. structure of some oxoacids are:



Sulphuric Acid (H_2SO_4)

The most important oxoacid of sulphur is sulphuric acid which is also known as the '*King of Chemicals*'.

Manufacture:

Sulphuric acid is manufactured by the **Contact Process** which involves three steps:

(i) burning of sulphur or sulphide ores in air to generate SO_2.

$S(s) + O_2(g) \rightarrow SO_2(g)$ **Or,**

$4\ FeS_2(s) + 11\ O_2(g) \longrightarrow 2\ Fe_2O_3(s) + 8\ SO_2(g)$

(ii) conversion of SO_2 to SO_3 by the reaction with oxygen in the presence of a catalyst (V_2O_5)

$$2SO_2 + O_2 \rightarrow 2SO_3$$

(iii) absorption of SO_3 in H_2SO_4 to give *Oleum* ($H_2S_2O_7$).

$$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$$

(iv) Dilution of oleum with water gives H_2SO_4 of the desired concentration.

$$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$$

Properties

Sulphuric acid is a colourless, dense, oily liquid. It dissolves in water with the evolution of a large quantity of heat. Hence, for diluting the acid, the concentrated acid must be added slowly into water with constant stirring.

Chemical properties: The chemical reactions of sulphuric acid are due to the following reasons:

(a) its low volatility

(b) strong acidic character

(c) strong affinity for water and

(d) its ability to act as an oxidising agent.

In aqueous solution, sulphuric acid ionises in two steps.

$$H_2SO_4(aq) + H_2O(l) \rightarrow H_3O^+(aq) + HSO_4^-$$

$$HSO_4^-(aq) + H_2O(l) \rightarrow H_3O^+(aq) + SO_4^{2-}$$

So it is dibasic and forms two series of salts: normal sulphates and acid sulphates.

Because of its low volatility sulphuric acid can be used for the manufacture of more volatile acids from their corresponding salts.

$2\ MX + H_2SO_4 \rightarrow 2\ HX + M_2SO_4$ (where X = F, Cl, NO_3 etc. and M is a metal)

Concentrated sulphuric acid is a strong dehydrating agent and drying agent. Many wet gases can be dried by passing them through sulphuric acid. Sulphuric acid removes water from organic compounds

e.g.: $C_{12}H_{22}O_{11} + H_2SO_4 \rightarrow 12C + 11H_2O$

Hot concentrated sulphuric acid is a moderately strong oxidising agent. It oxidises both metals and non- metals and the acid itself reduces to SO_2.

$$Cu + 2\ H_2SO_4(conc.) \rightarrow CuSO_4 + SO_2 + 2H_2O$$

$$S + 2H_2SO_4(conc.) \rightarrow 3SO_2 + 2H_2O$$

$$C + 2H_2SO_4(conc.) \rightarrow CO_2 + 2\ SO_2 + 2\ H_2O$$

Uses: The important uses of Sulphuric acid are:

1) In the manufacture of fertilizers 2) in petroleum refining 3) in the manufacture of pigments, paints and dyestuff intermediates 4) in detergent industry 5) in metallurgical applications 6) as electrolyte in storage batteries 7) in the manufacture of nitrocellulose products and 8) as a laboratory reagent.

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