(A)

F.Y. Deg. I Chem. Hons "Paper-I

Hydrogen Peroxide (H_2O_2)

Hydrogen Peroxide may be Prepared by any one of the following method:-

(1) From Metallic sodium :-

When metallic sodium is heated in an excess of oxygen or air, sodium Peroxide is obtained.

When this sodium Peroxide is treated with cold 20% sulphuric acid, formation of H_2O_2 takes place

$$Na_2O_2 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O_2$$

The Sodium Sulphate is removed by crystallisation.

(2) By Electrolytic Process :-

Hydrogen Peroxide is now Prepared by the electrolysis of 50% sulphuric acid using a Platinum anode and under a high current density.

Perdisulphuric acid is formed as an intermediate Product which undergoes hydrolysis with dil sulphuric acid to give H_2O_2

$$H_2SO_4 \rightleftharpoons H^+ + HSO_4^-$$

At anode $2(HSO_4^-) = 2HSO_4 + 2e$

$$2HSO_4 \longrightarrow H_2S_2O_8 \text{ (Perdisulphuric acid)}$$

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(B)

At Cathode :- $2H^+ + 2e \longrightarrow H_2$

Hydrolysis of $H_2S_2O_8 + H_2O \rightarrow H_2SO_5 + H_2SO_4$

$H_2SO_5 + H_2O = H_2O_2 + H_2SO_4$

Properties :-

Pure H_2O_2 is a Pale blue liquid. The Liquid has no smell. It boils between $66^\circ C - 70^\circ C$ under Pressure of 26 mm. Prismatic crystal is obtained at $-2^\circ C$. It decomposes at $140^\circ C$. Its boiling Point is $151^\circ C$ under reduced Pressure by extrapolation.

Hydrogen peroxide possesses one loosely bonded oxygen atom which is very reactive in oxidation reactions.

Catalytic decomposition :-

Pure H_2O_2 is decomposed very rapidly if any dust be Present. Finely divided gold, silver and colloidal Platinum accelerates decomposition of H_2O_2 Catalytically. Complex organic substances also function as Catalyst

The Presence of small quantities of substances such as Alcohol, Glycerol make the solution more stable.

These substances are called anti-catalyst or negative catalyst.

Oxidising Properties :—

H_2O_2 resembles ozone in strong oxidising property.

(1) It oxidises KI into Iodine. This reaction is accelerated by mineral acids and also in the presence of $FeSO_4$.

$$H_2O_2 + 2KI = 2KOH + I_2$$

(2) Ferrous sulphate is oxidised to Ferric sulphate in presence of dilute H_2SO_4

(3) It oxidises sodium sulphite to sodium sulphate.

$$Na_2SO_3 + H_2O_2 = Na_2SO_4 + H_2O$$

Reducing Properties :—

Hydrogen Peroxide reduces Powerful oxidising agents

(1) With ozone it forms oxygen and water

$$O_3 + H_2O_2 = H_2O + 2O_2$$

(2) It reduces acidified $KMnO_4$

$$2KMnO_4 + 3H_2SO_4 + 5H_2O_2 = K_2SO_4 + 2MnSO_4 + 8H_2O + 5O_2$$

(3) It reduces moist silver oxide to metallic silver. $Ag_2O + H_2O_2 = 2Ag + H_2O + O_2$