Prep. of Di Hydrogen

Lab.

$Zn + dil\ H_2SO_4 \longrightarrow ZnSO_4 + H_2$

$NaOH + Al \longrightarrow NaAlO_2 + H_2$

Commercial

★ **Electrolysis of H_2O**

$H_2O \xrightarrow{\text{electrolysis}} H_2 + O_2$

Pure (99.99%)

(ii) High purity (>99.95) H_2 is obtained by electrolysing of warm barium Hydroxide.

(i)

$$CH_4 + H_2O \xrightarrow[Ni]{1273K} \underbrace{CO + H_2}_{\text{water gas / Syn gas}}$$

(steam)

Synthesis

($CO + H_2$) is use to Synthesis of methanol and a number of Hydrocarbon.

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Now-a-days syn gas is produce by sawdust seawage newspaper and scrap wood.

$$C + H_2O \xrightarrow{1273K} CO + H_2$$

production of syn gas by coal with steam is called ✡ Coal gasification.

production of dihydrogen can be increse by reacting CO of syn gas with steam in presence of iron and Cr_2 oxide (catalyst) and this process is called (bosch process) $\frac{Fe_2O_3}{Cr_2O_3}$ | water gas shift reaction.

$$CO + H_2O \xrightarrow[\text{Catalyst}]{673} CO_2 + H_2$$

CO_2 is removed with scrubbing Sodium arsenite solution.

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Prop.

1. Colourless | odourless | tasteless | Combustile gas
2. Insoluble in water.
3. it is lighter than air.

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Dihydrogen Has highest Bond enthalpy

Hydride

(1) Covalent Hydride

(a) e⁻ deficient Hydride → 13th

(b) e⁻ precise Hydride → 14th

(c) e⁻ Rich Hydride — 15th | 16th | 17th

group Hydride

(2) Ionic Hydride → s-BLOCK

(3) metallic Hydride — d and f BLOCK

Ionic hydride | saline hydride | salt like hydride

They are stiochimetry hydride

→ they highly electropositive

→ They are solid, crystalline and nonconductor in solid state however in molten state they show conductivity

$NaH \longrightarrow Na^{+} + H^{\ominus}$

they are good R.A

like LiH | NaH

Some hydrides react violently with

$$NaH + H^{+}-OH \longrightarrow NaOH + H_2$$

Covalent Hydride

p-Block element can form Covalent hydride

Note ⇒ BeH_2 and MgH_2 — they are also Covalent hydride

type of Covalent hydride

① e^- def. → 13th group

example B_2H_6

Hypo val. | L.A

e^- species → 14th

CH4

Octet Complete

electron Rich — 15 16 17

they Have ability to donate l.p

So they Called L.B

Metallic Hydride

d- and f-Block

→ non stiochiometric / Interstitial hydride

→ 7 8 9 group of d-Block element
Can not these hydride

— and in 6th group only Cr Can form
metallic hydride

→ they Conduct heat and electricity
but not like their parent metal

Hardness

Ca^{+2} | Mg^{+2} | HCO_3^- | SO_4^{2-} | Cl^-

type of Hardness

(i) temp. Hardness → Ca^{+2} Mg^{+2} | HCO_3^-

it can be removed by boiling

boiling → $Ca(HCO_3)_2 \xrightarrow{\Delta}$ White ppt. $CaCO_3 + H_2O + CO_2$

$Mg(HCO_3)_2 \xrightarrow{\Delta} Mg(OH)_2 + CO_2 + H_2O$

White ppt.

acc. to NCERT

Δ it is because of high solubility product of $Mg(OH)_2$ than $MgCO_3$

Clark's Method — Calculated amount of $Ca(OH)_2$ (Slaked lime)

$$Mg(HCO_3)_2 + Ca(OH)_2 \longrightarrow Mg(OH)_2 + CaCO_3 + H_2O$$

White ppt White ppt

$$Ca(HCO_3)_2 + Ca(OH)_2 \longrightarrow CaCO_3 + H_2O$$

White ppt.

Parament Hardness

$Ca^{+2} | Mg^{+2}$ $Cl^{-} | SO_4^{-2}$

(1) Washing Soda

White ppt

$$MCl_2 + Na_2CO_3 \longrightarrow MCO_3 + 2NaCl$$

$$MSO_4 + Na_2CO_3 \longrightarrow MCO_3 + Na_2SO_4$$

$(M = Ca/Mg)$

White ppt.

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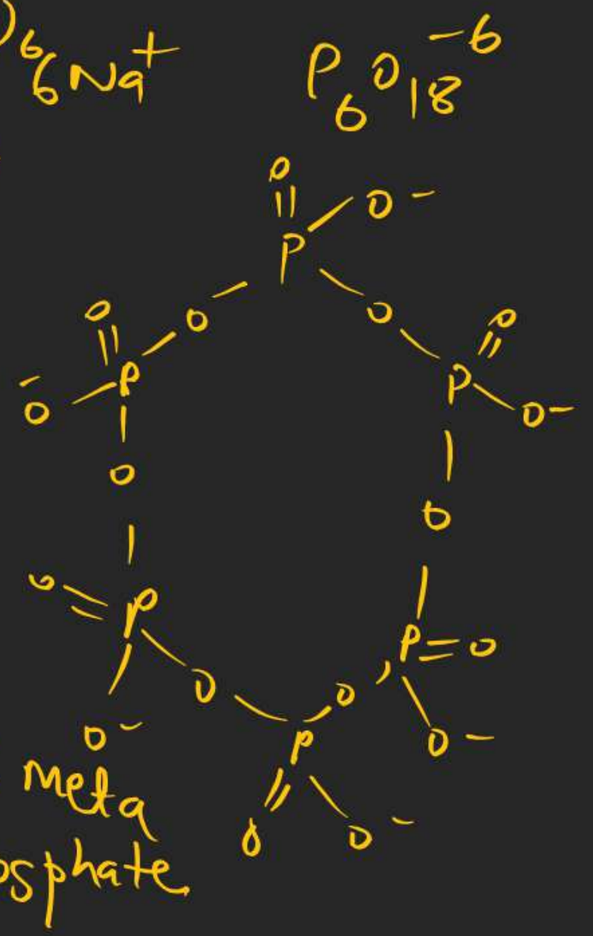
(2) Calgon Method

(Calgon) $Na_6P_6O_{18}$ → Sodium Hexa meta phosphate

$$Na_2[Na_4(PO_3)_6] \longrightarrow 2Na^+ + Na_4(PO_3)_6^{-2}$$

$$Na_4(PO_3)_6^{-2} + M^{+2} \longrightarrow Na_2M P_6O_{18}^{-2} + 2Na^+$$



Cyclic meta phosphate