

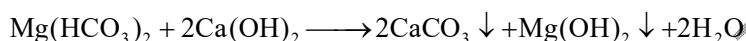
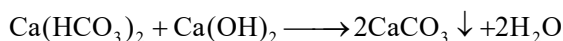
HINTS & SOLUTIONS

Hydrogen

[Set-2]

SECTION-A

1. (ii): In Clark's method, calculated amount of lime is added to hard water to precipitate CaCO_3 and Mg(OH)_2 which can be filtered off,



2. (ii): H^- ion is a strong conjugate base of weak acid, H_2
3. (iv): $\text{Na}_2\text{O}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}_2$
4. (i): Commercially, H_2O_2 is marketed as 10V which means it contains 3% H_2O_2 .
5. (ii): Electron deficient $\rightarrow \text{B}_2\text{H}_6$

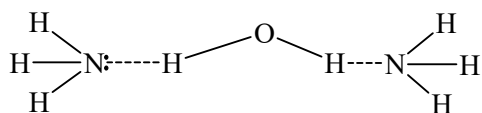
Saline $\rightarrow \text{NaH}$

Electron precise $\rightarrow \text{CH}_4$

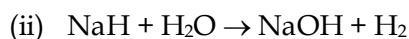
Interstitial $\rightarrow \text{CrH}$

6. (ii): Both assertion and reason are correct but reason is not the correct explanation of assertion. BeH_2 is covalent due to small size, high charge and high polarizing power of Be^{2+} .
7. (i): With KMnO_4 , H_2O_2 acts as a reducing agent and gets oxidized by KMnO_4 to O_2
- $$2\text{MnO}_4^- + 5\text{H}_2\text{O}_2 + 6\text{H}^+ \longrightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{O}_2$$
8. (iii): Only tritium ${}^3_1\text{H}$ is radioactive and emits low energy beta particles and the $t_{1/2}$ of ${}^3_1\text{H}$ is 12.3 years.
9. (iii): Some of the hydrides of the transition metals (called interstitial hydrides) can accommodate a very large volume of hydrogen and therefore can be used as its storage media. This property is called **hydrogen** storage and used as a source of energy.

10. (i): $\text{H}_2\text{O} \rightarrow$ amphoteric
- whereas alkali metal oxides Na_2O etc are basic and halogen oxide Cl_2O , etc are acidic in nature.
11. (i) NH_3 is completely miscible in water as NH_3 is capable of forming hydrogen bonds with water

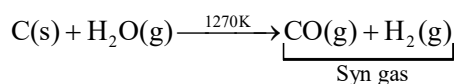


PH_3 is immiscible in H_2O and form bubbles because PH_3 is unable to form hydrogen bonds with water. This is due large size and less electronegativity of phosphorus and less polar nature of P - H bonds.

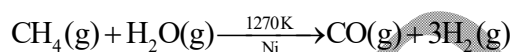


NaH is a salt of strong base NaOH and weak acid H_2 and gets hydrolysed by H_2O to give basic solution.

12. The mixture of CO and H_2 is called '**syn gas**' or **synthesis gas** as this mixture is used for the syntheris of methanol and a number of hydrocarbons. The 'syn gas' is produced by the reaction of steam on hydrocarbons or coke at high temperature

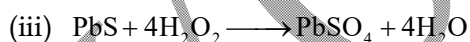
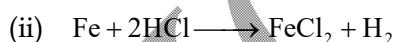
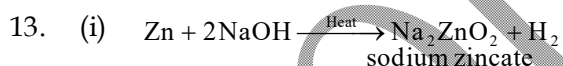


Or



OR

Temporary hardness is caused due to the presence of bicarbonates of calcium and magnesium. Permanent hardness is caused due to the presence of chlorides and sulphates of calcium and magnesium.



14. (i) **Electron deficient hydrides** are covalent hydrides in which the central atom has less than eight electrons and has incomplete ortet.

Examples: BeH_2 , B_2H_6

- (ii) **Electron precise hydrides** are also covalent hydrides in which the central atom has exactly eight electrons and form four single covalent bonds.

Example: CH_4 , SiH_4

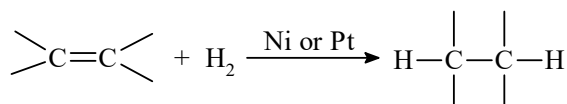
- (iii) **Electron rich hydrides** are covalent hydrides in which the central atom has one or more lone pair of electrons.

Examples: $\dot{\text{N}}\text{H}_3$, $\text{H}_2\ddot{\text{O}}$

OR

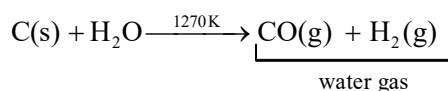
- (i) **Hydrogen economy:** It is the proposal to use hydrogen as a fuel in automobiles, power plants and in rockets and in space shuttles. This deals with the production, storage and efficient use of hydrogen as a fuel.
- (ii) **Hydrogenation:** This is the addition of hydrogen to unsaturated hydrocarbons in the presence of catalyst to form saturated hydrocarbons.

Hydrogenation is used on the industrial scale to convert vegetable oil into fats.

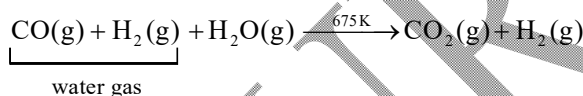


- (iii) **Water-gas shift reaction:**

Water gas is a mixture of CO and H₂ and is produced by reacting coke with steam at 1270 K



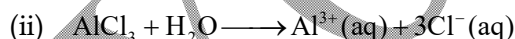
The amount of H₂ can be further increased by reacting water gas with steam when CO gets oxidized to CO₂(g) at high temperature.



This reaction in which CO of water gas reacts with steam to give more H₂ gas is called **water gas shift reaction**.

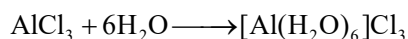


This reaction is called **hydrolysis** as Mg(OH)₂ is a strong base and pH of solution increases.



This is called **hydration**

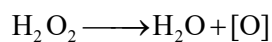
or



This reaction is called **redox reaction** as Fe²⁺ gets oxidised to Fe³⁺ by H₂O₂.

OR

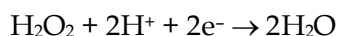
- (i) Hydrogen peroxide acts as bleaching agent due to the release of nascent oxygen.



This nascent oxygen combines with the colouring matter in clothes to make clothes colourless.

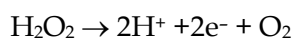
- (ii) **Oxidising nature**

When H_2O_2 act as an oxidizing agent, oxidation state of oxygen changes from -1 in H_2O_2 to -2 in H_2O



Reducing nature

When H_2O_2 act as a reducing agent, oxidation state of oxygen changes from -1 in H_2O_2 to zero in O_2 .



- (iii) H_2O_2 is more acidic than H_2O because H_2O_2 in aqueous medium ionize to large extent and give 2H^+ ions.

