HINTS & SOLUTIONS

Hydrogen

[Set-1]

SECTION-A

1. (ii): $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

   $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

2. (iv): When H_2O_2 acts as a reducing agent the oxidation state of oxygen changes from –1 to zero and one of the product is O_2 gas.

3. (iii): In B_2H_6, boron has an incomplete octet.

4. (ii): $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ cathode

   $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$ anode

5. (ii): $Li^+[AlH_4^-] \rightarrow$ ionic hydride

   $SiH_4 \rightarrow$ electron precise covalent hydride

   $NH_3 \rightarrow$ electron rich (one lone pair of electron on nitrogen) covalent hydride.

   $BeH_2 \rightarrow$ electron deficient covalent hydride.

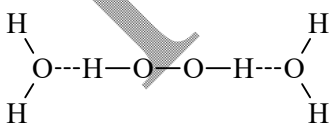
6. (ii): $\overset{(-1)}{2H_2O_2} \longrightarrow \overset{(-2)}{2H_2O} + \overset{(0)}{O_2}$

   This is a disproportionation reaction.

   H_2O_2 is less volatile than H_2O due to more extensive network of hydrogen bonding.

7. (i): Hydrolith is CaH_2, an ionic hydride contains H^- ion. This on electrolysis liberates H_2 gas at anode.

8. (iii): There is a hydrogen bonding between H_2O_2 and H_2O



9. (iv): Whenever H_2O_2 act as an oxidizing agent, oxidation state of oxygen changes from –1 in H_2O_2 to –2 in H_2O or OH^- ions.

10. (iii): Volume strength and molarity are related by

$$M = 2 \times \frac{\text{volume strength}}{22.4}$$

$$M = 2 \times \frac{10}{22.4} M$$

Strength of H_2O_2 = M × molecular mass

$$= \frac{2 \times 10}{22.4} \times 34$$

Strength of H_2O_2 = 30.36 g/L

11. (i) $CO(g) + 2H_2(g) \xrightarrow[\text{Catalyst}]{\text{Heat}} CH_3OH(g)$

(ii) $Ca_3N_2(s) + 6H_2O(\ell) \longrightarrow 3Ca(OH)_2(aq) + 2NH_3(g)$

12. (i) LiH < NaH < CsH

(i) F – F < D – D < H – H

OR

Hydration is the reaction of chemical substance with water with no change in pH.

$$NaCl(s) + H_2O(\ell) \longrightarrow Na^+(aq) + Cl^-(aq)$$

Hydrolysis is the reaction involving cleavage of chemical bonds with the help of water and with change in pH.

$$CuSO_4(s) + 3H_2O(\ell) \rightleftharpoons Cu(OH)_2(aq) + 2H^+(aq) + SO_4^{2-}(aq)$$

13. (i) $BaO_2.8H_2O(s) + H_2SO_4(aq) \rightarrow BaSO_4(s) + H_2O_2(aq) + 8H_2O(l)$

Anhydrous BaO_2 cannot be used since the precipitated $BaSO_4$ forms a protective layer around unreacted BaO_2 thereby preventing the further reaction.

(ii) Due to sall size, high charge and high polarizing power of Be^{2+}, BeH_2 is covalent in nature Calcium hydride is ionic due to large electronegativity difference between Ca and H.

(iii) Zn on reaction with conc. H_2SO_4 does not liberate H_2 gas. H_2 gas is a reducing agent and reduces H_2SO_4 to SO_2 gas.

$Zn + 2H_2SO_4 \rightarrow ZnSO_4 + SO_2 + 2H_2O$

OR

(i) (a) With Na metal

$$\underset{\text{(oxidising agent)}}{2Na + H_2} \longrightarrow 2NaH$$

(b) With CuO

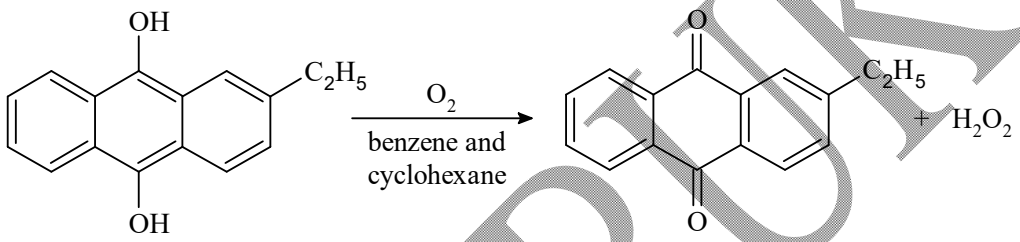
$$\underset{\text{(reducing agent)}}{H_2} + CuO \longrightarrow H_2O + Cu$$

(ii) Hydrogen from H^+ wheras halogen from X^-. Hydrogen from H^+ ion which exist only in solution as H_3O^+ ion wheras alkali metals form M^+ ion.

14.

(i)	**Hard water**	**Soft water**
	Water which does not produce lather with soap easily is called hard water e.g., sea water, well water	Water which produce lather with soap easily is called soft water. .e.g rain water, distilled water
(ii)	**Temporary hardness**	**Permanent hardness**
	This is due to the presence of bicarbonates of calcium and magnesium. It can easily be removed by boiling and filtering the water	This is due to the presence of soluble chlorides and sulphates of calcium and magnesium. It cannot be removed by simply boiling the water.

15. (i) (a)



2-ethyl anthraquinol

(b) $H_2O_2 + 2Fe^{2+} + 2H^+ \rightarrow 2H_2O + 2Fe^{3+}$

(ii) (a) H_2O_2 has a higher boiling pont than water because H_2O_2 is highly associated via extensive network of intermolecular hydrogen bonding.

(b) H_2O_2 decomposed to give H_2O and O_2. This reaction is catalyzed by light or heavy ions impurities. To prevent this, we stored H_2O_2 in wax-lined glass vessels in dark.

(c) Ice has a open strcture containing hydrogen bonds with wide holes. That's why ice has less density than water and ice floats over water.

OR

(i) **Non-stoichiometric hydrides** are the binary componds of hydrogen with d-block and f-block elements and are deficient in hydrogen. The metal to hydrogen ratio is not a simple whole number ratio. For example

$NiH_{0.6-0.7}$, $VH_{0.56}$

Alkali metals form stoichiometric ionic hydrides with hydrogen due to their high electropositive nature. Example, NaH, CaH_2

(ii) $CuSO_4.5H_2O$ is represented as $[Cu(H_2O)_4]\ SO_4H_2O$ in which $4H_2O$ molecules are bonded to Cu^{2+} ion by coordinate covalent bond and one H_2O molecule is hydrogen bonded to SO_4^{2-} ion.

(iii) Atomic hydrogen or oxy-hydrogen torches find uses for cutting and welding purposes.

Atomic hydrogen atoms (produced by dissociation of H_2 with the help of an electric arc) are allowed to recombine on the surface to be welded to generate the temperature of 4000 K.

