II. Short Answer Type Questions

Question 1. Show how H_2O_2 junctions both as a reducing and as an oxidising agent.
Answer: As oxidising agent.
$2I^- + H_2O_2 + 2H^+ \rightarrow I_2 + 2H_2O$
As reducing agent.
$H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Question 2. What are interstitial hydrides? Give two examples.
Answer: Many transition and inner-transition metals absorb hydrogen into the interstices of their lattices to yield metal like hydrides also called the interstitial hydrides. These hydrides are generally non stoichiometric and their composition vary with temperature and pressure.
For example,$T_iH_{1.73}$, $CeH_{2.7}$

Question 3. The aqueous solution of H_2O_2 is acidic in nature. Explain with the help of example. Name two substances which catalyse the decomposition reaction of H_2O_2.
Answer: The aqueous solution of H_2O_2 is weakly acidic in nature.

$$H_2O_2 + H_2O \rightleftharpoons H_3O^+ + HO_2^-$$

It gives two types of salts with alkalies, peroxides and hydroperoxides.
$2NaOH + H_2O_2 \rightarrow Na_2O_2 + 2H_2O$
$NaOH + H_2O_2 \rightarrow NaHO_2 + H_2O$
MnO_2 and finely divided metals like Pt and Fe catalyse the decomposition of H_2O_2.

Question 4. Complete the following reactions:
(i) $SiCl_4 + LiAlH_4 \rightarrow$
(ii) $Mg_3N_2 + H_2O \rightarrow$
(iii) $NaH + CO \rightarrow$
Answer:
(i) $SiCl_4 + LiAlH_4 \rightarrow SiH_4 + LiCl + AlCl_3$
(ii) $Mg_3N_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2NH_3$
(iii) $NaH + 2CO \rightarrow HCOONa + C$

Question 5. Explain the following:
(i) Temporary hardness can remove by boiling
(ii) Soft water lathers with soap but hard water not.
Answer: (i) On boiling, the bicarbonates of calcium and magnesium decompose to insoluble carbonate which can be removed by filteration.

$$Ca(HCO_3)_2 \xrightarrow{\text{Boil}} CaCO_3\downarrow + H_2O + CO_2\uparrow$$

$$Mg(HCO_3)_2 \xrightarrow{\text{Boil}} MgCO_3\downarrow + H_2O + ppt + CO_2\uparrow$$

(ii) Because of the presence of Ca^{2+} and Mg^{2+} ions in hard water which exchange with Na+ ions of the soap to form corresponding

calcium and magnesium salts that form insoluble ppt.

$$\underset{\text{Soap}}{RCOONa} + \underset{\text{Hardwater}}{Ca^{2+}} \longrightarrow \underset{\text{ppt.}}{(RCOO)_2Ca} + 2Na^+$$

$$\underset{\text{Soap}}{RCOONa} + \underset{\text{(Hardwater)}}{Mg^{2+}} \longrightarrow \underset{\text{ppt.}}{(RCOO)_2Mg} + 2Na^+$$

Question 6.(a) How is dihydrogen prepared from water by using a reducing agent?
(b) Give the industrial use of dihydrogen which depends upon heat liberated when it bums.
Answer:
(a) Dihydrogen is prepared from water by the action of alkali metals like Na and K which is a strong reducing agent.
$2Na + 2H_2O \rightarrow 2NaOH + H_2$
$2K + 2H_2O \rightarrow 2KOH + H_2$
(b) For welding purposes.
$H_2(g) + 1/2\ O_2(E) \rightarrow H_2O\ (g) + heat$

Question 7. Water molecule is bent, not linear. Explain?
Answer: In water molecule, O is sp^3 hybridized. Due to stronger lone pair-lone pair repulsion than bond pair-bond pair repulsions, the HOH bond angle decreases from 109.5° to 104.5°. Thus water is bent molecule.

Question 8. Account for the following:
(i) dihydrogen gas is not preferred in balloons.
(ii) Cone. H_2SO_4 cannot be used for drying H_2.
Answer:
(i) Dihydrogen is the lighest gas but due to its highly combustible nature it is not preferred in balloons.
(ii) Cone. H_2SO_4 on absorbing H_2O forms moist H_2 produces so much heat that hydrogen catches fires.

Question 9. Calculate the volume strength of a 3% solution of H_2O_2
Answer:
100 ml of H_2O_2 solution contain H_2O_2 = 3g.
∴ 1000 ml of H_2O_2 solution will contain = 3/100x 1000 = 30g

Question 10. Complete the following reactions:

$$(i)\quad CO(g) + H_2(g) \xrightarrow{\Delta}$$

$$(ii)\quad Zn(s) + NaOH\ (aq) \xrightarrow{heat}$$

$$(iii)\quad C_3H_8(g) + 3H_2O(g) \xrightarrow[Catalyst]{\Delta}$$

Answer:

$$(i)\quad CO(g) + 2H_2(g) \xrightarrow[\text{Catalyst}]{\Delta} CH_3OH(l)\ \text{methanol}$$

$$(ii)\quad Zn(s) + 2NaOH(aq) \xrightarrow{\text{heat}} Na_2ZnO_2(s) + H_2(g)$$

$$(iii)\quad C_3H_8(g) + 3H_2O \xrightarrow{Ni\ 1270K} 3CO(g) + 7H_2(g)$$

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