

Chapter 8. Hydrogen

Question-1

Classify the following hydrides into covalent, ionic and interstitial hydrides.

Solution:

NH_3 , ZrH_2 , CaH_2 , NaH , B_2H_6

Covalent = NH_3 B_2H_6

Ionic = NaH , CaH_2

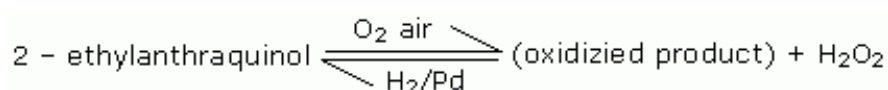
Interstitial = ZrH_2 .

Question-2

How is H_2O_2 manufactured?

Solution:

Industrially H_2O_2 is prepared by the auto oxidation of 2 hydroxy anthraquinols. It involves a cycle of reactions. The net reaction is to catalyst union of H_2 and O_2 to yield H_2O_2



It is concentrated by careful distillation under low pressure.

Question-3

What is the use of Zeolite / permutit?

Solution:

Zeolite or permutit is a sodium aluminium silicate. $\text{Na Al SiO}_4 \cdot 3\text{H}_2\text{O}$. When hard water, which contains Ca^{2+} / Mg^{2+} ions, is passed through Zeolite / permutit, Na^+ ion in the silicate gets exchanged for Ca^{2+} / Mg^{2+} in hard water. Thus hard water is softened.

Question-4

What is meant by 100-volume of Hydrogen peroxide?

Solution:

Each milliliter of 100-volume H_2O_2 will liberate 100 volumes of oxygen at STP. It may be 30% solution H_2O_2 .

Question-5

Give examples for electron deficient, electron-precise and electron rich molecular hydrides.

Solution:

Electron deficient: B_2H_6 (has less number of electrons to write Lewis structure)

Electron – precise: CH_4

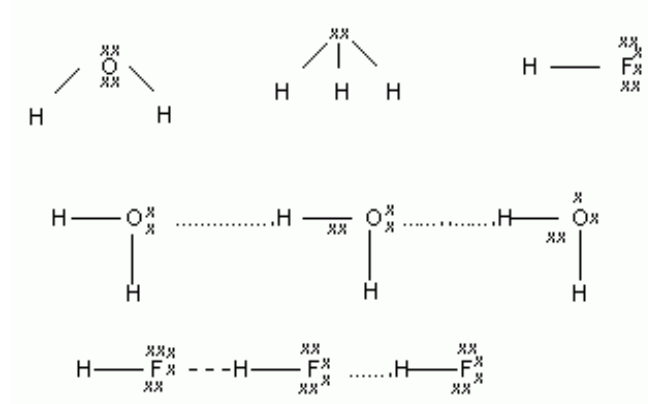
Electron – rich: NH_3 and H_2O (N and O have lone pairs of electrons).

Question-6

Why HF , H_2O and NH_3 have higher boiling points, and aggregation?

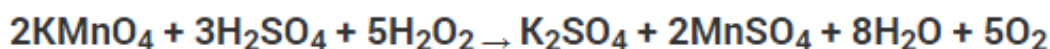
Solution:

Fluorine, oxygen and nitrogen are electronegative elements: They have lone pairs of electron in HF , H_2O and NH_3 , electron rich hydride.



Question-7

Solution:



KMnO_4 is converted into MnSO_4 : Oxidation number of Mn is changed from +7 to +2 by H_2O_2 . That is H_2O_2 acts as a reducing agent, giving electrons to manganese. H_2O_2 is changed to O_2 by KMnO_4 . Oxidation number of oxygen in H_2O_2 is changed from -1 to 0 in oxygen molecule. Hence KMnO_4 removes electron from oxygen of H_2O_2 . Hence H_2O_2 is oxidized by KMnO_4 to H_2O .



S^{2-} in PbS is oxidized to SO_4 ; oxidation number of S in Pbs (-2) changed to (+6) in PbSO_4 . Electrons are removed from Pbs by H_2O_2 to convert PbS to PbSO_4 . Hence H_2O_2 is an oxidizing agent.

H_2O_2 is converted into H_2O : Oxidation number (-1) in H_2O_2 is changed into (-2) in H_2O . Hence H_2O_2 is reduced by PbS .

Question-8

How is H_2O_2 concentrated?

Solution:

Aqueous H_2O_2 solutions spontaneously decompose to give H_2O and O_2 . Hence 1% H_2O_2 , formed during preparation cannot be concentrated by distillation under atmospheric pressure. Hence H_2O_2 solution is concentrated to 30% by distillation under reduced pressure. This further concentrated to 85% by careful distillation under low pressure. The remaining water is frozen out to give pure H_2O_2 .

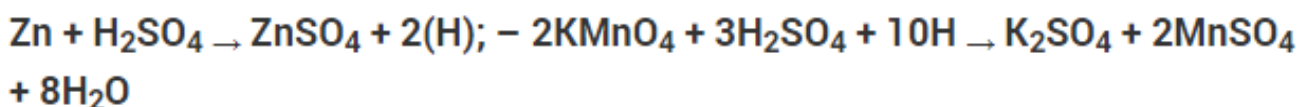
Question-9

What is nascent hydrogen? How is its reactivity?

Solution:

The hydrogen at the time of its production (new born) is much more reactive and is called nascent hydrogen. It is in a atomic state at the moment of its formation.

E.g. H_2 molecule does not reduce $KMnO_4$. But, Zn and HCl reduces $KMnO_4$. Decolourise $KMnO_4$.



Question-10

What is the reaction involved using H_2O_2 for renovating old painting?

Solution:

Old paintings rendered black PbS by the atmospheric H_2S . Black PbS in painting is oxidized by H_2O_2 to white $PbSO_4$

