CBSE Class 11 Chemistry

Important Questions

Chapter 9

Hydrogen

1 Marks Questions

1.Which isotope of hydrogen

(i) does not contain neutron?

(ii) is radioactive?

Ans. (i) Protium

(ii) Tritium

2.Give the electronic configuration of hydrogen

Ans. 1s'

3.Name the isotopes of hydrogen.

Ans. Hydrogen has three isotopes:

Protium, ${}_{1}^{1}H$

deuterium, ${}_{1}^{2}H$

tritium, ${}_{1}^{3}H$

4.What is syn-gas?

Ans. Mixture of CO and H_2 is used for the synthesis of methanol and a number of hydrocarbons it is also called synthesis gas or 'syngas'

5.What is coal gasification?

Ans. The process of producing syn gas from coal is called 'coal gasification.

$$C(s)+H_2O(g)\xrightarrow{1270k}CO(g)+H_2(g).$$

6.Give the laboratory method of preparation of hydrogen.

Ans. Hydrogen is usually prepared by the reaction of granulated zinc with dilute hydrochloric acid

$$Zn+2H^+\rightarrow Zn^{2+}+H_2.$$

7.Give the commercial method of preparation of dihydrogen.

Ans. Electrolysis of acidified water using platinum electrodes give hydrogen.

$$2H_2O(l)\xrightarrow[\text{Traces of acid / base}\ H^+/OH^-]{\text{Electrolysis}}2H_2(g)+O_2(g)$$

8.What is water – gas shift reaction?

Ans. The production of dihyrogen can be increased by reacting carbon monoxide of syn gas mixtures with steam in the presence of iron chromate as catalyst.

$$CO(g)+H_2O\ (g)\xrightarrow[\text{Catalyst}]{673k}CO_2(g)+H_2(g)$$

This is called water gas – shift reaction.

9.Why is dihydrogen gas not preferred in balloons?

Ans. Dihydrogen is the lightest gas and should have been used in balloons. But it is not preferred due to its highly combustible nature.

10.What is the pH of water?

Ans. The pH value of water is 7.

11.How is methrol prepared using dihydrogen?

Ans.CO on reacting with dihydrogen yields bulk amount of methanol.

$$CO(g) + 2H_2(g) \xrightarrow[\text{Catalyst}]{\text{Cobalt}} CH_3OH(l)$$

12.How is ammonia prepared using dihydrogen?

Ans. With dinitrogen it form ammonia.

$$3H_2(g) + N_2(g) \xrightarrow[Fe]{673k,\ 200atm} 2NH_3(g)$$

This is the method for the manufacture of ammonia by the Haber process.

13.Name the categories into which hydrides are categorized.

Ans.The hydrides are classified into three categories -

(i) Ionic or saline or salt like hydrides.

(ii) Covalent or molecular hydrides

(iii) Metallic or non-stoichiometric hydrides.

14.What are hydrides?

Ans. Dihydrogen under certain reaction conditions combines with almost all elements, except noble gases, to form binary compounds, called hydrides.

15.Give an example of each of an ionic hydride and a covalent hydride.

Ans. Ionic hydride: LiH, NaH Covalent hydride CH_4, NH_3 and H_2O

16.What happens when water is added to calcium hydride?

Ans. Calcium hydroxide is formed $\underset{\text{(Calcium hydride)}}{CaH_2} + H_2O \rightarrow \underset{\text{Calcium hydroxide}}{Ca(OH)_2}$

17.Give an example of electron – deficient hydride.

Ans. Diborane.

18.What is the behavioral similarity between NH_3, H_2O HF compounds?

Ans. They behave as Lewis is bases i.e. electron donors. The presence of lone pairs on highly electronegative atoms like N, O and F in hydrides results in hydrogen bond formation between the molecules.

19.Give a reaction in which water acts as an oxidizing agent.

Ans.

$$Na + H_2O \rightarrow NaOH + \frac{1}{2}H_2.$$

20.Write the Name of a zeolite used in softening of hard water.

Ans. Sodium aluminum silicate $Na_2Al_2Si_2O_8$. X H_2O.

21.Define hard water.

Ans. Water which does not produce lather with soap solution readily is called hard water. eg. hand pump water, river water, sea water etc.

22.What is calgon?

Ans. Sodium hexameta phosphate ($Na_6P_6O_{18}$) is commercially called calgon.

23.Why is H_2O_2 a better oxidant than water?

Ans. H_2O_2 is easily reduced to form O and H_2O.

$$H_2O_2 \rightarrow H_2O + O$$

24.What happens when H_2O_2 reacts with ethylene?

Ans.

25.What do you mean by 100 volume of hydrogen peroxide?

Ans. It means that one milliliter of 30% H_2O_2 solution will give 100v of oxygen at STP

26.What happens when BaO_2 is treated with phosphoric acid?

Ans. H_2O_2 is obtained

$$3BaO_2 + 2H_3PO_4 \rightarrow Ba_3(PO_4)_2 \downarrow + \underline{3H_2O_2}$$

CBSE Class 12 Chemistry

Important Questions

Chapter 9

Hydrogen

2 Marks Questions

1.Why does hydrogen occupy unique position in the periodic table?

Ans. Inspite of the fact that hydrogen, to a certain extent resembles both with alkali metals (ns') and halogens ($ns^2\ np^5$), it differs from them as well. Hydrogen has very small size as a consequence H^+ does not exist freely and is always associated with other atoms or molecules. Thus, it is unique in behaviors and is therefore, best placed separately in the periodic table.

2.Give the main characteristics of isotopes.

Ans. Since, the isotopes have the same electronic configuration, they have almost the same chemical properties. The only difference is in their rates of reactions, mainly due to their different enthalpy of bond dissociation. However, in physical properly of these isotopes differ considerably due to their large mass differences.

3.How can the production of dlhydrogen obtained from 'coal gasification be increased'?

Ans. By reacting carbon monoxide of syngas mixtures with steam in the presence of iron chromate as catalyst

$$CO(g)+H_2O(g)\xrightarrow[\text{Catalyst}]{673k}CO_2(g)+H_2(g)$$

4.Why is dihydrogen used an fuel cells for generating electrical energy?

Ans. Because it does not produce any pollution and releases greater energy per unit mass of fuel in comparison to gasoline or any other fuel.

5.What is understood by hydrogenation?

Ans. Hydrogenation is used for the conversion of polyunsaturated oils into edible fats.

6.Which fuel is used as a rocket fuel?

Ans. Dihydrogen is used as a rocket fuel in space research.

7.What happens when sodium hydride reacts with water?

Ans. Saline hydride (sodium hydride) react violently with water producing dihydrogen gas

$$NaH(s) + H_2O(aq) \rightarrow NaOH(aq) + H_2(g).$$

8.What is the geometry of the compound formed by group 14 to form molecular hydride?

Ans. Tetrahedral in structure.

9.What are the characteristic features of ionic or saline hydrides?

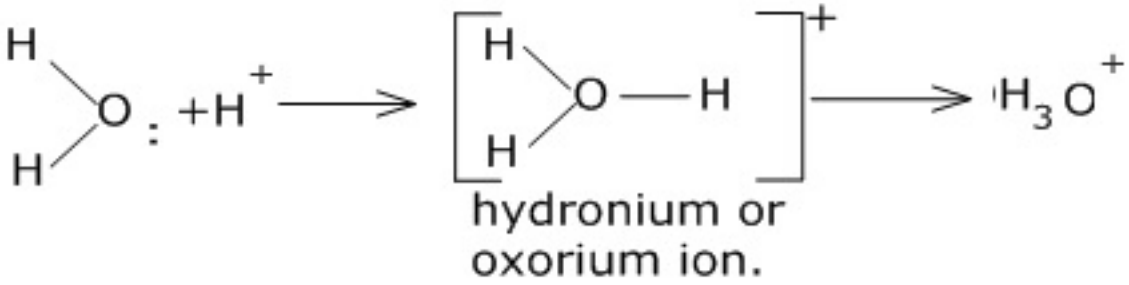
Ans. The ionic hydrides are crystalline, non – volatile non – conducting in solid state. However their melts conduct electricity.

10.Which gas is produced on electrolysis of ionic hydride?

Ans. Dihydrogen gas is produced at the anode on electrolysis of ionic hydride.

11.How does H^+ ion forms hydronium ion (OH_3^+) in water?

Ans. In water H^+ ion forms a covalent bond with H_2O and forms hydronium ion, (H_3O^+).



12.Show with reaction the amphoteric nature of water.

Ans. Water acts as an acid with NH_3 and base with H_2S

$$H_2O(i) + NH_3(aq) \rightleftharpoons OH^- + (aq) + NH_4^+(aq)$$

$$H_2O(i) + H_2S(aq) \rightleftharpoons H_3O^+(aq) + HS^-(aq).$$

13.Why is ice less dense then water and what kind of attractive forces must be overcome to melt ice?

Ans. The structure of ice is an open structure having a number of vacant spaces. Therefore, the density of ice is less than water. When ice melts the hydrogen bonds are broken and the water molecules go in between the vacant spaces. As a result, the structure of liquid water is less open than structure of ice. Thus ice is less dense than
water

14.Why does hard water not form lather with soap?

Ans. Hard water does not produce lather with soap readily because the cations (Ca^{2+} and Mg^{2+}) present in hard water react with soap to precipitate of tcalcium and magnesium salts of fatly acids.

$$M^{2+} + 2C_{17}H_{35}COONa \rightarrow (C_{17}H_{35}COO)_2M + 2Na^+$$

From hard water sodium stearate form Ca/Mg stearate

15.Why is water an excellent solvent for ionic or polar substances?

Ans. Water is a polar solvent with a high dielectric constant. Due to high dielectric constant of water the force of attraction between cation and anion gets weakened. Thus water molecules are able to remove ions from the lattice site using in dipole forces easily.

16.How many hydrogen – bonded water molecule are associated in $CuSO_4.5H_2O$?

Ans. Only one water molecule, which is outside the brackets (coordinator spheres), is hydrogen bonded. The other four molecules of water are co-ordinated.

17.What happens when H_2O_2 reacts with acidified $KMnO_4$?

Ans. Reducing property of H_2O_2 is observed.

$$2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$$

18.Hydrogen peroxide acts as oxidizing agent as well as a reducing agent. Why?

Ans. Hydrogen peroxide can act as an oxidizing agent because it readily decomposes to evolve oxygen and also take up oxygen from water.

19.Why is hydrogen peroxide stored in wax-lined glass or plastic vessels in dark?

Ans. H_2O_2 decomposes slowly on exposure to light

$$2H_2O_2 \rightarrow 2H_2O(l) + O_2(g)$$

In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalyzed.

20.What is the volume strength of 2M-H_2O_2?

Ans. Since 1M – H_2O_2 solution contains 17g H_2O_2

∴ 2 M – H2O2 solution contains 34g of H_2O_2

But 68g of H_2O_2 contains = $\frac{22400x34}{68}$

= 11200ml of O_2 at NTP

Thus 1000ml of H_2O_2 soln. gives off O_2 = 11200ml at NTP

Hence 1 ml of H_2O_2 soln gives off

= $\frac{11200}{1000} = 11.2ml$

Thus volume strength of H_2O_2 = $\underline{\underline{11.2}}$

21.Calculate the strength in volumes of a solution containing 30.36 g/l of H_2O_2.

Ans. $2H_2O_2 \rightarrow 2H_2O + O_2$

22.4l at NTP

68g of H_2O_2 produce 22.4 l O2 at NTP

30.36g of H_2O_2 produce = $\frac{22.4}{08} x30.36$

= 10l O_2 at NTP

∴ volume strength = 10 volumes.

22.What happens when hydrogen peroxide reacts with acidified $K_2Cr_2O_7$?

Ans. Acidified $K_2Cr_2O_7$ is oxidized to blue peroxide of chromium (Cr_2O_3) which is unstable.

However, it is soluble in ether and produces blue colored solution.

$$K_2Cr_2O_7 + 4H_2SO_4 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3(O)$$

$$[H_2O_2 + O \rightarrow H_2O + O_2] \times 3$$

$$K_2Cr_2O_7 + 4H_2SO_4 + 3H_2O_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + SO_2$$

Orange green.