Hydrogen

1. Very pure hydrogen (99.9%) can be made by which of the following processes? **[AIEEE-2012]**

   (1) Mixing natural hydrocarbons of high molecular weight

   (2) Electrolysis of water

   (3) Reaction of salt like hydrides with water

   (4) Reaction of methane with steam

2. In which of the following reactions H_2O_2 acts as a reducing agent? **[JEE (Main)-2014]**

   (a) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

   (b) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

   (c) $H_2O_2 + 2e^- \rightarrow 2OH^-$

   (d) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

   (1) (a), (b)

   (2) (c), (d)

   (3) (a), (c)

   (4) (b), (d)

3. The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na$ (mol. wt. 206). What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin? **[JEE (Main)-2015]**

   (1) $\frac{1}{103}$ (2) $\frac{1}{206}$

   (3) $\frac{2}{309}$ (4) $\frac{1}{412}$

4. From the following statement regarding H_2O_2, choose the incorrect statement **[JEE (Main)-2015]**

   (1) It can act only as an oxidizing agent

   (2) It decomposes on exposure to light

   (3) It has to be stored in plastic or wax lined glass bottles in dark.

   (4) It has to be kept away from dust

5. Which one of the following statements about water is FALSE? **[JEE (Main)-2016]**

   (1) Water can act both as an acid and as a base

   (2) There is extensive intramolecular hydrogen bonding in the condensed phase

   (3) Ice formed by heavy water sinks in normal water

   (4) Water is oxidized to oxygen during photosynthesis

6. The isotopes of hydrogen are **[JEE (Main)-2019]**

   (1) Tritium and protium only

   (2) Deuterium and tritium only

   (3) Protium and deuterium only

   (4) Protium, deuterium and tritium

7. A water sample has ppm level concentration of the following metals: Fe = 0.2 ; Mn = 5.0 ; Cu = 3.0 ; Zn = 5.0. The metal that makes the water sample unsuitable for drinking is: **[JEE (Main)-2019]**

   (1) Cu (2) Mn

   (3) Zn (4) Fe

8. The temporary hardness of water is due to **[JEE (Main)-2019]**

   (1) $CaCl_2$ (2) NaCl

   (3) Na_2SO_4 (4) $Ca(HCO_3)_2$

9. The total number of isotopes of hydrogen and number of radioactive isotopes among them, respectively, are **[JEE (Main)-2019]**

   (1) 2 and 1 (2) 3 and 2

   (3) 2 and 0 (4) 3 and 1

10. Among the following reactions of hydrogen with halogens, the one that requires a catalyst is **[JEE (Main)-2019]**

    (1) $H_2 + Cl_2 \rightarrow 2HCl$ (2) $H_2 + I_2 \rightarrow 2HI$

    (3) $H_2 + Br_2 \rightarrow 2HBr$ (4) $H_2 + F_2 \rightarrow 2HF$

11. The correct statements among (a) to (d) regarding H_2 as a fuel are

(a) It produces less pollutants than petrol.

(b) A cylinder of compressed dihydrogen weighs ~ 30 times more than a petrol tank producing the same amount of energy.

(c) Dihydrogen is stored in tanks of metal alloys like $NaNi_5$.

(d) On combustion, values of energy released per gram of liquid dihydrogen and LPG are 50 and 142 kJ, respectively. **[JEE (Main)-2019]**

(1) (b) and (d) only

(2) (a) and (c) only

(3) (b), (c) and (d) only

(4) (a), (b) and (c) only

12. The hydride that is NOT electron deficient is **[JEE (Main)-2019]**

(1) SiH_4 (2) GaH_3

(3) B_2H_6 (4) AlH_3

13. The hardness of a water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3} M $CaSO_4$ is (molar mass of $CaSO_4$ = 136 g mol^{-1}) **[JEE (Main)-2019]**

(1) 10 ppm (2) 100 ppm

(3) 90 ppm (4) 50 ppm

14. The volume strength of 1M H_2O_2 is (Molar mass of H_2O_2 = 34 g mol^{-1}) **[JEE (Main)-2019]**

(1) 11.35 (2) 22.4

(3) 5.6 (4) 16.8

15. 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 g of magnesium bicarbonate. The hardness of this water sample expressed in terms of equivalents of $CaCO_3$ is (molar mass of calcium bicarbonate is 162 g mol^{-1} and magnesium bicarbonate is 146 g mol^{-1}) **[JEE (Main)-2019]**

(1) 5,000 ppm (2) 100 ppm

(3) 10,000 ppm (4) 1,000 ppm

16. The strength of 11.2 volume solution of H_2O_2 is [Given that molar mass of H = 1 g mol^{-1} and O = 16 g mol^{-1}] **[JEE (Main)-2019]**

(1) 13.6% (2) 1.7%

(3) 3.4% (4) 34%

17. The synonym for water gas when used in the production of methanol is : **[JEE (Main)-2019]**

(1) Fuel gas

(2) Syn gas

(3) Laughing gas

(4) Natural gas

18. The correct statements among (a) to (d) are :

(a) Saline hydrides produce H_2 gas when reacted with H_2O.

(b) Reaction of $LiAlH_4$ with BF_3 leads to B_2H_6.

(c) PH_3 and CH_4 are electron - rich and electron - precise hydrides, respectively.

(d) HF and CH_4 are called as molecular hydrides. **[JEE (Main)-2019]**

(1) (a), (c) and (d) only.

(2) (c) and (d) only.

(3) (a), (b) and (c) only.

(4) (a), (b), (c) and (d).

19. The temporary hardness of a water sample is due to compound X. Boiling this sample converts X to compound Y. X and Y, respectively are: **[JEE (Main)-2019]**

(1) $Ca(HCO_3)_2$ and $Ca(OH)_2$

(2) $Mg(HCO_3)_2$ and $Mg(OH)_2$

(3) $Mg(HCO_3)_2$ and $MgCO_3$

(4) $Ca(HCO_3)_2$ and CaO

20. In comparison to the zeolite process for the removal of permanent hardness, the synthetic resins method is **[JEE (Main)-2020]**

(1) Less efficient as it exchanges only anions

(2) More efficient as it can exchange only cations

(3) More efficient as it can exchange both cations as well as anions

(4) Less efficient as the resins cannot be regenerated

21. Among statements (a)-(d) the correct ones are:

(a) Decomposition of hydrogen peroxide gives dioxygen.

(b) Like hydrogen peroxide, compounds, such as $KClO_3$, $Pb(NO_3)_2$ and $NaNO_3$ when heated liberate dioxygen.

(c) 2-Ethylanthraquinone is useful for the industrial preparation of hydrogen peroxide.

(d) Hydrogen peroxide is used for the manufacture of sodium perborate. **[JEE (Main)-2020]**

(1) (a) and (c) only (2) (a), (b) and (c) only

(3) (a), (b), (c) and (d) (4) (a), (c) and (d) only

22. Hydrogen has three isotopes (A), (B) and (C). If the number of neutron(s) in (A), (B) and (C) respectively, are (x), (y) and (z), the sum of (x), (y) and (z) is **[JEE (Main)-2020]**

(1) 4 (2) 2

(3) 3 (4) 1

23. Amongst the following, the form of water with the lowest ionic conductance at 298 K is

[JEE (Main)-2020]

(1) Distilled water

(2) Sea water

(3) Water from a well

(4) Saline water used for intravenous injection

24. Biochemical Oxygen Demand (BOD) is the amount of oxygen required (in ppm) **[JEE (Main)-2020]**

(1) By bacteria to break-down organic waste in a certain volume of a water sample

(2) For sustaining life in a water body

(3) By anaerobic bacteria to break down inorganic waste present in a water body

(4) For the photochemical break down of waste present in 1 m^3 volume of a water body

25. The strengths of 5.6 volume hydrogen peroxide (of density 1 g/mL) in terms of mass percentage and molarity (M), respectively, are

(Take molar mass of hydrogen peroxide as 34 g/ mol) **[JEE (Main)-2020]**

(1) 1.7 and 0.5 (2) 0.85 and 0.5

(3) 1.7 and 0.25 (4) 0.85 and 0.25

26. Hydrogen peroxide, in the pure state, is

[JEE (Main)-2020]

(1) linear and blue in color

(2) planar and blue in color

(3) linear and almost colorless

(4) non-planar and almost colorless

27. The one that is NOT suitable for the removal of permanent hardness of water is

[JEE (Main)-2020]

(1) Calgon's method

(2) Ion-exchange method

(3) Clark's method

(4) Treatment with sodium carbonate

28. Dihydrogen of high purity (> 99.95%) is obtained through **[JEE (Main)-2020]**

(1) The electrolysis of acidified water using Pt electrodes

(2) The electrolysis of warm $Ba(OH)_2$ solution using Ni electrodes

(3) The electrolysis of brine solution

(4) The reaction of Zn with dilute HCl

29. The hardness of a water sample containing 10^{-3} M $MgSO_4$ expressed as $CaCO_3$ equivalents (in ppm) is _____.

(molar mass of $MgSO_4$ is 120.37 g/mol)

[JEE (Main)-2020]

30. 10.30 mg of O_2 is dissolved into a liter of sea water of density 1.03 g/mL. The concentration of O_2 in ppm is _____ . **[JEE (Main)-2020]**

31. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. ($R = 0.0821$ L atm K^{-1} mol^{-1}) (rounded off to the nearest integer) **[JEE (Main)-2020]**

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