

The dihydrogen (H_2) available in the most abundance in the world comes third in the proportion on the surface of the earth. It is seen as the largest source of energy in future.

Symbol : H

Atomic number : 1

Atomic weight : 1.008 u

● **Position of Hydrogen in periodic table**

Similarity with Alkali metals			
No.	Property	Hydrogen	Alkali metals
(1)	Electronic configuration	$1s^1$	ns^1
(2)	Oxidation state	+1	+1
(3)	Reductant	strong	strong
(4)	Halogen elements and reaction with oxygen	stable halide and oxide	stable halide and oxide
Non-similarity with Alkali metals			
No	Property	Hydrogen	Alkali metals
(1)	Ionization Enthalpy	very high 1312 KJ/mole	very less Li = 520 KJ/mole
(2)	Physical state	Diatomic Gas	Solid
Similarity with Halogen			
No	Property	Hydrogen	Halogen
(1)	Oxidation state	-1 (Hydride)	-1
(2)	Atomic	Diatomic	Diatomic
(3)	Ionization enthalpy	1312 KJ/mole	F=1680 KJ/mole
(4)	Reaction with metals	Hydride e.g. NaH	Halide e.g NaCl

● **Non-similarity with Halogen**

No.	Property	Hydrogen	Halogen
(1)	Electronic configuration	$1s^1$	$ns^2 np^5$
(2)	Colour	Colourless	Coloured
(3)	Oxidant	Weak	Strong

Thus position of hydrogen is not definite, so it is placed in the middle of first period.

● **Isotopes of Hydrogen**

No	Name and symbol	Atomic Number	Atomic mass	Number of proton	Number of neutron	Proportion	Stability and $t_{\frac{1}{2}}$
(1)	Protium ${}^1_1\text{H}$	1	1	1	0	Highest 99.98	Stable
(2)	Deuterium ${}^2_1\text{H}$	1	2	1	1	0.015 %	Stable
(3)	Tritium T, ${}^3_1\text{H}$	1	3	1	2	T : ${}^1_1\text{H}$ 1 : 10^{17}	Radio active ${}^3_1\text{H} \rightarrow {}^3_2\text{He} + {}^0_{-1}\text{e}$ $t_{\frac{1}{2}} = 12.33 \text{ year}$

The physical properties of these isotopes differ from each other due to large difference in atomic weight.

Their electronic configuration are same, so their chemical properties are similar, but have different rate of reaction.

- Which element is seen as the largest source of energy in future ?
(A) Monoatomic gas (B) Diatomic non metal gas
(C) least weight of diatomic gas (D) triatomic gas
- Which of the following possess electronic configuration similar to that of hydrogen ?
(A) strong oxidant elements (B) Noble gases
(C) Anhydrous substance (D) Strong reductant elements
- Which property of hydrogen differ from strong reducing agent elements ?
P. Preparation of stable peroxide Q. $\Delta_f\text{H}$ R. physical state
(A) Q, R (B) only P (C) only Q (D) P, R
- To which of the following reagent hydrogen acts as oxidant ?
(A) Na (B) Fe_2O_3 (C) Cl_2 (D) $\text{CH}_2 = \text{CH}_2$
- Which of the elements show similarity when hydrogen gains one electron to attain stable electronic configuration like inert gas ?
(A) Alkali metal (B) Alkaline Earth metal (C) Halogen (D) Chalcogen
- Which oxidation states are possible in hydrogen ?
(A) only 0 (B) +1, -1, 0 (C) only +1 (D) only -1
- Which property of hydrogen differs from halogen ?
(A) Electronegative characteristics (B) Ionization enthalpy
(C) Non-metallic (D) Reductant
- Which of the following statement is incorrect for protium, duterium and tritium ?
(A) They are isotopes of each other (B) They have 1, 2 and 3 nucleons respectively
(C) They have same electronic configuration, so physical properties are also same
(D) Their relative proportion of isotopes : 99.98 : 0.0516 : 10^{-15}

9. ${}^3_1\text{H} \rightarrow \text{X} + \beta^-$ particle, X =

(A) ${}^2_1\text{H}$

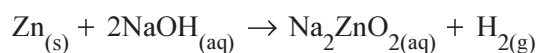
(B) ${}^3_2\text{He}$

(C) ${}^1_1\text{H}$

(D) ${}^4_2\text{He}$

Answers : 1. (C), 2. (D), 3. (A), 4. (A), 5. (C), 6. (B), 7. (D), 8. (C), 9. (B)

● Preparation of dihydrogen

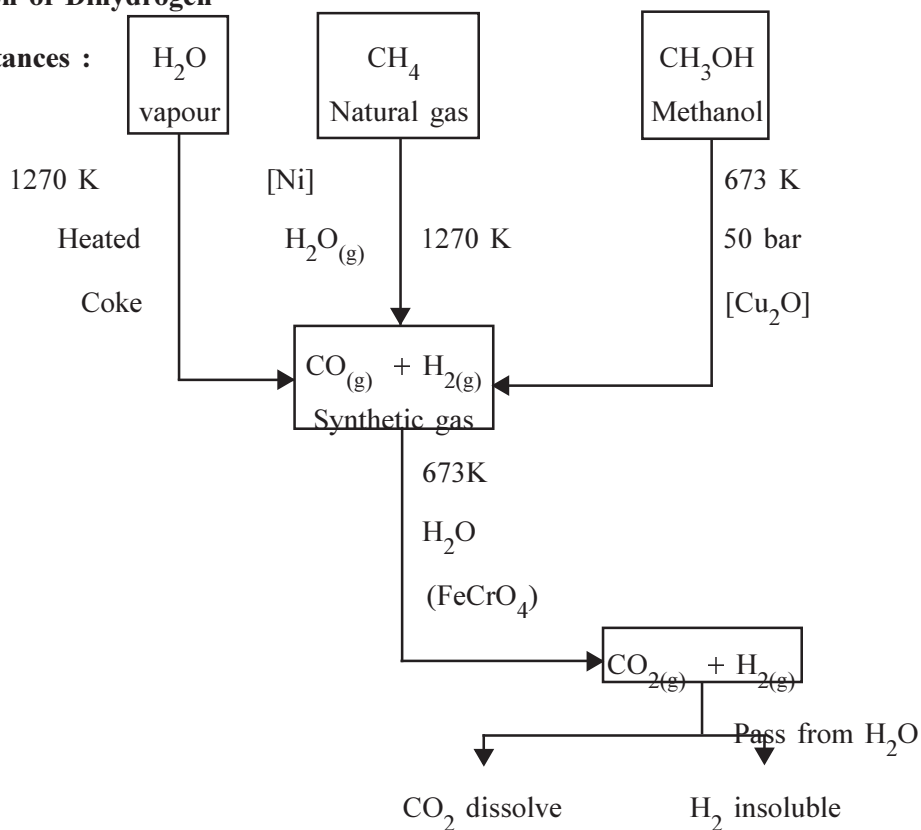


Sodium zincate



● Industrial Preparation of Dihydrogen

(i) Initial substances :



(ii) **Electrolysis of water**

	Electrolyte	Electrode
(a)	Acidic water	Pt
(b)	Aqueous solution of $\text{Ba}(\text{OH})_2$	Ni

H_2 gas obtained on cathode.

● Physical properties of Dihydrogen

(1) Colourless, odourless, Tasteless gas

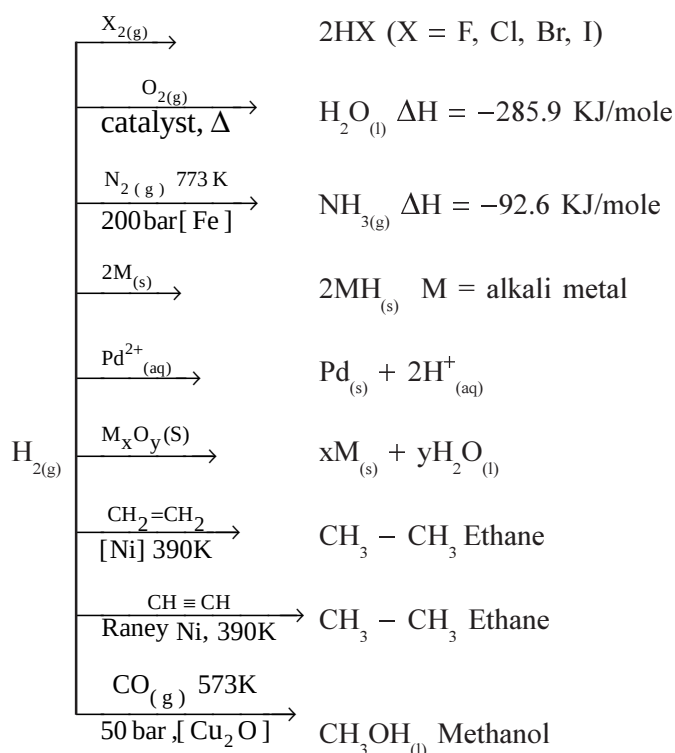
(2) Lighter than air

(3) Insoluble in water

(4) Diamagnetic

(5) Reduction potential 0.0 V

● **Chemical reactions of dihydrogen**



● **Hydride**

Noble gases, Indium (In), Thallium (Tl) and Group 7, 8 and 9 do not give hydride.

General formula : MH or M_mH_n .

Types of Hydride	Element	Properties	Uses
(1) Saline or Ionic	s-block Group-1 MH Group 2 MH_2	(i) Crystalline, solid, non volatile and non conductor (ii) $2H^{-} \xrightarrow{\text{anode}} H_{2(g)} + 2e^{-}$ (iii) Polymeric structure like $(BeH_2)_n$ and $(MgH_2)_n$ (iv) $MH_{(s)} + H_2O_{(l)} \rightarrow MOH_{(aq)} + H_{2(g)}$	Uses of LiH is to prepare $LiAlH_4$ and $LiBH_4$ which act as reducing agent
(2) Metallic or Interstitial	d-block, f-block, only Cr from 6th Group.	Non-stoichiometric because hydrogen is absorbed in the interstitial place of metal.	catalyst
(3) Molecular or Co-valent	Metallic and non metallic p-block elements, Electron deficient hydride : B_2H_6 Electron precise hydride : CH_4 Electron rich hydride : H_2O , NH_3 , HF	(i) Gas, liquid form (ii) stable	

10. When Zn metal is added to concentrated NaOH it produces combustible gas and gives
 (A) Na_2ZnO_3 (B) Na_3ZnO_2 (C) Na_2ZnO_2 (D) NaZnO_2
11. Which electrolysis gives pure dihydrogen ?
 (A) Aqueous solution of KOH (B) Aqueous solution of $\text{Ba}(\text{OH})_2$
 (C) Water containing H_2SO_4 (D) Water containing NaOH
12. $\text{Water gas} + \text{H}_2\text{O}_{(g)} \xrightarrow[\text{[Z]}]{673\text{K}} \text{CO}_{2(g)} + 2\text{H}_{2(g)}$ Z =
 (A) Cu_2O (B) Fe (C) Ni (D) FeCrO_4
13. Which of the following passes through $\text{CO}_{2(g)} + \text{H}_{2(g)}$ to get H_2 gas ?
 (A) H_2O (B) Con. H_2SO_4 (C) dil. HCl (D) Hot solution of KCl
14. Which electrolysis produces H_2 gas on anode ?
 (A) Aqueous solution of $\text{Ba}(\text{OH})_2$ (B) Acidic water
 (C) Fused sodium hydride (D) concentrated NaCl
15. Which of the following pair of elements do not give hydride compounds ?
 (A) Ca, Be (B) In, Tl (C) Li, P (D) Sb, V
16. Which hydride of s-block possess covalent and polymeric structure ?
 (A) BeH_2 (B) LiH (C) CaH_2 (D) NaH
17. $2\text{MH} + \text{B}_2\text{H}_6 \rightarrow 2\text{MBH}_4$ which block of M-element belong ?
 (A) d (B) s (C) p (D) f
18. Position of element in periodic table, which of the following is electron precise hydride ?
 (A) period 2, group 14 (B) period 2, group 15 (C) period 2, group 13 (D) period 2, group 16
19. What is the set of quantum no of valence electron in which it is electron deficient hydride ?
 (A) $n = 3, l = 1$ (B) $n = 2, l = 0$ (C) $n = 2, l = 1$ (D) $n = 4, l = 2$

Answers : 10. (C), 11. (B), 12. (D), 13. (A), 14. (C), 15. (B), 16. (A), 17. (B) 18. (A), 19. (C)

● Water : Universal Solvent

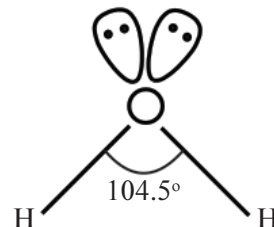
Physical Property :

- (1) colourless, odourless, tasteless liquid
- (2) Melting Point : 273K, boiling point : 373K, density 1.0 gm cm^{-3} at 298 K
- (3) Polar, anomalous volume expansion between 273K to 277K

Structure :

(1) Types of hybridisation : sp^3

Bond angle : 104.5° , Bond length : 95.7 pm



Due to two non-bonding e^- pairs bond angle decreases from $109^\circ 28'$

(2) **Ice** : A definite three dimensional structure is formed by hydrogen bonds. It is lighter than water.

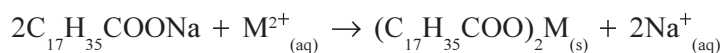
● Chemical Properties of Water

	concentration →	55.55 mol lit ⁻¹ at 298 K	
H ₂ O →		H ₃ O ⁺ _(aq) + OH ⁻ _(aq)	At equilibrium [H ₃ O ⁺] = [OH ⁻] = 10 ⁻⁷ M
NH _{3(g)} →	Base	NH ₄ ⁺ _(aq) + OH ⁻ _(aq)	} Amphoteric nature
H ₂ S →	Acid	HS ⁻ _(aq) + H ₃ O ⁺ _(aq)	
HS ⁻ →	Acid	S ⁻² _(aq) + H ₃ O ⁺ _(aq)	
Na →		NaOH _(aq) + H _{2(g)}	Oxidizing agent
H ₂ O _(l) →	CO ₂ Photo synthesis	C ₆ H ₁₂ O ₆ + O ₂	} Reducing agent
F ₂ →		HF _(aq) + O _{2(g)}	
P ₄ O ₁₀ →		H ₃ PO ₄	
AlCl ₃ →		[Al(H ₂ O) ₆] ³⁺ _(aq) + 3Cl ⁻ _(aq)	} Hydration reaction
SiCl ₄ →		SiO ₂ + HCl	
Ca ₃ N ₂ →		Ca(OH) ₂ + NH ₃	

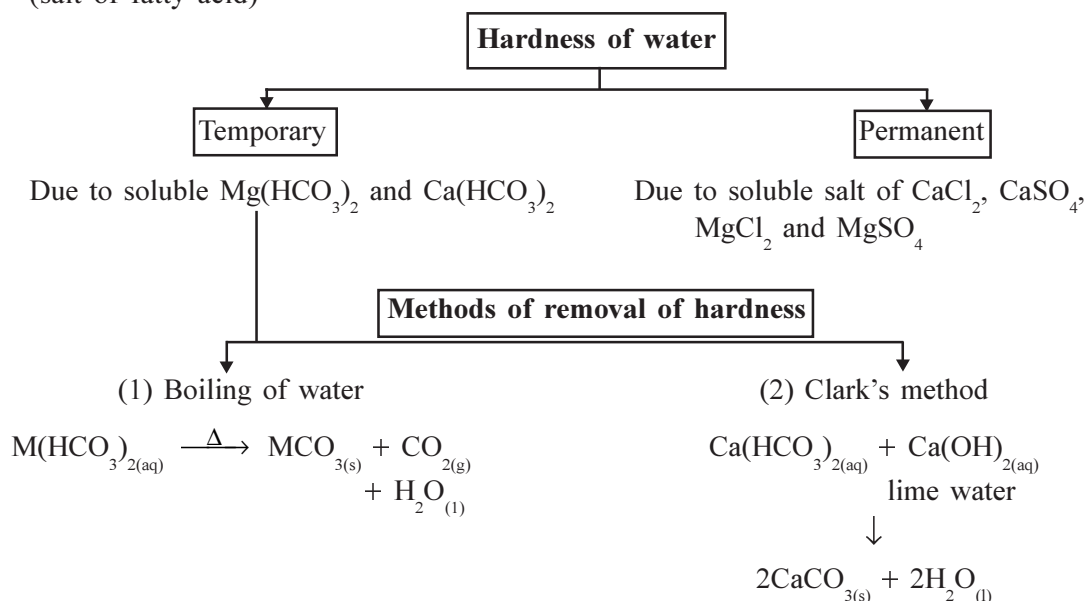
Some compounds are hydrous. The number of molecules of water associated with it is called water of crystallization. Metallic salt : CuSO₄ · 5H₂O, FeSO₄ · 7H₂O, BaCl₂ · 2H₂O

Complex salt : [Ni(H₂O)₆](NO₃)₂, [Cr(H₂O)₆]Cl₃

The water which does not easily form leather with soap is called hard water.



(salt of fatty acid)



● **Methods to remove permanent hardness**

(i) Chemical Method	(ii) Ion-Exchange	(iii) Synthetic Resin
(a) Add determined amount of washing soda $\text{MCl}_{2(aq)} + \text{Na}_2\text{CO}_{3(s)}$ $\text{MCO}_{3(s)} + 2\text{NaCl}_{(aq)}$ $\text{M} = \text{Ca}^{2+} / \text{Mg}^{2+}$	- uses of zeolite - It is aluminosilicate. $\text{Na}_2\text{Al}_2\text{Si}_4\text{O}_{12}$ - Structure like honey comb.	Very effective Exchange Ca^{2+} and Mg^{2+} from cation exchange region (RSO_3Na)
(b) By use of sodium hexa meta phosphate Ca^{2+} and Mg^{2+} ions can be made ineffective.	Na^+ present in void exchange by Ca^{2+} and Mg^{2+} ion.	$2\text{R Na}_{(s)} + \text{M}^{+2}_{(aq)} \rightarrow \text{R}_2\text{M}_{(s)} + 2\text{Na}^+_{(aq)}$
$\text{Na}_6\text{P}_6\text{O}_{18} \rightarrow 2\text{Na}^+ + \text{Na}_4\text{P}_6\text{O}_{18}^{-2}$ calgon $\text{M}^{2+} + \text{Na}_4\text{P}_6\text{O}_{18}^{-2} \rightarrow 2\text{Na}^+ + [\text{Na}_2\text{MP}_6\text{O}_{18}]^{2-}$ ($\text{M} = \text{Ca}, \text{Mg}$).	$2\text{Na}^+\text{Z}^- + \text{Ca}^{2+} \rightarrow \text{Ca}^{2+}(\text{Z}^-)_2 + 2\text{Na}^+$	To remove anions from water, anion exchange resins are used. To make efficient resin again NaCl is passed through it.

20. H–O–H bond angle in water is 104.5° instead of $109^\circ 28'$ because
 (A) it possess sp^3 hybridisation. (B) it contains hydrogen bond
 (C) it has non-bonding e-pair effect (D) it is polar
21. What is the concentration of pure water at 298 K temperature ?
 (A) 10^{-7} M (B) 55.55 M (C) 10^{-14} M (D) 7.00 M
22. In the reaction : $\text{H}_2\text{S}_{(l)} + \text{H}_2\text{O}_{(l)} \rightleftharpoons \text{HS}^-_{(aq)} + \text{H}_3\text{O}^+_{(aq)}$ H_2O acts as
 (I) Acid (II) Base (III) Reductant
 (A) only (I) (B) (II) and (III) (C) (I) and (III) (D) only (II)
23. Hard water is not suitable for washing clothes because
 (A) water forms micelle with soap (B) sodium salt of fatty acid is precipitated
 (C) soap is hydrolysis by water (D) magnesium salt of fatty acid is precipitated
24. Which method is used to remove temporary hardness of water ?
 (A) Distillation (B) Sublimation (C) Filtration (D) Boiling
25. Which substance is used for hard water becomes soft by Clark's method ?
 (A) CaCl_2 (B) Ca(OH)_2 (C) CaCO_3 (D) $\text{Ca(NO}_3)_2$
26. Removal of permanent hardness of water calgon is used because
 (A) to form soluble complex with RCOO^- (B) precipitation of negative components
 (C) to form soluble complex with Ca^{2+} and Mg^{2+} (D) precipitation of positive components.
27. Which method is used to soften hard water completely without salt ?
 (A) Ion exchange (B) Electrolysis (C) Synthetic resin (D) Clark's method

Answers : 20. (C), 21. (B), 22. (D), 23. (D), 24. (D), 25. (B), 26. (C), 27. (C)

● Hydrogen Peroxide (H₂O₂)

Physical Properties :

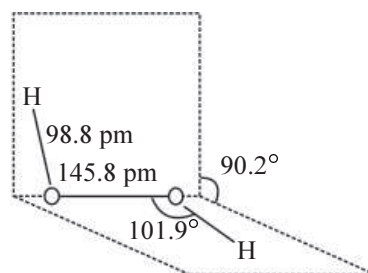
- (i) H₂O₂ in pure form is colourless but in more proportion, it is a blue coloured dense liquid.
- (ii) Its density in solid form is 1.64 g cm⁻³ and in liquid form 1.44 g cm⁻³.
- (iii) Melting Point = 272.4 K, boiling point = 423 K
 - Strong oxidizing agent.
 - H₂O₂ sold in market has H₂O₂ 30% in 100 volume with water.
 - At STP in one millilitre 30% H₂O₂ gives 100 ml of oxygen.

● Structure

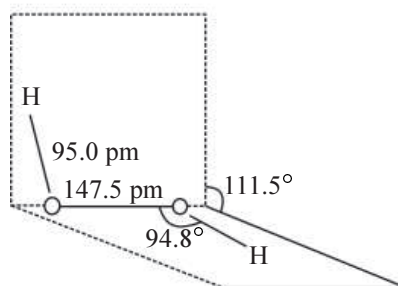
- There are two bonds O–O and H–O in H₂O₂.
- In peroxide (–O–O)²⁻ ion is present. Its molecule is non planar.

Uses :

- (i) As bleaching agent.
- (ii) As mild disinfectant in dentistry which is sold in market as perhydral.
- (iii) In preparation of chemicals like sodium percarbonate, sodium perborate etc.
- (iv) As the controller in pollutants.



(Solid Form)



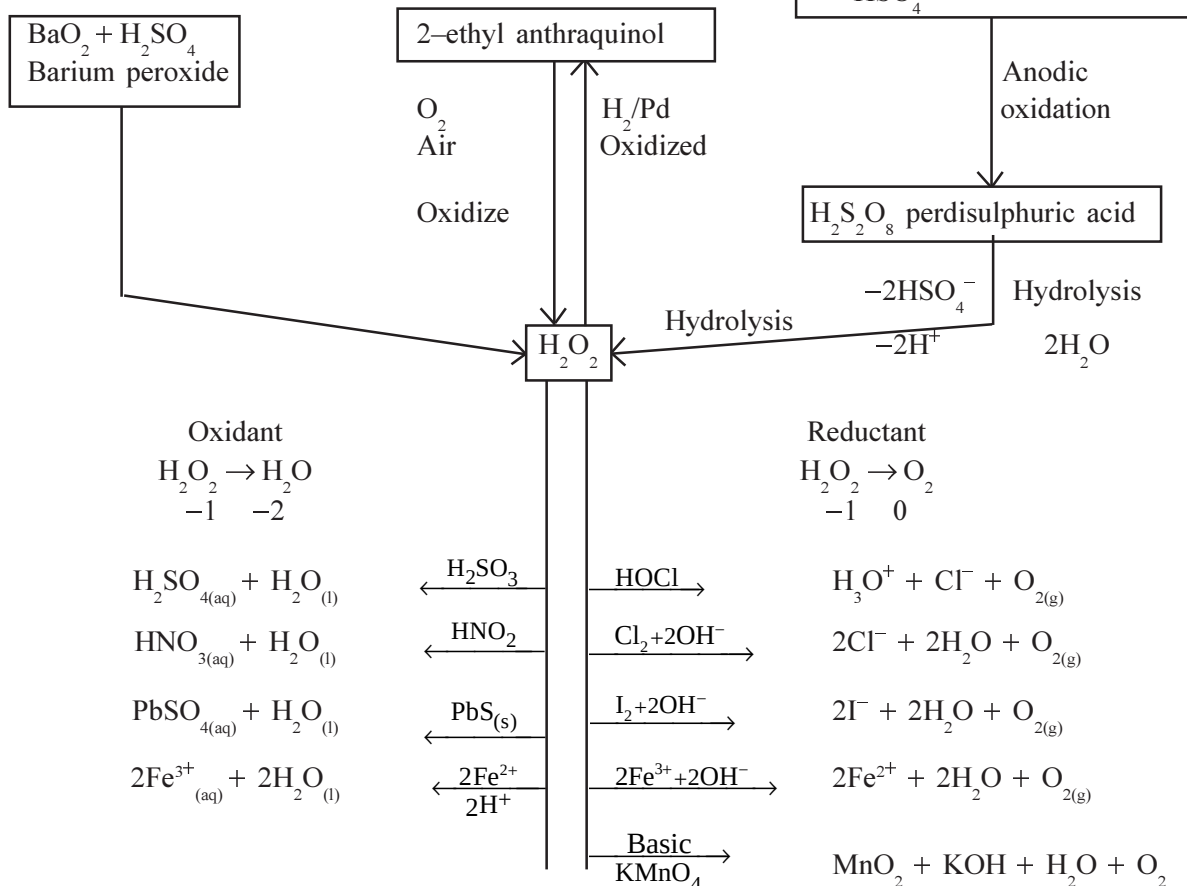
(Gas Form)

● Preparation and properties of H₂O₂

(1) J. L. Thenard

(2) Industrially

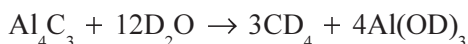
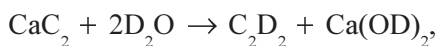
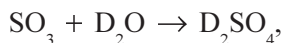
(3) High current density of HSO₄⁻



- **Heavy water (D₂O)**

Oxides of dueterium

- **Chemical Properties**



- **Uses**

As moderator, to obtain compounds of dueterium to understand mechanism of a reaction exchange of ions etc.

- **Economic utility of Dihydrogen**

Because of decrease in quantity of crude oil available from the earth, not possible to store electrical energy and limitations of obtaining nuclear energy, the utility of dihydrogen can be the source of energy in its place

Hydrogen fuel is ecofriendly

- **Problems**

(i) production of low cost (ii) storage (iii) transformation

- **Uses of dihydrogen :**

(i) As a fuel in rocket (ii) As reductant (iii) Production of NH₃, CH₃OH, HCl etc. (iv) Used in cutting and welding work of metals.

- **Formulas of Examples**

$$(1) M = \frac{W}{M' \times V} \quad \text{Where, } M = \text{molarity}$$

$$(2) N = \frac{W}{E \times V} \quad \text{Where, } N = \text{normality}$$

W = weight of solute (gm.)

W = weight of solute (gm.)

M' = molecular weight of solute (gm)

E = equivalent weight of solute

V = volume of solution (lit.)

V = volume of solution (lit)

$$(3) \frac{\text{gram}}{\text{litre}} = N \times \text{Equivalent weight}$$

$$(4) \text{Equivalent weight of H}_2\text{O}_2 = 17$$

$$(5) N \text{ for H}_2\text{O}_2 = 2M$$

$$(6) \% \frac{W}{V} = \text{gm of H}_2\text{O}_2 \text{ dissolve in 100 ml}$$

volume of solution

$$(7) \text{Volume} = \% \frac{W}{V} \times 3.294$$

$$(8) \% \frac{W}{V} = 3.4 \times M$$

$$(9) \% \text{ Volume} = 11.2 \times M$$

$$(10) N_1 V_1 = N_2 V_2$$

$$(11) (\text{strength})_1 \times (\text{volume of solution})_1 + (\text{strength})_2 \times (\text{volume of solution})_2 + (\text{strength})_3 \times (\text{volume of solution})_3 = \text{Strength} \times \text{Volume of mix solution}$$

$$\text{where, strength} = \% \frac{W}{V} = \frac{\text{gram}}{\text{litre}} = \text{volume}$$

28. Which statement is wrong according to H_2O_2 ?
 (A) It is blue coloured dense liquid. (B) It contains two-OH group in one plane.
 (C) It possess open book like structure. (D) As bleaching agent in leather industry.
29. Which behaviour of H_2O_2 show in the reaction ? $\text{H}_2\text{O}_{2(l)} \rightarrow 2\text{H}^+ + \text{O}_{2(g)} + 2\text{e}^-$
 (A) oxidant (B) reductant (C) acidic (D) catalyst
30. Which of the following substance is reduced by H_2O_2 in basic medium ?
 (A) Fe^{2+} (B) PbS (C) HOCl (D) SO_3^{2-}
31. Structure of H_2O_2 is
 (A) planar (B) spherical (C) linear (D) non planar
32. Which product is obtained when calcium carbide reacts with heavy water ?
 (A) CD_4 (B) CD_2 (C) Ca_2OD (D) C_2D_2
33. What litre of O_2 gas produced by decomposition of 40 gm litre of H_2O_2 at STP ?
 (A) 9.52 litre (B) 22.4 litre (C) 13.17 litre (D) 17.13 litre
34. How many litres of O_2 gas is produced when 440 gm solute dissolved in 6 lit. H_2O_2 at STP ?
 (A) 5.19 lit. (B) 24.156 lit. (C) 0.865 lit. (D) 144.9 lit.
35. What strength volume and % W/V of 48 gm solubility in 500 ml aqueous solution of H_2O_2 ?
 (A) 31.62, 9.6 (B) 63.24, 19.2 (C) 3.162, 0.96 (D) 6.324, 1.92
36. What amount (gm) of 3.72 mol lit^{-1} aqueous solution of H_2O_2 in 8 lit volume ? As well as what strength in % W/V of its solution ?
- | | Amount (gm) | % W/V |
|-----|-------------|--------|
| (A) | 505.92 | 12.648 |
| (B) | 1011.8 | 12.648 |
| (C) | 101.189 | 1.2648 |
| (D) | 50.592 | 1.2648 |
37. What is molarity (M), normality (N) and strength of solution in gm/lit respectively of 20 volume H_2O_2 solution ?
 (A) 3.57, 3.57, 121.42 (B) 3.57, 7.14, 121.42 (C) 1.785, 3.57, 60.70 (D) 1.785, 1.78, 60.70
38. What is molarity (M), strength in gm/lit and volume of H_2O_2 solution, when 30 ml 0.1M KMnO_4 solution is required for complete oxidation of 30 ml acidic solution of H_2O_2 ?
 (A) 0.12, 0.9, 0.6 (B) 0.06, 0.7, 0.8 (C) 0.1, 1.0, 0.9 (D) 0.05, 1.7, 0.56

39. What is molarity (M), normality (N), strength (%w/v), gm/lit and in volume of 10 lit H_2O_2 solution containing 284 gm H_2O_2 ?

	M	N	% $\frac{W}{V}$	gm/ml	volume
(A)	1.67	1.67	5.68	56.78	18.70
(B)	1.67	3.34	2.839	5.678	18.70
(C)	0.835	1.67	2.839	28.39	9.352
(D)	0.835	0.835	1.419	28.39	9.352

40. What is strength in % $\frac{W}{V}$, gm/lit and volume of solution of H_2O_2 prepared by mixing 400 ml 1.25% $\frac{W}{V}$, 350 ml 2.1% $\frac{W}{V}$ and 250 ml 2.65% $\frac{W}{V}$ strength of H_2O_2 ? As well as what is the molarity (M) and normality (N) of the resulting solution ?

	% $\frac{W}{V}$	gm/lit	Volume	M	N
(A)	1.006	10.06	3.31	0.03	0.06
(B)	1.006	1.006	3.31	0.03	0.03
(C)	1.897	1.897	6.25	1.116	1.116
(D)	1.897	1.897	6.25	0.558	1.116

41. What is the normality of KMnO_4 solution, when 10 ml KMnO_4 aqueous solution is required for complete oxidation of acidic solution of 30 ml 1.5 volume H_2O_2 ?

(A) 0.4 (B) 0.19 (C) 0.8 (D) 0.65

Answers : 28. (B), 29. (B), 30. (C), 31. (D), 32. (D), 33. (C), 34. (B), 35. (A), 36. (B), 37. (C), 38. (D), 39. (C), 40. (D), 41. (C)

● Column Type Questions

42. Match column I with column II.

Column I (Substance)	Column II (Use)
(1) D_2O	(P) As a fuel
(2) H_2O_2	(Q) As moderator
(3) Liquid hydrogen	(R) As disinfectant
(4) $\text{P}_{618}\text{O}_{18}^{6-}$	(S) To understand mechanism of reaction
	(t) To make of Ca^{2+} and Mg^{2+} effective in hard water

- (A) (1) $\rightarrow$ (Q), (2) $\rightarrow$ (R), (3) $\rightarrow$ (P), (4) $\rightarrow$ (t)
 (B) (1) $\rightarrow$ (Q), (R), (2) $\rightarrow$ (P), (3) $\rightarrow$ (S), (4) $\rightarrow$ (t)
 (C) (1) $\rightarrow$ (Q), (S), (2) $\rightarrow$ (R), (3) $\rightarrow$ (P), (4) $\rightarrow$ (t)
 (D) (1) $\rightarrow$ (Q), (P), (2) $\rightarrow$ (R), (S), (3) $\rightarrow$ (P), (4) $\rightarrow$ (t)

43. Match column I with column II.

Column I (Compounds)	Column II (Types of hydride)
(1) LaH_3	(P) Saline
(2) H_2S	(Q) Molecular
(3) CaH_2	(R) Electron rich
(4) B_2H_6	(S) Interstitial

(A) (1) $\rightarrow$ (Q), (2) $\rightarrow$ (R), (3) $\rightarrow$ (P), (4) $\rightarrow$ (Q), (R)

(B) (1) $\rightarrow$ (S), (2) $\rightarrow$ (Q), (3) $\rightarrow$ (P), (4) $\rightarrow$ (Q)

(C) (1) $\rightarrow$ (Q), (S), (2) $\rightarrow$ (R), (3) $\rightarrow$ (P), (4) $\rightarrow$ (R)

(D) (1) $\rightarrow$ (S), (2) $\rightarrow$ (Q), (R), (3) $\rightarrow$ (P), (4) $\rightarrow$ (Q)

44. Match column I with column II.

Column I	Column II
(1) Calgon	(P) Complex salt
(2) $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$	(Q) Market name of H_2O_2
(3) Perhydra	(R) $\text{Na}_4\text{P}_6\text{O}_{18}$
(4) Palladium hydride	(S) Metallic salt
	(T) $\text{P}_6\text{O}_{18}^{6-}$
	(U) Non-stoichiometric

(A) (1) $\rightarrow$ (R), (2) $\rightarrow$ (P), (3) $\rightarrow$ (Q), (4) $\rightarrow$ (S)

(B) (1) $\rightarrow$ (T), (2) $\rightarrow$ (S), (3) $\rightarrow$ (Q), (4) $\rightarrow$ (U)

(C) (1) $\rightarrow$ (R), (2) $\rightarrow$ (P), (3) $\rightarrow$ (Q), (4) $\rightarrow$ (U)

(D) (1) $\rightarrow$ (T), (2) $\rightarrow$ (S), (3) $\rightarrow$ (Q), (4) $\rightarrow$ (P), (U)

Answers : 42. (C), 43. (D), 44. (B)

● T = True, F = False Type Questions

45. (i) To prevent the decomposition of aqueous solution of H_2O_2 stabilizer PO_4^{3-} is added.

(ii) H_2O_2 is useful to prepare good quality of detergent.

(iii) Use of H_2O_2 is dangerous to environment.

(iv) In basic medium H_2O_2 does not make colourless the aqueous solution of KMnO_4 .

(A) TTTF

(B) FTTT

(C) TTFF

(D) FTTF

46. (i) Dihydrogen is paramagnetic.

(ii) Ozone gas is used in cutting and welding of metals.

(iii) Hydrogenation of edible oil in presence of Ni catalyst to give edible fat.

(iv) Water gas is known as synthetic gas.

(A) FFTT

(B) TFFT

(C) TTTT

(D) FFFT

47. (i) Na_2CO_3 is used to remove temporary and permanent hardness of water.

(ii) Basic solution containing Fe^{3+} ion becomes blue by addition of H_2O_2 .

(iii) Oxidation number of hydrogen is +1 in saline hydride.

(iv) Percentage of deuterium in heavy water is 11.11.

(A) TTTF

(B) FFFF

(C) FFTF

(D) FFTT

Answers : 45. (C), 46. (A), 47. (B)

- **There are two statements are given: Among this one is statement (A) and other is reason (R). Select correct option to study instructions carefully.**
 - (A) Statement (A) and Reason (R) both are true and reason (R) is correct explanation of statement (A)
 - (B) Statement (A) and Reason (R) both are true and reason (R) is not correct explanation of statement (A)
 - (C) Statement (A) is correct but reason (R) is wrong.
 - (D) Statement (A) and Reason (R) both are incorrect.
- 48. Statement (A) : Calgon is used to remove Ca^{2+} and Mg^{2+} from hard water.**
Reason (R) : Calgon gives precipitate with Ca^{2+} and Mg^{2+}
- 49. Statement (A) : In acidic medium, H_2O_2 , reacts with KMnO_4 to produce O_2 .**
Reason (R) : KMnO_4 oxidised of H_2O_2 in presence of O_2 .
- 50. Statement (A) : Boron hydride is co-valent hydride.**
Reason (R) : Difference of electronegativity is more between boron and hydrogen.

Answers : 48. (D), 49. (A), 50. (C).

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