HYDROGEN AND THE HYDRIDE

PROBLEMS BASED ON GIVEN TOPICS

- Electronic structure
- Position in the periodic table
- Abundance of hydrogen
- Preparation of hydrogen
- Properties of molecular hydrogen
- Isotopes of hydrogen
- Ortho and para hydroge
- Hydrides
  - Ionic or salf - like hydrides
  - Covalent hydrides
  - Metallic (or interstitial) hadrides
  - Intermediate hydrides
- The hydrogen ion
- Acids and Bases
  - Arrhenius theory
  - Acid and bases in proton solvens
  - Bronsted - Lowry theory
  - Lewis theory
  - The lux-flood definition

CHAPTER 8

Hydrogen and The Hydride

EXERCISE # I

❑ **Only one correct answer :**

1. An unreactive diatomic gas A(1 mole) was treated with 3 moles of H_2 in presence of catalyst to give another gas (*b*) which is basic in nature. Gas (*b*) on further oxidation in moist condition gives a compound (*c*) which is part of acid rain. Gas (*a*) and gas (*b*) are respectively.

(*a*) Cl_2 and HCl (*b*) Br_2 and HBr

(*c*) P_2 and PH_3 (*d*) N_2 and NH_3

2. The radioactive isotopes of hydrogen is :-

(*a*) Tritium (*b*) Deuterium

(*c*) Protium (*d*) Hydronium

3. Electron precise hydrides are formed by combination of hydrogen with all :-

(*a*) Elements of group 13

(*b*) Elements of group 14

(*c*) Elements of group 15

(*d*) Elements of group 16

4. Elements of group 15 form :-

(*a*) Elements defficient hydrides

(*b*) Elements rich hydrides

(*c*) Elements precise hydrides

(*d*) None

5. Ionisation energy of hydrogen in kJ mol^{-1} is :-

(*a*) 520 (*b*) 495

(*c*) 1681 (*d*) 1312

6. Hydrolith is :-

(*a*) CaH_2 (*b*) BaH_2

(*c*) SrH_2 (*d*) BeH_2

7. Heavy water (D_2O) is used :-

(*a*) For preparation of polymer

(*b*) For preparation of hydro carbon

(*c*) In atomic reactor to carry out nuclear fission

(*d*) None

8. An ionic hydride of an alkali metal has significant covalent charater and is almost unreactive towareds oxygen and chlorine. It is used to prepare the synthesis of other useful hydrides which acts as reducing agent. The hydries is -

(*a*) LiH (*b*) BeH_2

(*c*) CaH_2 (*d*) KH

9. $H_2O + NH_2^- \rightleftharpoons NH_3 + OH^-$ ...(i)

$H_2O + CH_3CO_2H \rightleftharpoons CH_3CO_2^- + H_3O^+$ ...(ii)

In reation (i) and (ii) water acts as :-

(*a*) acid & acid respectively

(*b*) acid & base respectively

(*c*) base & acid respectively

(*d*) base & base respectively

10. Electron precise hydrides are :-

(*a*) Pyramidal (*b*) Trigonal planar

(*c*) Tetrahedral (*d*) Bent

11. H^+ in aqueous solution exists as :-

(*a*) OH^- (*b*) H-O-O^-

(*c*) H_3O^+ (*d*) H_3O^{2+}

12. When Na_2O_2 is treated with dilute H_2SO_4, the products obtained are :-

(*a*) Na_2O_2 & H_2O_2 (*b*) Na_2SO_4 & O_2

(*c*) Na_2SO_4 & H_2 (*d*) Na_2SO_4 & H_2O_2

8.4 HYDROGEN AND THE HYDRIDE

13. Hydrogen combines with other elements by :-
(*a*) Loosing an electron only
(*b*) Gaining an electron only
(*c*) Sharing an electron only
(*d*) Loosing, gaining and sharing electron

14. Hydrogen is :-
(*a*) Colourless and odourless gas
(*b*) Colourless and pungent odour gas
(*c*) Coloured and odourless gas
(*d*) Coloured and pungent odour gas

15. Heavy water is :-
(*a*) H_2O^{18}
(*b*) D_2O
(*c*) Water with specific gravity 1
(*d*) Water at 0°C

16. Heavy water freezes as :-
(*a*) 0°C (*b*) –3.8°C
(*c*) 3.8°C (*d*) –5°C

17. Electrolysis of molten ionic hydride gives :-
(*a*) Hydrogen at cathode
(*b*) Hydrogen at anode
(*c*) Metal at anode
(*d*) No reaction

18. Which of the following represent a pair of covalent hydrides :-
(*a*) $TiH_{1.5-1.8}$; $VH_{0.56}$ (*b*) H_2S ; HF
(*c*) KH ; NaH (*d*) SiH_4 ; RbH

19. Which of the following represent a pair of interstitial hydrides :-
(*a*) $TiH_{1.5-1.8}$; $VH_{0.56}$ (*b*) H_2S ; HF
(*c*) KH ; NaH (*d*) SiH_4 ; RbH

20. Which has least boiling point :-
(*a*) Liquid CO_2 (*b*) Liquid O_2
(*c*) Liquid H_2 (*d*) Liquid N_2

21. Hydrogen can not reduced :-
(*a*) Heated CuO (*b*) Heated Fe_2O_3
(*c*) Heated SnO_2 (*d*) Heated Al_2O_3

22. Which of the following can not be oxidised by H_2O_2 :-
(*a*) PbS (*b*) KI + HCl
(*c*) Na_2SO_3 (*d*) O_3

23. Deionised water is obtained by passing hard water through :-
(*a*) Cation exchanger
(*b*) anion exchanger
(*c*) Both cation and anion exchanger
(*d*) Permutit process

24. Elements of which of the following groups in periodic table do not form compound with hydrogen :-
(*a*) Group 7,8,9 (*b*) Group 13
(*c*) Group 15,16,17 (*d*) Group 14

25. The correct order of ionic character among all alkaline earth hydride :-
(*a*) $BeH_2 < CaH_2 < MgH_2 < BaH_2 < SrH_2$
(*b*) $BeH_2 < CaH_2 < MgH_2 < SrH_2 < BaH_2$
(*c*) $BeH_2 < CaH_2 < BaH_2 < MgH_2 < SrH_2$
(*d*) $SrH_2 < CaH_2 < MgH_2 < BaH_2 < BeH_2$

26. Boiling point of H_2O_2 is more than H_2O. It is due to :-
(*a*) more intermolecular hydrogen bonding in H_2O_2 w.r.t. H_2O
(*b*) more intramolecular hydrogen bonding in H_2O_2 w.r.t. H_2O
(*c*) less polarity in H_2O_2 w.r.t. H_2O
(*d*) higher specific heat in H_2O_2 w.r.t. H_2O

27. Which can not be used to prepare H_2O_2 , when BaO_2 reacts with:-
(*a*) conc. H_2SO_4 (*b*) dilute H_2SO_4
(*c*) H_3PO_4 (*d*) CO_2 in H_2O

28. Marck perhydrol is the trade name of which chemical species ?
(*a*) H_2 (*b*) H_2O
(*c*) H_2O_2 (*d*) O_2

29. Which of the following can be soluble soag ?
(*a*) $C_{17}H_{35}CO_2Na$ (*b*) $(C_{17}H_{35}CO_2)_2Mg$
(*c*) $(C_{17}H_{35}CO_2)_2Ca$ (*d*) $C_{17}H_{35}CO_2Li$

30. Temporary hardness of water is caused by the presence of :-

(*a*) insoluble bicarbonates of calcium , magnesium and iron in water

(*b*) soluble bicarbonates of calcium , magnesium and iron in water

(*c*) insoluble carbonates of calcium , magnesium and iron in water

(*d*) soluble carbonates of calcium , magnesium and iron in water

31. A clear transparent liquid is taken in a glass. Which of the following will provide clue whether it is water or not

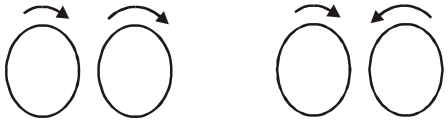
(*a*) Adding a litmus paper

(*b*) Adding few drops of the liquid over anhydrous copper sulphate

(*c*) Adding few drops of the liquid over anhydrous Sodium chloride

(*d*) By testing its smell

32.



A (parallel spin of protons) B (opposed spin of protons)

(*a*) A is called ortho hydrogen and B is called para hydrogen

(*b*) A is called para hydrogen and B is called ortho hydrogen

(*c*) A is called ortho hydrogen and B is called meta hydrogen

(*d*) A is called para hydrogen and B is called meta hydrogen

33. When zeolite, which is hydrated sodium aluminium silicate is treated with hard water, the sodium ion are exchanged with :-

(*a*) H^+ ions (*b*) Ca^{2+} ions

(*c*) SO_4^{2-} ions (*d*) OH^-

34. Polyphosphates are used as water softening agnets because they :-

(*a*) form soluble complexes with anionic species

(*b*) percipitate anionic species

(*c*) form soluble complexes with cationic species

(*d*) percipitate cationic species

35. Which one of the following processes will produce permanent hard water :-

(*a*) addition of Na_2SO_4 to water

(*b*) saturation of water with $CaCO_3$

(*c*) saturation of water with $MgCO_3$

(*d*) saturation of water with $CaSO_4$

36. The reagent commonly used to determine hardness of water titrimetrically is :-

(*a*) oxalic acid

(*b*) disodium salt of EDTA

(*c*) sodium citrate

(*d*) sodium thiosulphate

37. In context with the industrial preparation of hydrogen form water gas (CO+ H_2), which of the following is the correct statement :-

(*a*) CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of CO_2 in alkali

(*b*) CO and H_2 are fractionally separated using differences in their densities

(*c*) CO is removed by absorption in aqueous Cu_2Cl_2 solution

(*d*) H_2 is removed through occlusion with Pd

38. H_2 (Ni) can not reduce :-

(*a*) RCN (*b*) RCHO

(*c*) RCO_2H (*d*) R–CH=CH–R

39. Organic higly branched alkyl groups and higly polar inorganic groups are :-

(*a*) hydrophobic and hydrophilic respectively

(*b*) hydrophilic and hydrophobic respectively

(*c*) hydrophilic only

(*d*) hydrophobic only

40. Roshan heard that instructions were given to laboratory attendent to store a particular chemical in dark room. It must be kept away from the dust. This chemical is important for use in the pollution control treatment of domestic and industrial effluents. The chemical is

(*a*) O_3 (*b*) H_2O_2

(*c*) H_2O (*d*) H_2

8.6 HYDROGEN AND THE HYDRIDE

41. Which of the following statement is incorrect :-

(*a*) Hydrogen peroxide is stored in wax lined bottles

(*b*) Hard water does not form lather with soap

(*c*) Tritium is a strategic material for thermonuclear weapons (Hydrogen bomb)

(*d*) None is incorrect

42. Which of the following reaction is an examples of used of water gas in the synthesis of other compounds?

(*a*) $CH_4(g) + H_2O(g) \xrightarrow[(Ni)]{1270K} CO(g) + H_2(g)$

(*b*) $CO(g) + H_2O(g) \xrightarrow[(Catalyst)]{673K} CO_2(g) + H_2(g)$

(*c*) $C_nH_{2n+2} + nH_2O(g) \xrightarrow[(Ni)]{1270K} nCO + (2n+1)H_2$

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

43. A mixture of two gases AsH_3 and SbH_3 is passed through a tube heated at the middle portion. It is called Marsh's Test. What is the observation and why?

(*a*) Black mirror of antimany is deposited far away from heated spot because of more thermal stability of SbH_3 than AsH_3

(*b*) Black mirror of antimany is deposited nearer from heated spot because of less thermal stability of SbH_3 than AsH_3

(*c*) No black deposit is formed

(*d*) Brown colour gas SbH_3 evolved but no evolution of AsH_3 takes place.

44. Which has highest dipole moment ?

(*a*) H_2 (*b*) CH_4

(*c*) H_2O (*d*) H_2O_2

45. 2000 gm aqueous solution of $CaCO_3$ contains 20 gm of $CaCO_3$. Concentration of the solution is

(*a*) 10 ppm (*b*) 100 ppm

(*c*) 1000 ppm (*d*) 10000 ppm

46. Excess of KI and dilute H_2SO_4 were mixed in 50 ml H_2O_2. The I_2 liberated requires 20 ml of 0.1 (N) $Na_2S_2O_3$. The strength of H_2O_2 in gm/lit will be

(*a*) 0.12 (*b*) 0.24

(*c*) 0.39 (*d*) 0.52

EXERCISE # II

❑ **One or More Than One Correct Answer :**

1. Elements of group 13 form :-

(*a*) Hydrides which are electron defficient

(*b*) Hydrides which are electron rich

(*c*) Hydrides which have incomplete octet

(*d*) Hydrides which have complete octet

2. What are the characteristic features of ionic hydrides :-

(*a*) ionic hydrides do not conduct electricity in solid state

(*b*) ionic hydrides are very good conductors of electricity in solid state

(*c*) ionic hydrides conduct electricity in aqueous solution

(*d*) metallic hydrides are example of ionic hydrides

3. Hydrogen is released by the action of cold dilute HNO_3 on :-

(*a*) Fe (*b*) Mn

(*c*) Cu (*d*) Mg

4. Which of the followings are example of saline hydrides :-

(*a*) NH_3 (*b*) NaH

(*c*) SiH_4 (*d*) KH

5. Which elements when combined with hydrogen give products where hydrogen has negative oxidation state :-

(*a*) Li (*b*) S_8

(*c*) N_2 (*d*) Be

6. In which of the following compound hydrogen has positive oxidation state :-

(*a*) HBr (*b*) NH_3

(*c*) BaH_2 (*d*) HI

7. Which oxidation state are exhibited by hydrogen in its compound :-

(*a*) 0

(*b*) +1

(*c*) +2

(*d*) –1

8. In what aspect, hydrogen molecule resemble alkali metals ?

(*a*) Hydrogen molecules & alkali metals both are diatomic with almost same ionisation energy

(*b*) Both elements can loose electron to form mono positive ion

(*c*) When HX and MX are electrolysed , hydrogen (H_2) and M (metal) are generated at cathode

(*d*) Both are diatomic

9. Which property of hydrogen molecule similar to halogen :-

(*a*) Hydrogen accepts an electron to form noble gas configuration like halogen

(*b*) Hydrogen , halogen both are diatomic molecule

(*c*) Hydrogen , halogen both are polar molecule

(*d*) Hydrogen , halogen both are nonpolar molecule

10. Sodium reacts with which compound to give hydrogen gas :-

(*a*) Cyclopentadine (*b*) Ethyl alcohol

(*c*) Diethyl ether (*d*) Ethane

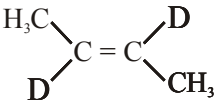
11. Which of the following reaction give correct product :-

(*a*) $CaC_2 + 2D_2O \rightarrow C_2D_2 + Ca(OD)_2$

(*b*) $CH_3MgX + D_2O \rightarrow CH_3D + (OD)MgX$

(*c*) $CD_4 + Cl_2 \rightarrow CD_3Cl + DCl$

(*d*) $H_3C - C \equiv C - CH_3 \xrightarrow{\text{Li in } ND_3}$



12. Correct increasing order :-

(*a*) $BeH_2 < TiH_2 < CaH_2$ (electrical conductance)

(*b*) LiH < NaH < CsH (ionic character)

(*c*) F–F < D–D < H–H (bond dissociation energy)

(*d*) $H_2O < NH_3 < PH_3$ (reducing property)

13. Which of the following statements are not true for hydrogen :-

(*a*) it forms a large number of ionic compound by loosing an electron

(*b*) it has one electron in outermost shell

(*c*) it can loose an electron to form a cation which can freely exists

(*d*) it can loose an electron to form a cation which can not freely exists

14. Which reaction indicate reducing property of H_2O_2:-

(*a*) $KIO_4 + H_2O_2 \rightarrow KIO_3 + H_2O + O_2$

(*b*) $2Fe^{3+} + 2H^+ + H_2O_2 \rightarrow 2Fe^{2+} + 2H_2O + O_2$

(*c*) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

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

15. Which reaction indicate oxidising property of H_2O_2:-

(*a*) $2[Fe(CN)_6]^{4-} + 2H^+ + H_2O_2 \longrightarrow 2[Fe(CN)_6]^{3-} + 2H_2O$

(*b*) $2I^- + 2H^+ + H_2O_2 \longrightarrow I_2 + 2H_2O$

(*c*) $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2OH^-$

(*d*) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

16. Correct option regarding H_2O.

(*a*) H_2O is a weak field ligand

(*b*) H_2O can act as lewis base

(*c*) H_2O is used as protic solvent

(*d*) H_2O is a very important analytical reagent to identify acidic radical

17. F_2 when reacts with H_2O, the products obtained can be

(*a*) HF (*b*) O_2

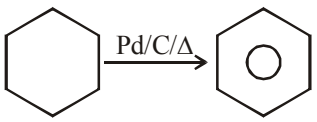
(*c*) O_3 (*d*) F_2O

18. Which of the following process, correct name is given

(*a*) $RCH = CHR + H_2 \rightarrow RCH_2 - CH_2R$ hydrogenolysis

(*b*) $RCH = CHR + O_3 \rightarrow RCHO + RCHO$ ozonolysis

(*c*) $RCO_2R + H_2O \rightarrow RCO_2H + ROH$ hydrolysis

(*d*)  dehydrogenation

19. H^- and He both have $1s^2$ electronic configuration

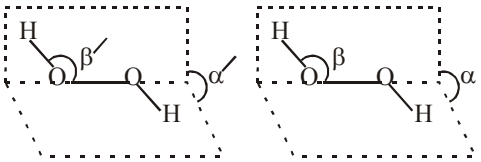
(*a*) reactivity order $H^- = He$

(*b*) Stability order $H^- = He$

(*c*) reactivity order $H^- > He$

(*d*) Stability order $H^- < He$

20. The structure of H_2O_2 in solid crystal and gas phase is given as follows :-



Correction option

(*a*) $\alpha' > \beta'$ (*b*) $\beta' > \alpha'$

(*c*) $\alpha > \beta$ (*d*) $\beta > \alpha$

EXERCISE # III

❑ **Linked Comprehension Type :**

Passage for Q.1 to Q.3

Binary compounds of the elements with hydrogen are called hydrides. The type of hydride which an element forms largely depend on its electronegativity. They are broadly of three types namely salt like, molecular and interstitial hydride.

1. Correct option regarding salt like hydride.

(*a*) They are formed by elements of very low electronegativity, e.g. the alkali and alkaline earth metals of group IA and IIA.

(*b*) They are colourless solid formed by heating the metal in H_2 at temperature 150°C to 700°C.

(*c*) They are ionic hydrides, contain hydride ion

(*d*) All

2. Correct option regarding molecular hydride.

(*a*) They are formed by elements of higher electronegativity, e.g. non-metal of group IIIB to VIIB

(*b*) They are covalent , usually volatile liquid

(*c*) They are low melting and boiling point and are nonelectrolyte in the liquid state and in solution in nonpolar solvent.

(*d*) All

3. Correct option regarding interstitial hydride.

(*a*) Their formula are non-stoichiometric for e.g., $TiH_{1.73}$; $VH_{0.6}$

(*b*) A number of transition metals when heated to moderate temperature absorbs large amount of hydrogen form interstitial hydride.

(*c*) The interstitial hydrides are less than the parent metals

(*d*) All

Passage for Q.4 to Q.6

Nascent hydrogen is hydrogen at the moment of its generation. Nascent hydrogen is more reactive than ordinary hydrogen. It is more powerful reducing agent than ordinary hydrogen.

4. Correct option regarding Nascent hydrogen.

(*a*) Nascent hydrogen is in ionic state of hydrogen

(*b*) Nascent hydrogen is in molecular state of hydrogen

(*c*) Nascent hydrogen is in atomic state of hydrogen

(*d*) Nascent hydrogen is in deactivated state of hydrogen

5. Which reaction can generate Nascent hydrogen?

(*a*) Devardas alloy + NaOH $\rightarrow$

(*b*) Sodium amalgum + $H_2O \rightarrow$

(*c*) Zinc + dilute $H_2SO_4 \rightarrow$

(*d*) All

6. Nascent hydrogen can reduce.

(*a*) Yellow $FeCl_3$ solution

(*b*) Pink solution of $KMnO_4$, H^+

(*c*) Potassium chlorate

(*d*) All

Passage for Q.7 to Q.9

Cold water is rapidly decomposed by alkali metals Li, Na, K etc. The vigour of the reaction may be moderate by alloying the alkali metal with lead of using an amalgum of the metal.

7. The reactivity of alkali metals towards water-

(*a*) Li > Na > K > Rb > Cs

(*b*) Cs > Rb > K > Na > Li

(*c*) Na > K > Li > Rb > Cs

(*d*) Cs > Rb > Li > K > Na

8. Which alkaline earth metal does not react with cold water to give hydrogen gas ?

(*a*) Be (*b*) Mg

(*c*) Ca (*d*) Ba

9. Red hot metal when reacts with steam give mixed oxide. Which metal can not give mixed oxide?

(*a*) Zn (*b*) Mg

(*c*) Both Zn and Mg (*d*) Fe

Passage for Q.10 to Q.12

Pure hydrogen peroxide is a clear pale blue, viscous liquid. It is soluble in water in all proportions, also soluble in ether but is insoluble in benzene. It slowly decomposes at ordinary temperature and readily when heated into water and oxygen evolving much heat.

10. Which of the following compound / object retards the deocmposition of H_2O_2 -

(*a*) Metals like gold (*b*) Dust particles

(*c*) Phosphoric acid (*d*) Fe_3^+

11. Which of the following statement is not correct regarding H_2O_2 ?

(*a*) H_2O_2 has dipole moment 1.02 Debye

(*b*) H_2O_2 has boiling point 152°C Debye

(*c*) O–O bond distance is 1.49Å

(*d*) $\angle$ HOO bond angle is 97° in liquid H_2O_2

12. Which reagents can be used to distinguish H_2O_2 and O_3 ? (H_2O_2 participate in the reaction to change the colour but for O_3, no reaction)

(*a*) K_2CrO_4 solution + dil. H_2SO_4

(*b*) $KMnO_4$ solution + dil. H_2SO_4

(*c*) TiO_2 solution + dil. H_2SO_4

(*d*) All

Passage for Q.13 to Q.15

Water is a hydride of oxygen. Water is liquid at ordinary temperature. The properties of liquid water are highly anomalous. It's specific heat, latent heat of fusion and vaporisation are all abnormally high. It boils at 100°C.

13. Individual water molecules are only existent in -

(*a*) Solid state

(*b*) Liquid state

(*c*) Vapour state above 100°C

(*d*) All

14. X ray study of crystalline structure of ice indicates each water molecule is tetrahedrally surrounded by the other four water molecule. What type of bonding exists ?

(*a*) Two by H-bonding & two by normal covalent bonding

(*b*) Three by H-bonding & one by normal covalent bonding

(*c*) One by H-bonding & three by normal covalent bonding

(*d*) All four by H-bonding

15. Soap (soluble sodium salt of palmitic acid) $\xrightarrow[\text{(hard water)}]{+CaCl_2}$ 2NaCl + P↓ (insoluble calcium palmitate)

P is -

(*a*) $(C_{17}H_{35}CO_2)_2Ca$ (*b*) $(C_{15}H_{31}CO_2)_2Ca$

(*c*) $(C_{17}H_{32}CO_2)_2Ca$ (*d*) None

Matrix Match Type :

1. Match the column :-

Column - I (Reaction)

(*a*) Steam + Red hot coke $\xrightarrow{1000°C}$

(*b*) Steam + Red hot iron $\xrightarrow{600\text{-}850°C}$

(*c*) 20% Castic soda $\xrightarrow{\text{electrolysis}}$

(*d*) CH_4 + steam $\xrightarrow{\text{high temperature}}$

Column - II (Process/Product)

(P) Water gas process

(Q) H_2 preparation (industrial)

(R) Steam iron process

(S) Oxide formed as biproduct

(T) Steam hydrocarbon process

2. Match the column :-

Column - I	**Column - II**
Product formed	**Type of reaction**
(*a*) D_2O	(P) electrolysis of 50% H_2SO_4
(*b*) H_2O_2	(Q) prolonged electrolysis of water (H_2O)
(*c*) (H_2+CO_2)	(R) water gas shift reaction
(*d*) O_3	(S) auto oxidation of 2 ethyl anthraquinol
	(T) silent discharge of oxygen gas

3. Match the column :-

Column - I (Behave as)

(*a*) H_2O_2 acts as reducing agent

(*b*) H_2O_2 acts as oxidising agent

(*c*) H_2 acts as reducing agent

(*d*) H_2 acts as oxidising agent

Column - II (With elements compounds/in medium)

(P) with metals like Na, K, Ca

(Q) in acidic medium

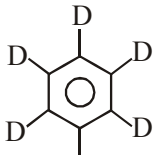
(R) in basic medium

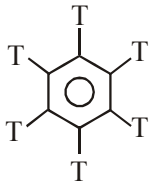
(S) with nonmetals like Cl_2

4. Match the column :-

Column - I (Molecules)

(*a*) 

(*b*) 

(*c*) 

(*d*) D_2O

Column - II (Features)

(P) Polar molecule

(Q) dipole moment is zero

(R) most reactive towards nitration

(S) most reactive towards sulphonation

(T) dielectric constant less than water

5. Match the column :-

Column - I

(*a*) Use of hexametaphosphate

(*b*) Use of hydrogen peroxide

(*c*) Use of sodium borohydride

(*d*) Use of hydrogen (nickel)

Column - II

(P) Removal of permanent hardness

(Q) Reducing agent

(R) Hydrogenation

(S) Propellant

6. Match the column :-

Column - I **Molecules**	**Column - II** **Features**
(*a*) H_2O	(P) Polar solvent
(*b*) H_2O_2	(Q) Nonlinear molecule
(*c*) D_2O	(R) Less acidic than methanol
(*d*) C_2H_5OH	(S) Used in atomic reactor

7. Match the column :-

Column - I	**Column - II**
(*a*) $H_2 > D_2$	(P) Boiling point
(*b*) $D_2 > H_2$	(Q) Freezing point
(*c*) $H_2O > D_2O$	(R) Vapour pressure
(*d*) $D_2O > H_2O$	(S) Latent heat of vaporisation at boiling point
	(T) Latent heat of fusion at melting point

8. Match the column :-

Column - I	**Column - II**
(*a*) Protium	(P) one proton
(*b*) Deuterium	(Q) two neutrons
(*c*) Tritium	(R) one neutron
(*d*) Helium	(S) zero neutron
	(T) two proton

9. Match the column :-

Column - I	**Column - II**
(*a*) Hydrolith	(P) Hydrogen has oxidation state –1
(*b*) NaH	(Q) Hydrogen has oxidation state +1
(*c*) NH_3	(R) Act as lewis base
(*d*) HI	(S) Act as bronsted acid
	(T) Covalent molecule

10. Match the column :-

Column - I

(*a*) $H_2Te > H_2Se > H_2S$

(*b*) HF > HI > HBr > HCl

(*c*) HF > HCl > HBr > HI

(*d*) $HF > H_2O > NH_3 > CH_4$

Column - II

(P) Bond polarity order

(Q) Acidic strength order

(R) Boiling point order

(S) Thermal stability order

11. Match the column :-

Column - I	**Column - II**
(*a*) LiH	(P) Non stoichiometric
(*b*) $(BeH_2)_n$	(Q) Bridging bond present
(*c*) CH_4	(R) Salt like hydride
(*d*) $ZrH_{1.92}$	(S) Metallic hydride
	(T) Vander waals force of attraction exists between gaseous molecule

EXERCISE # IV

❑ **Integer Type :**

1. Number of isotopes present in hydrogen -

2. Number of reactions liberate hydrogen gas -

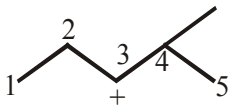
(i) $Zn + NaOH \rightarrow$ (ii) $Zn + dil\ H_2SO_4 \rightarrow$

(iii) $Zn + dil\ HCl \rightarrow$ (iv) $Ag + HNO_3 \rightarrow$

(v) $Pb + NaOH \rightarrow$ (vi) $Sn + NaOH \rightarrow$

(vii) $Fe + Steam \rightarrow$

3. During carbocation rearrangement some times shift of Hydride ion takes place. From which carbon shift of hydride ion takes place.



4. Number of element of group 6 forms hydride -

5. Number of compounds give H_2O_2 on reaction with dilute H_2SO_4

PbO_2 ; MnO_2 ; TiO_2 ; $BaO_2 . 8H_2O$; XeO_2

6. Number of statements whch are not true -

(i) the electrolysis of molten hydrolith liberates H_2 gas at cathaode.

(ii) Na_2SO_3 and KNO_2 when reacts with H_2O_2, H_2O_2 acts as reducing agent.

(iii) In the reactions of H_2O_2 and Na_2CO_3, H_2O_2 acts as acid.

(iv) H_2O and H_2O_2 both are ionic hydride of oxygen.

(v) H_2O_2 can be used as fuel as it produces pollution free atmosphere because its combustion product is water.

7. Commercial 22.4 volume H_2O_2 solution has a molarity.

8. 1.5% solution of H_2O_2 (1.5 gm H_2O_2 in 100 ml solution) is equivalent to x volume H_2O_2. What is the value of x.

9. $CH_3COCH_3 \xrightarrow{OD^-/D_2O}$ Number of hydrogen exchange by deuterium in the prodcut.

10. Find out number of reactions where phenol can generate hydrogen

(i)  + Na $\rightarrow$

(ii)  + Ca $\rightarrow$

(iii)  + Al $\rightarrow$

(iv)  + NaOH $\rightarrow$

(v)  + $NaNH_2$ $\rightarrow$

(vi)  + NaH $\rightarrow$

11. Find out number of hydrides which has more boiling point than H_2O.

HF ; HCl ; HBr ; CH_4 ; NH_3 ; B_2H_6

12. Find the number of atoms which are more electronegative than hydrogen atom.

C ; Si ; N ; I ; Br ; Be ; Al; B

13. Find out pH of water at 25°C.

14. $NiCl_2 + 2C_6H_5MgBr \rightarrow MgBr_2 + MgCl_2 + P$

$P + 2H_2 \rightarrow Q + NiH_2$

Find out the number of π electrons.

15. Numer of elements which can adsorb large volume of hydrogen

Ni ; Pd ; Pt ; Zn ; Hg ; Cd

■■

CH-8 HYDROGEN AND THE HYDRIDE

EXERCISE # I

1. (*c*)	**2.** (*a*)	**3.** (*b*)	**4.** (*c*)	**5.** (*d*)	**6.** (*a*)	**7.** (*c*)	**8.** (*a*)	**9.** (*b*)	**10.** (*c*)
11. (*c*)	**12.** (*d*)	**13.** (*d*)	**14.** (*a*)	**15.** (*b*)	**16.** (*c*)	**17.** (*b*)	**18.** (*b*)	**19.** (*a*)	**20.** (*c*)
21. (*c*)	**22.** (*d*)	**23.** (*c*)	**24.** (*a*)	**25.** (*b*)	**26.** (*a*)	**27.** (*a*)	**28.** (*c*)	**29.** (*a*)	**30.** (*b*)
31. (*b*)	**32.** (*a*)	**33.** (*b*)	**34.** (*c*)	**35.** (*d*)	**36.** (*b*)	**37.** (*d*)	**38.** (*c*)	**39.** (*a*)	**40.** (*b*)
41. (*d*)	**42.** (*d*)	**43.** (*b*)	**44.** (*d*)	**45.** (*c*)	**46.** (*a*)				

EXERCISE # II

1. (*a*,*c*)	**2.** (*c*,*d*)	**3.** (*b*,*d*)	**4.** (*b*,*d*)	**5.** (*a*,*d*)	**6.** (*a*,*b*,*d*)
7. (*b*,*d*)	**8.** (*b*,*c*)	**9.** (*a*,*b*,*d*)	**10.** (*a*,*b*)	**11.** (*a*,*b*,*c*,*d*)	**12.** (*a*,*b*,*d*)
13. (*a*,*b*,*d*)	**14.** (*a*,*b*,*c*,*d*)	**15.** (*a*,*b*,*c*,*d*)	**16.** (*a*,*b*,*c*)	**17.** (*a*,*b*,*c*)	**18.** (*a*,*b*,*c*,*d*)
19. (*c*,*d*)	**20.** (*b*,*c*)				

EXERCISE # III

Paragraph Type :

1. (*d*)	**2.** (*d*)	**3.** (*d*)	**4.** (*c*)	**5.** (*d*)	**6.** (*d*)	**7.** (*b*)	**8.** (*a*)	**9.** (*b*)	**10.** (*c*)
11. (*a*)	**12.** (*d*)	**13.** (*c*)	**14.** (*a*)	**15.** (*b*)					

Matrix Match Type :

	(*a*)	(*b*)	(*c*)	(*d*)		(*a*)	(*b*)	(*c*)	(*d*)
1.	P,Q,S;	Q,R,S;	Q;	Q,S,T	**2.**	Q;	P,S;	R;	T
3.	R,S;	Q;	S;	P	**4.**	Q,R,S,T;	Q,R,T;	Q,R,T;	P,T
5.	P;	S;	Q;	R	**6.**	P,Q,R;	P,Q;	P,Q,R,S;	P,Q,R
7.	R;	P,Q,S,T;	R,S,T;	P,Q,R	**8.**	P,S;	P,R;	P,Q;	T
9.	P,R;	P,R;	Q,R,T;	Q,S,T	**10.**	Q,R;	R;	P,Q;	P,S
11.	R;	Q;	T;	P,S					

EXERCISE # IV

1. 3	**2.** 6	**3.** 4	**4.** 1	**5.** 1	**6.** 4	**7.** 2	**8.** 5	**9.** 6	**10.** 6
11. 0	**12.** 4	**13.** 7	**14.** 6	**15.** 3					