Hydrogen Important Questions With Answers

NEET Chemistry 2023

1. Which of the following act as a stabiliser for the storage of H_2O_2?
   a) Alkali b) Dust **c) Urea** d) None of these.

   Solution : -

   H_2O_2 decomposes slowly on exposure to light.

   $2H_2O_{2(l)} \rightarrow 2H_2O_{2(l)} + O_{2(g)}$

   In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalysed. It is, therefore, stored in wax-lined glass or plastic vessels in dark. Urea can be added as a stabiliser. It is kept away from dust because dust can induce explosive decomposition of the compound.

2. **Assertion:** A 30% solution of H_2O_2 is marketed a '100 volume' hydrogen peroxide.
   Reason: 1 L of 30% H_2O_2 will give 100 mL ofoxygen at STP.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.

   Solution : -

   One millilitre of 30% H_2O_2 solution will give 100 mL of oxygen at STP

3. Which of the following hydrides is electron-precise hydride?
   a) B_2H_6 b) NH_3 c) H_2O **d) CH_4**

   Solution : -

   Methane CH_4 is electron-precise hydride.

   Diborane B_2H_6 is electron-deficient hydride

   Ammonia NH_3 and water H_2O are electron-rich hydrides.

   Elements of group 14 form electron-precise (having required number of electrons to write the Lewis structure) form precise hydrides.

4. 5.0 cm^3 of H_2O_2 liberates 0.508 g of iodine from an acidified KI solution. The strength of H_2O_2 solution in terms of volume strength at STP is
   a) 6.48 volumes **b) 4.48 volumes** c) 7.68 volumes d) none of these.

   Solution : -

   The reaction between H_2O_2 and the acidified KI solution is

   $$2Kl + H_2SO_4 + \underset{5.0cm^3}{\overset{34g}{H_2O_2}} \longrightarrow K_2SO_4 + 2H_2O + \underset{0.508g}{\overset{254 \quad g}{I_2}}$$

   Then, Mass of H_2O_2 that liberates 0.508 g of I_2

   $\frac{34}{254} \times 0.508$ = 0.068g

   This much H_2O_2 is present in 5.0 cm^3.

   Hydrogen peroxide decomposes as follows:

$$\underset{2\times34g=68g}{\underset{2mol}{2H_2O_2}} \longrightarrow 2H_2O + \underset{22400cm^3(at\quad STP)}{\underset{1mol}{O_2}}$$

Then 68 g of H_2O_2 gives 22400 cm^3 of oxygen

1 g of H_2O_2 gives $\frac{22400cm^3}{68}$ of oxygen

0.068 g of H_2O_2 gives $\frac{22400cm^3}{68}$ x 0.068g = 22.4 cm^3 of oxygen

Thus, S cm3 of H_2O_2 gives 22.4 cm^3 of oxygen at STP

So, 1 cm^3 of H_2O_2 gives $\frac{22.4}{5}cm^3$ of oxygen at STP = 4.48 cm^3 at STP

Therefore, strength of the given H_2O_2 sample = 4.48 volumes.

5. In a permutit, the calcium and magnesium ions of hard water are exchanged by:
   a) CO_3^{2-} and HCO_3^- ions of permutit **b) Na^+ ions of permutit** c) Al^{3+} ions of permutit
   d) Si^{4+} ions of permutit.

   Solution : -
   Permutit is an artificial zeolite. It is sodium aluminium orthosilicate
   $Na_2Al_2Si_2O_8.xH_2O$.
   $Na_2Al_2Si_2O_8.xH_2O + Ca^{2+}$ (or Mg^{2+}) $\rightarrow CaAl_2Si_2O_8.xH_2O + 2Na^+$
   permutit exhausted permutit

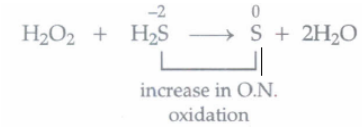
6. Elements of which of the following group(s) of periodic table do not form hydrides.
   a) Groups 7, 8, 9 b) Group l3 c) Groups 15,16,17 d) Group 14

   Solution : -
   The metals of group 7, 8 and 9 do not form hydrides.

7. Match the following and identify the correct option.
   B_2H_6
   a) An electron deficient hydride b) Non-Planar structure c) Synthesis gas
   d) $Mg(HCO_3)_2 + Ca(HCO_3)_2$

8. The reaction of H_2O_2 with hydrogen sulphide is an example of ..... reaction:
   a) Addition b) Oxidation c) Reduction d) Acidic

   Solution : -
   Since, H_2O_2 acts as an oxidizing agent, hence when it reacts with hydrogen sulphide (H_2S), it oxidizes H_2S to sulphur (S) and water is formed as a by-product.



9. Which of the following statements about hydrogen is incorrect?
   a) Hydronium ion, H_3O^+ exists freely in solution. b) Dihydrogen does not act as a reducing agent.
   c) Hydrogen has three isotopes of which tritium is the most common.
   d) Hydrogen never acts as cation in ionic salts.

   Solution : -
   Hydrogen has three isotopes of which protium $\left(_1^1H\right)$ is the most common. The percent abundance of protium, deuterium and tritium are 99.985, 0.0156 and 10^{-15} respectively.

10. In complex hydrides, hydride ions act as ligand and are coordinated to metal ions. These hydrides are good reducing agents. Which of the following hydrides is not a complex hydride?
    a) $LiAlH_4$ b) $NaBH_4$ **c) $(AlH_3)_n$** d) $LiBH_4$

    Solution : -

$(AlH_3)n$ is a polymeric hydride like $(BeH_2)n$, $(MgH_2)_n$, etc.
Whereas, $LiAlH_4$ and $NaBH_4$ and $LiBH_4$ are complex co-ordinate hydrides.

11. **Assertion:** Ice cube floats on water.
Reason: Density of ice is less than that of water.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

12. Which of the following is not a process of preparation of hydrogen peroxide?
a) Auto-oxidation of 2-ethylanthraquinol. **b) By passing oxygen through boiling water.**
c) By oxidation of isopropyl alcohol. d) Byreaction of barium peroxide with dil. H_2SO_4.

Solution : -
Preparation of 2-ethylanthraquinol
Preparation of H_2O_2

(i) 2-ethylanthrquinol $\xrightarrow[H_2/pd]{O_2}$ H_2O_2 + oxidized product

(ii) By reaction of barium oxide (per) with dif.H_2SO_4
$BaO_2.8H_2O(s) + H_2SO_4 \rightarrow BaSO_4 + H_2O_2 + 8H_2O$
(iii) By oxidation of is propyl (alcohol)

13. The various types of hydrides and examples of each type are given below:

	Hydride type		**Compound**
(A)	Electron deficient	(i)	LiH
(B)	Saline	(ii)	CH_4
(C)	Electron -precise	(iii)	NH_3
(D)	Interstitial	(iv)	B_2H_6
(E)	Electron rich	(v)	CrH

Choose the correct matching from the codes given below:
a) (A) - (ii), (B) - (iv), (C) - (v), (D) - (iii), (E) - (i) **b) (A) - (iv), (B) - (i), (C) - (ii), (D) - (v), (E) - (iii)**
c) (A) - (iv), (B) - (iii), (C) - (v), (D) - (ii), (E) - (i) d) (A) - (v), (B) - (iii), (C) - (iv), (D) - (ii), (E) - (i)

Solution : -
(A) electron deficient $\rightarrow B_2H_6$
(which can accept a love pair of electron)
(B) saline (Ionic hydrides)$\rightarrow$ LiH
(C) Electron precise $\rightarrow CH_4$
(which can neither accept nor give pair of e^- 14^{th} group element makes this hydride)
(D) Interstitial $\rightarrow$ CrH
(d block element from intersfical hydride)
(E) Electron rich $\rightarrow$ NH_3
molecule which can donate pair of electron

14. What will be the strength of 20 vol of H_2O_2 in terms of gram per litre?
a) 60.71 gL^{-1} b) 5.6 gL^{-1} c) 30.62 gL^{-1} d) 17 gL^{-1}

Solution : -
20 vol of H_2O_2 means:
1L of this H_2O_2 will give 20 L of oxygen at STP.

$$\underset{68g}{2H_2O_2} \rightarrow \underset{22.4atSTP}{O_2} + H_2O$$

22.4 L of O_2, is produced from 68 g of H_2O_2

20 L of O_2, is produced from = $\frac{68\times20}{22.4} = 60.71 gL^{-1}$ of H_2O_2

15. The order of reactivity of halogens towards hydrogen is

a) $F_2 > Cl_2 > Br_2 > I_2$ b) $I_2 > Br_2 > Cl_2 > F_2$ c) $Cl_2 > Br_2 > I_2 > F_2$ d) $Br_2 > Cl_2 > F_2 > I_2$

16. H_2O_2 acts as a bleaching agent because of

a) reducing nature of H_2O_2 **b) oxidising nature of H_2O_2** c) acidic nature of H_2O_2

d) basic nature of H_2O_2

Solution : -

Due to oxidising nature of H_2O_2, it acts as a bleaching agent.

17. Why does H^+ ion always get associated with other atoms or molecules?

a) Ionisation enthalpy of hydrogen resembles that of alkali metals. b) Its reactivity is similar to halogens.

c) It resembles both alkali metals and halogens.

d)

Loss of an electron from hydrogen atom results in a nucleus of very small size as compared to other atoms or ions. Due to small size it cannot exist free.

Solution : -

Loss of an electron from H atom results in H+ ion having extremely small size (-1.5×10^{-3} pm) as compared to normal atomic and ionic sizes of 50-200 pm. As a consequence, H^+ does not exist freely and is always associated with other atoms or molecules.

18. Fluorine decomposes cold water to give

a) $4H^+ + 4F^-$ and O_2 b) HF and H_2 c) HF only d) H_2F_2 and HFO_4.

Solution : -

Fluorine on reaction with cold water gives HF and oxygen. F_2 due to its high oxidizing power oxidizes water to oxygen and ozone by ripping apart hydrogen bond from water and bonding with fluorine to form hydrofluoric acid. The yield of Ozone is less as compared to oxygen thereby considering ozone as an impurity.

$2F_2 + 2H_2O \rightarrow 4H^+ + 4F^- + O_2$

19. Given below are two reactions of water with sodium and carbon dioxide. What is the nature of water in these reactions?

(i) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

(ii) $6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6H_2O + 6O_2$

a) In (ii) water acts as an oxidising agent and in (i) it acts as a reducing agent.

b) In (i) water acts as an oxidising agent while in (ii) it acts as a reducing agent.

c) In both, (i) and (ii) hydrogen acts as a reducing agent.

d) In both, (i) and (ii) hydrogen acts as an oxidising agent.

Solution : -

With sodium metal water acts as an oxidising agent and gets reduced to H_2, with CO_2 water acts as a reducing agent and is oxidised to oxygen.

20. A metal which does not react with cold water but reacts with steam to liberate H_2 gas is

a) Na b) Mg c) Au **d) Fe**

Solution : -

Na reacts with cold water, Mg reacts with hot water, Fe reacts with steam and Au does not react with water.

$3Fe + \underset{(stream)}{4H_2O} \longrightarrow Fe_3O_4 + 4H_2 \uparrow$

21. **Assertion:** H_2O_2 is stored in wax-lined glass or plastic vessels.

Reason : H_2O_2 decomposes slowly on exposure to light.

a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

Solution : -

H_2O_2 decomposes slowly on exposure to light.

$2H_20_{2(l)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$

In the presence of metal surfaces or traces of alkali (present in glass containers), the above reaction is catalysed. Hence, H_2O_2 is stored in wax-lined glass or plastic containers in dark.

22. Which of the following series of transitions in the spectrum of hydrogen atom fall in visible region?
a) Balmer series b) Paschen series c) Brackett series d) Lyman series

Solution : -

In H-spectrum, Balmer series transitions fall in visible region.

23. **Assertion:** All the three isotopes of hydrogen have almost the same chemical properties.
Reason: Isotopes differ from one another in respect of the presence of neutrons.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

Solution : -

Isotopes have almost the same chemical properties because they have the same electronic configuration.

24. Alkenes combine with carbon monoxide and hydrogen in presence of octacarbonyldicobalt as catalyst under high temperature and pressure to form
a) aldehydes which can be further reduced to alcohols by hydrogen
b) alkanes which are formed by addition of hydrogen c) alcohols formed by reaction of CO and hydrogen
d) ketones which can be further reduced to aldehydes by hydrogen.

Solution : -

$R - CH = CH_2 + H_2 + CO \rightarrow RCH_2CH_2\ CHO \xrightarrow{H_2} RCH_2 \underset{alcohol}{CH_2}\ CH_2OH$

25. Match the column I with column II and mark the appropriate choice.

Column - I		**Column - II**	
(A)	Clark's method	(i)	$Na_6P_6O_{18}$
(B)	Calgon's method	(ii)	$NaAlSiO_4$
(C)	Ion- exchange method	(iii)	RSO_3H
(D)	Synthetic resins method	(iv)	$Ca(OH)_2$

a) (A) $\rightarrow$ (i), (B) $\rightarrow$ (iii), (C) $\rightarrow$ (iv), (D)$\rightarrow$ (ii) b) (A) $\rightarrow$ (ii), (B) $\rightarrow$ (iii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (i)
c) (A) $\rightarrow$ (iii), (B) $\rightarrow$ (ii) , (C) $\rightarrow$ (i), (D) $\rightarrow$ (iv) **d) (A) $\rightarrow$ (iv), (B) $\rightarrow$ (i), (C) $\rightarrow$ (ii), (D) $\rightarrow$ (iii)**

Solution : -

All method used below are method of removing Henderson of water

26. Syngas is a mixture of:
a) $CO_2 + H_2$ **b) $CO + H_2$** c) $CO + CO_2$ d) $CO + O_2$

Solution : -

Syngas also known as synthetic gas, is the name given to a mixture of CO and H_2.

27. Which of the following is not a property of hydrogen?
a) It is a colourless, odourless gas. b) It is highly combustible. **c) It is highly poisonous gas.**
d) It is lighter than air.

Solution : -

Hydrogen is a non-poisonous gas. Hydrogen is a colourless, odorless gas. It is highly combustible. It is lighter than air.

28. Which of the following is not a disadvantage of using hard water?
a) In production of steam in boilers b) Formation of scales in cooking utensils
c) In cooking, bathing and washing **d) In ion exchangers**

Solution : -

In an ion exchange using hard water is not a disadvantage since it becomes soft by exchanging anions or cations. Na^+, Ca^{2+} and Mg^{2+} ions (from water) are exchanged with H^+ ions (from cation exchange resins). Cl^-, SO_4^{2-} and NO_3^- ions (from water) are exchanged with OH^- ions (from anion exchange resins).

29. A commercial sample of hydrogen peroxide is labelled as 10 volume. Its percentage strength is nearly:
a) 3% b) 1% c) 90% d) 10%

Solution : -

1 mL of 10 volume H_2O_2 = 10 mL of O_2 at NTP.

$2H_2O_2 \rightarrow 2H_2O + O_2$

2(2+32) = 68 g 22400 mL at NTP

22400 mL of O_2 at NTP are obtained from 68 g of H_2O_2

10 mL of O_2 at NTP are obtained from $\frac{68}{22400} \times 10$g of H_2O_2

10 mL of O_2 at NTP are obtained from $\frac{68}{2240}$ g of H_2O_2

1 ml of H_2O_2 solution contains $\frac{68}{2240}$ g of H_2O_2.

100 ml of H_2O_2 solution contains $\frac{68}{2240} \times 100$ = 3% of H_2O_2.

30. Which of the following represents the chemical equation involved in the preparation of $H_2O_2$from barium peroxide?
a) $BaO_2 \cdot 8H_2O + H_2SO_4 \rightarrow BaSO_4 + H_2O_2 + 8H_2O$ b) $CH_3CHOHCH_3 + O_2 \rightarrow CH_3COCH_3 + H_2O_2$
c) $BaO_2 + CO_2 + H_2O \rightarrow BaCO_3 + H_2O_2$ d) $Ba_3(PO_4)_2 + 3H_2SO_4 \rightarrow 3BaSO_4 + 2H_3PO_4$

Solution : -

Barium peroxide react with sulfuric acid to produce Hydrogen peroxide and Barium sulfate.

Isopropyl Alcohol oxidises to Acetone and water, and not hydrogen peroxide.

CO_2 reacts with water to form carbonic acid. It then reacts with barium peroxide to form barium carbonate and hydrogen peroxide. Barium carbonate is insoluble and is easy to remove by filtration. this process is widely used to manufacture H_2O_2.

Barium phosphate reacts with Sulphuric acid to form Barium sulfate and Phosphoric acid.

31. The production of dihydrogen obtained from coal gasification can be increased by reacting carbon monoxide of syngas mixture with steam in presence of a catalyst iron chromate. What is this process called?
a) Hydrogen reaction **b) Water-gas shift reaction** c) Coal-gas shift reaction d) Syn gasification

Solution : -

The production of dihydrogen can be increased by reacting carbon monoxide of syngas with steam. This is called water-gas shift reaction.

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

32. A water sample is said to contain permanent hardness if water contains
a) sulphates and chlorides of calcium and magnesium b) carbonates of calcium and magnesium
c) bicarbonates of calcium and magnesium d) sulphates and chlorides of sodium and potassium.

Solution : -

Permanent hardness of water is due to sulfates and chlorides of calcium and magnesium. Temporary hardness of water is due to bicarbonates of calcium and magnesium.

33. If a mole of hydrogen molecule is heated to a high temperature then which of the following reactions take place?
a) $H_{2(g)}$+ 436 kJ $mol^{-1} \rightarrow H_{(g)} + H_{(g)}$ b) $2H_{2(g)}$ + 820 kJ $mol^{-1} \rightarrow 2H_{2(g)}$
c) $H_{2(g)}$+ $H_{2(g)}$+ 436 kJ $mol^{-1} \rightarrow H^+_{(aq)}$+ $H^-_{(aq)}$ d) $H_{2(g)}$+ 200 kJ $mol^{-1} \rightarrow H_{(g)} + H_{(g)}$

Solution : -
The amount of energy required to break H - H bond of 1 mole of hydrogen is 436 kJ mol^{-1}
$H_{2(g)}$+ 436 kJ $mol^{-1} \rightarrow H_{(g)} + H_{(g)}$

34. Dihydrogen forms three types of hydrides. (i) hydrides are formed by alkali metals and alkaline earth metals. (ii) hydrides formed by non-metals and (iii) hydrides formed by d and f-block elements at elevated temperature. Complex metal hydrides that are powerful reducing agents are:

a)

(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**
Covalent	Molecular	Saline	NaH	LiH

b)

(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**
Molecular	Covalent	Ionic	$LiAlH_4$	CaH_2

c)

(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**
Ionic	**Covalent**	**Interstitial**	**$LiAlH_4$**	**CaH_2**

d)

(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**
Covalent	Saline	Interstitial	$LiAlH_4$	$NaBH_4$

35. Match the following and identify the correct option.
Temporary hardness of water
a) $\mathrm{Mg(HCO_3)_2 + Ca(HCO_3)_2}$ b) An electron deficient hydride c) Synthesis gas
d) Non-Planar structure

36. Match the reactions of column I with their types given in column II and mark the appropriate choice.

Column - I		**Column -II**	
(A)	$H_2O+NH_3 \rightleftharpoons NH_4^+ + OH$	(i)	Self ionisation of H_2O
(B)	$FeCl_3 + 3H_2O \rightarrow Fe(OH)_3 + 3HCl$	(ii)	Decomposition
(C)	$H_2O + H_2O \rightleftharpoons H_3O^+ + OH$	(iii)	Acidic nature of H_2O
(D)	$2H_2O \rightarrow 2H_2 + O_2$	(iv)	Hydrolysis

a) (A) $\rightarrow$(ii), (B) $\rightarrow$ (i), (C) $\rightarrow$ (iii), (D) $\rightarrow$ (iv) b) (A) $\rightarrow$(iii), (B) $\rightarrow$ (ii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (i)
c) (A) $\rightarrow$ (i), (B) $\rightarrow$ (ii), (C) $\rightarrow$ (iv), (D) $\rightarrow$ (iii) **d) (A) $\rightarrow$ (iii), (B) $\rightarrow$ (iv), (C) $\rightarrow$ (i), (D) $\rightarrow$ (ii)**

Solution : -
(a) $H_2O + NH_3 \rightleftharpoons NH_4 + OH^-$
Here NH_3 is Lewis base and H_2O
acid as acid to it represents
acidic nature of H_2O
(b) $F_eCl_3 + H_2O \rightarrow F_e(OH)_3 + 3HCl$
it is are example of hydrolysis reaction which produces acid and base
(C) $H_2O + H_2o \rightarrow H_3O + OH^-$
self ionisation of water
(D) $2H_2O \rightarrow 2H_2 + O_2$
Decomposition of water in their corresponding molecule

37. When sodium peroxide is treated with dilute sulphuric acid, we get_____.
a) sodium sulphate and water b) sodium sulphate and oxygen c) sodium sulphate, hydrogen and oxygen
d) sodium sulphate and hydrogen peroxide

Solution : -

$$\underset{\substack{sodium\\peroxide}}{Na_2O_2} + H_2SO_{4(dil)} \longrightarrow \underset{\substack{sodium\\sulphate}}{Na_2O_4} + \underset{\substack{Hydrogen\\peroxide}}{H_2O_2}$$

38. Match the column I with column II and mark the appropriate choice.

Column I		Column - II	
(A)	NaH	(i)	Interstitial hydride
(B)	CH_4	(ii)	Molecular hydride
(C)	$VH_{O.56}$	(iii)	Ionic hydride
(D)	B_2H_6	(iv)	Electron -deficient hydride

a) (A)→ (iii), (B)→(iv), (C)→ (ii) (D)→ (i) b) (A)→(ii), (B)→(iv), (C)→(iii), (D)→(i)
c) (A)→(i), (B)→(ii) , (C)→(iv), (D)→(iii) **d) (A)→(iii), (B)→(ii), (C)→(i), (D)→(iv)**

Solution : -

NaH is an ionic compound and is made of sodium cations (Na^+) and hydride anions (H^-). It has the octahedral crystal structure with each sodium ion surrounded by six hydride ions.

CH_4 forms molecular or covalent hydrides. These are mainly formed by p - block elements and some s - block elements.

The third compound has an oxidation number of hydrogen which is zero. So it belongs to Interstitial hydride.

In B_2H_6 the Boron atom is surrounded by 6 electrons, so it is electron deficient due to its incomplete octet.

39. Heavy water is obtained by

a) boiling water b) heating H_2O_2 **c) prolonged electrolysis of H_2O** d) All of these.

Solution : -

Heavy water is obtained by prolonged electrolysis of H_2O which involves multi-stage electrolysis of ordinary water containing alkali.

40. Some statements about heavy water are given below:

(a) Heavy water is used as a moderator in nuclear reactors.
(b) Heavy water is more associated than ordinary water.
(c) Heavy water is more effective solvent than ordinary water.
Which of the above statements are correct?

a) (a) and (c) **b) (a) and (b)** c) (a), (b) and (c) d) (b) and (c)

Solution : -

Healy water is used for slowing down the speed of neutrons and used as moderators. Boiling point of heavy water is more than that of ordinary water, so it is more associated.

41. Hydrolysis of $SiCl_4$ gives

a) $Si(OH)_4$ b) $SiOCl_2$ **c) SiO_2** d) H_2SiO_4

Solution : -

Hydrolysis of $SiCl_4$ gives SiO_2 (silica or silicon dioxide).

$SiCl_{4(l)} + 2H_2O_{(l)} \rightarrow SiO_{2(s)} + 4HCl_{(aq)}$

42. Which of the following metals does not liberate hydrogen from acids?

a) Fe **b) Cu** c) Mg d) Zn

Solution : -

Copper, silver, gold and platinum being less reactive than hydrogen cannot displace hydrogen from acids. Metals that are more reactive than hydrogen can displace hydrogen from acids. These metals include sodium, potassium, lead and zinc.

43. Non-stoichiometric hydrides are produced by

a) palladium, vanadium b) manganese, lithium c) nitrogen, fluorine d) carbon, nickel

Solution : -

The hydrogen deficient compounds formed by the reaction of d−block and f−block elements with dihydrogen are called Non-stoichiometric compounds.

The d-block and f-block element form non-stoichiometric hydride because of the vacant d- and f-orbitals along with the small size.

Their elemental composition proportions cannot be represented in integers. They disobey the law of constant composition. Among the elements given, only vanadium and palladium form non-stoichiometric hydrides.

44. Only one element of_____forms hydride.

a) group 6 b) group 7 c) group 8 d) group 9

Solution : -

From group 6, only one element i.e., chromium forms CrH.

45. Which of the following reactions is an example of use of water gas in the synthesis of other compounds?

a) $CH_4(g)+H_2O(g) \xrightarrow[Ni]{1270k} CO_{(g)}+H2_{(g)}$ b) $CO_{(g)}+H_2O(g) \xrightarrow[catalyst]{673k} CO_2(g)+H_2(g)$

c) $CnH_{2n+2} + nH_2O_{(g)} \xrightarrow[Ni]{1270K} nCO + (2n+1)H_2$ d) $CO_{(g)}+2H_{2(g)} \xrightarrow[catalyst]{cobalt} CH_3OH_{(l)}$

Solution : -

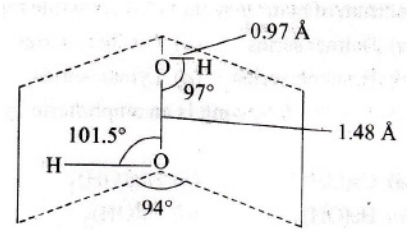
The mixture of CO and Hz is called water gas. As this mixture of CO and H_2 is used for the synthesis of methanol and a number of hydrocarbons, it is also called 'synthesis gas' or 'syngas'

46. The structure of H_2O_2 is

a) planar **b) non-Planar** c) spherical d) linear

Solution : -

H_2O_2 shows non-planar structure. It has a half opened book like structure in which the two O-H groups lie on the two pages of the book.



O-O single bond distance is 1.48 A

47. Number of hydrogen-bonded water molecules are associated in $CuSO_4 \cdot 5H_2O$ is:

a) Five **b) One** c) Four d) Three

Solution : -

In $CuSO_4.5H_2O$, Cu is coordinated with 4 water molecules and two more oxygen atoms from Sulphate ion.

Now fifth water molecule is hydrogen-bonded and is deeply embedded in a crystal. It is not coordinated.

Only 4 water molecules are coordinated and the fifth is the only hydrogen bonded.

48. Match the column I with column II and mark the appropriate choice.

Column - I		**Column - II**	
(A)	Syngas	(i)	$Na_6P_6O_{18}$
(B)	Calgon	(ii)	$NaAlSi0_4$
(C)	Permutit	(iii)	$CO+H_2$
(D)	Producer gas	(iv)	$CO+N_2$

a) (A)→ (i), (B)→(ii), (C)→ (iii), (D)→ (iv) **b) (A)→(iii), (B)→(i), (C)→(ii), (D)→(iv)**

c) (A)→(iii), (B)→ (ii) , (C)→(iv), (D)→(i) d) (A)→(iii), (B)→(ii), (C)→(i), (D)→ (iv)

49. **Assertion:** Permanent hardness of water can be removed by using washing soda.
Reason: Washing soda reacts with soluble calcium and magnesium chlorides and sulphates in hard water to form insoluble carbonates.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

50. Some statements about heavy water are given below:
(i) Heavy water is used as a moderator in nuclear reactors.
(ii) Heavy water is more associated than ordinary water.
(iii) Heavy water is more effective solvent than ordinary water.
Choose the correct answer:
a) (i) and (ii) b) (i), (ii) and (iii) c) (ii) and (iii) d) (i) and (iii)

Solution : -
Heavy water is used for slowing down the speed of neutrons in nuclear reactors, hence used as moderator.
Boiling point of heavy water is greater (374.42 K) to that of ordinary water (373 K), hence heavy water is more associated.
Dielectric constant of ordinary water is greater than that of heavy water, hence ordinary water is a better solvent.