

HYDROGEN

MULTIPLE CHOICE QUESTIONS

1. Which of the following is formed by the action of water on sodium peroxide?

(A) H_2

(B) N_2

(C) O_2

(D) CO_2

Sol. C



2. The melting points of most of the solid substances increase with an increase of pressure acting on them. However, ice melts at a temperature lower than its usual melting point when the pressure is increased. This is because

(A) pressure generates heat

(B) the chemical bonds break under pressure

(C) ice is less denser than water

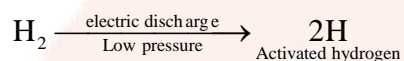
(D) ice is not a true solid

Sol. C

On increasing pressure, coordination number of ions in solids increases thus thereby increasing their melting point but in ice pressure does not increase the coordination number of oxygen & melting point does not increase but decrease under pressure.

3. Activated hydrogen is obtained by
(A) electrolysis of heavy water
(B) reaction of water with heavy metals
(C) thermal decomposition of water
(D) passing silent electric discharge through hydrogen gas at low pressure

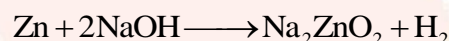
Sol. D



Hence, (D) is correct answer.

4. The metal which gives hydrogen on treatment with acid as well as sodium hydroxide is
(A) Fe (B) Zn
(C) Cu (D) none of these

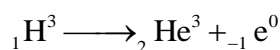
Sol. B



Hence (B)

5. The decay product of tritium is
(A) ${}_1\text{H}^1$ (B) ${}_1\text{H}^2$
(C) ${}_2\text{He}^3$ (D) ${}_2\text{He}^4$

Sol. C



6. Polyphosphates are used as water softening agents because they

- (a) Form soluble complexes with anionic species
- (b) Precipitate anionic species
- (c) Forms soluble complexes with cationic species
- (d) Precipitate cationic species

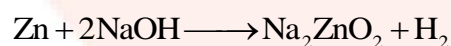
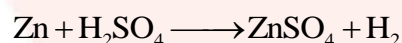
Sol. (c)

Polyphosphates (sodium hexametaphosphates, sodium tripolyphosphate or STPP) form soluble complexes with Ca^{+2} , Mg^{+2} present in hard water.

7. When the same amount of zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide, the ratio of volumes of hydrogen evolved is

- (A) 1: 1
- (B) 1: 2
- (C) 2: 1
- (D) 9: 4

Sol. A



The ratio of volumes of H_2 evolved in both the cases is 1: 1.

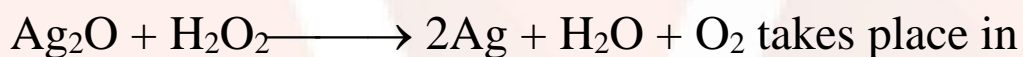
\therefore (A)

8. The critical temperature of water is higher than that of O_2 because H_2O molecule has
- (a) Fewer electrons than oxygen (b) Two covalent bonds
(c) V-shape (d) Dipole moment

Sol. (d)

Critical temperature of water is more than O_2 due to its dipole moment (Dipole moment of water = 1.84 D; Dipole moment of O_2 = zero D) .

9. The reaction:



- (A) basic medium
(B) bleaching agent
(C) neutral medium
(D) both in acidic and basic medium

Sol. A

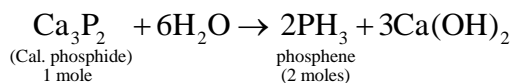
H_2O_2 on oxidation gives O_2 only in basic medium

\therefore (A)

10. One mole of calcium phosphide on reaction with excess water gives

- (a) One mole of phosphine
(b) Two moles of phosphoric acid
(c) Two moles of phosphine
(d) One mole of phosphorus pentaoxide

Sol. (c)



11. Which of the following compounds turns white on treatment with H_2O_2 ?

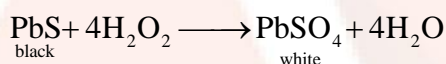
(A) HgS

(B) PbS

(C) NiS

(D) CuS

Sol. A



\therefore (B)

12. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water the sodium ions are exchanged with

(a) H^+ ions

(b) Ca^{2+} ions

(c) Mg^{2+} ions

(d) Both Ca^{2+} and Mg^{2+}

Sol. (d)

Zeolite when treated with hard water exchange Ca^{+2} and Mg^{+2} ions (present in hard water) with Na^+ ions.

13. Hard water does not contains

(A) Ca^{2+}

(B) F^-

(C) Mg^{2+}

(D) Ba^{2+}

Sol. A

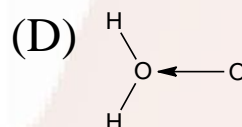
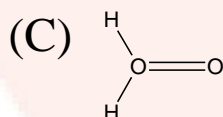
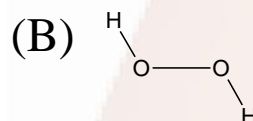
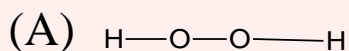
14. Pick the odd one out

- (a) Sodium borohydride reacts very slowly with cold water.
- (b) Sodium borohydride reacts very violently with cold water to produce H_2 .
- (c) Solubility of sodium borohydride in water at $25^\circ C$ is 10.05 g/mL.
- (d) Melting point of sodium borohydride is $500^\circ C$.

Sol. (b)

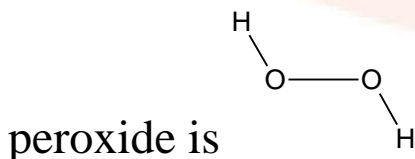
Reaction of $NaBH_4$ with cold water is very slow. All other statements except (b) are correct.

15. Which of the following is the true structure of H_2O_2 ?



Sol. B

Oxygen atom is sp^3 hybridized having two large pair of electrons. Therefore the structure of hydrogen



\therefore (B)

16. Hydrogen will not reduce

- | | |
|--------------------------|----------------------------|
| (a) Heated cupric oxide | (b) Heated ferric oxide |
| (c) Heated stannic oxide | (d) Heated aluminium oxide |

Sol. (d)

H_2 will not reduce heated Al_2O_3 .

17. A hydride of nitrogen which is acidic is

- | | |
|--------------|--------------|
| (A) NH_3 | (B) N_2H_4 |
| (C) N_2H_2 | (D) N_3H |

Sol. D

N_3H (hydrazoic acid) is the acidic hydride of nitrogen

\therefore (D)

18. HCl is added to following oxides. Which one would give H_2O_2

- | | |
|-------------|-------------------|
| (a) MnO_2 | (b) PbO_2 |
| (c) BaO | (d) None of these |

Sol. (d)

MnO_2 , PbO_2 and BaO will not give H_2O_2 with HCl. MnO_2 and PbO_2 will give Cl_2 and BaO will react with HCl to give $BaCl_2$ and water.

19. When electric current is passed through an ionic hydride in the molten state
- (A) hydrogen is liberated at the anode
 - (B) hydrogen is liberated at the cathode
 - (C) no reaction takes place
 - (D) hydride ion migrates towards cathode

Sol. A

Ionic hydride contains H^- ion which liberates H_2 at the anode.

\therefore (A)

20. Heavy water is a compound of
- (A) hydrogen & heavier isotope of oxygen
 - (B) heavier isotope of hydrogen & heavier isotope of oxygen
 - (C) oxygen & heavier isotope of hydrogen
 - (D) none of the above

Sol. C

D_2O is heavy water.

21. D_2O is preferred to H_2O , as a moderator, in nuclear reactors because
- (a) D_2O slows down fast neutrons better
 - (b) D_2O has high specific heat
 - (c) D_2O is cheaper

(d) None of these

Sol. (d)

H_2O absorbs neutrons more than D_2O and this decreases the number of neutrons for the fission process.

22. Which of the following can not be oxidized by H_2O_2 ?

(A) $\text{KI} + \text{HCl}$

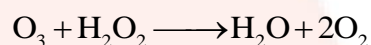
(B) O_3

(C) PbS

(D) Na_2SO_3

Sol. B

O_3 is more powerful oxidizing agent than H_2O_2 . So H_2O_2 reduces O_3 to O_2 .



\therefore (B)

23. Saline hydrides react explosively with water, such fires can be extinguished by

(a) Water

(b) Carbon dioxide

(c) Sand

(d) None of these

Sol. (c)

Fire due to action of water on saline hydrides cannot be extinguished with water or CO_2 . These hydrides can reduce CO_2 at high temperature to produce O_2 .

24. When temporary hard water containing $\text{Mg}(\text{HCO}_3)_2$ is boiled the ppt. formed is of

- (a) MgCO_3 (b) MgO
(c) $\text{Mg}(\text{OH})_2$ (d) None of these

Sol. (c)

$\text{Mg}(\text{OH})_2$ is less soluble than MgCO_3 . On boiling temporary hard water containing Mg^{+2} ions, the ppt. obtained is of $\text{Mg}(\text{OH})_2$ are not that of MgCO_3 .

INTEGER TYPE QUESTIONS

25. A commercial sample of hydrogen peroxide is labelled as 10 volume. Its percentage strength is nearly

Sol. (1%)

10 volume solution of H_2O_2 is 3.035% solution

i.e., 3.035 g of H_2O_2 is present in 100ml of the solution.

26. The amount of H_2O_2 present in 1 L of 1.5 N H_2O_2 solution is

Sol. (25.5)

Strength = Normality \times Eq. mass

$$= 1.5 \times 17 \text{ (eq. mass of } \text{H}_2\text{O}_2 \text{)}$$

$$= 25.5 \text{ gL}^{-1}$$

27. The nuclei of tritium (H^3) atom would contain neutrons

Sol. (2)

$$\begin{aligned}\text{Number of neutrons} &= \text{Mass number} - \text{Atomic number} \\ &= 3 - 1 = 2\end{aligned}$$

28. The sum of protons, electrons and neutrons in the heaviest isotope of hydrogen is

Sol. (4)

${}_1\text{H}^3$ has 3 nucleons (1 proton + 2 neutrons) and one electron so sum of these is $3 + 1 = 4$.

29. Number of nucleons in D_2 molecule is

Sol. (4)

$${}_1^2\text{D}_2 = (2 \text{ neutrons} + 2 \text{ protons}) = 4 \text{ nucleons.}$$

30. Hydrogen has three isotopes, the number of possible diatomic molecules will be

Sol. (6)

