

Previous Year Questions

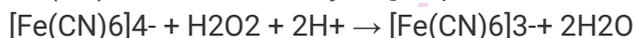
Subject	Chemistry
Class	11
Chapter	9
Topic Name	Hydrogen

1. Hydrogen peroxide oxidises $[\text{Fe}(\text{CN})_6]^{4-}$ to $[\text{Fe}(\text{CN})_6]^{3-}$ in acidic medium but reduces $[\text{Fe}(\text{CN})_6]^{3-}$ to $[\text{Fe}(\text{CN})_6]^{4-}$ in alkaline medium. The other products formed are, respectively :

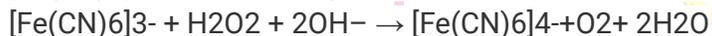
- (1) $(\text{H}_2\text{O} + \text{O}_2)$ and $(\text{H}_2\text{O} + \text{OH}^-)$
- (2) H_2O and $(\text{H}_2\text{O} + \text{O}_2)$
- (3) H_2O and $(\text{H}_2\text{O} + \text{OH}^-)$
- (4) $(\text{H}_2\text{O} + \text{O}_2)$ and H_2O

Solution:

$[\text{Fe}(\text{CN})_6]^{4-}$ reacts with hydrogen peroxide in acidic medium to form $[\text{Fe}(\text{CN})_6]^{3-}$ and water.



$[\text{Fe}(\text{CN})_6]^{3-}$ reacts with hydrogen peroxide in alkaline medium to form $[\text{Fe}(\text{CN})_6]^{4-}$, oxygen and water.



Hence option (2) is the answer.

2. Which one of the following statements about water is false?

- (1) Water is oxidized to oxygen during photosynthesis.
- (2) Water can act both as an acid and as a base.
- (3) There is extensive intramolecular hydrogen bonding in the condensed phase.
- (4) Ice formed by heavy water sinks in normal water.

Solution:

There is extensive intermolecular hydrogen bonding in water molecules in the condensed phase. It is not intramolecular hydrogen bonding.

Hence option (3) is the correct answer.

3. Which physical property of dihydrogen is wrong?

- (1) Colourless gas
- (2) Odourless gas
- (3) Tasteless gas
- (4) Non-inflammable gas

Solution:

Dihydrogen is an inflammable gas.

Hence option (4) is the correct answer.

4. Identify the incorrect statement regarding heavy water.

- (1) It reacts with SO_3 to form deuterated sulphuric acid (D_2SO_4).
- (2) It is used as a coolant in nuclear reactors.
- (3) It reacts with CaC_2 to produce C_2D_2 and $\text{Ca}(\text{OD})_2$.
- (4) It reacts with Al_4C_3 to produce CD_4 and $\text{Al}(\text{OD})_3$.

Solution:

Heavy water is used as a moderator in nuclear reactors to control the speed of neutrons. It is not used as a coolant.

Hence option (2) is the correct answer.

5. The chemical nature of hydrogen peroxide is

- (1) oxidising and reducing agent in both acidic and basic medium
- (2) oxidising agent in acidic medium, but not in basic medium
- (3) oxidising and reducing agent in acidic medium, but not in basic medium
- (4) reducing agent in basic medium, but not in acidic medium.

Solution:

Hydrogen peroxide acts as both oxidising and reducing agent in both acidic and basic medium.

Hence option (1) is the answer.

6. The metal that gives hydrogen gas upon treatment with both acid, as well as base, is

- (1) magnesium
- (2) zinc
- (3) mercury
- (4) iron.

Solution:

Zinc is the metal that gives hydrogen gas upon treatment with both bases as well as an acid.

Hence option (2) is the correct answer.

7. NaH is an example of

- (1) metallic hydride
- (2) saline hydride
- (3) electron-rich hydride
- (4) molecular hydride.

Solution:

NaH is an example of saline hydride. Hydrides are binary compounds of the elements with hydrogen.

Hence option (2) is the answer.

8. Determine the total number of neutrons in three isotopes of hydrogen

- (1) 1
- (2) 2
- (3) 3
- (4) 4

Solution:

Number of neutrons = $0+1+2 = 3$

Hence option (3) is the answer.

9. Which of the following statements are correct?

- (1) On decomposition of H_2O_2 , O_2 gas is released.
- (2) 2-ethylanthraquinol is used in the preparation of H_2O_2
- (3) On heating $KClO_3$, $Pb(NO_3)_2$, $NaNO_3$, O_2 gas is released.
- (4) In the preparation of sodium peroxoborate, H_2O_2 is treated with sodium metaborate.

- (1) 1,2,4
- (2) 2,3,4
- (3) 1,2,3,4
- (4) 1,2,3

Solution:

All the given statements are correct.

Hence option (3) is the answer.

10. The synonym for water gas, when used in the production of methanol, is

- (1) fuel gas
- (2) natural gas
- (3) laughing gas
- (4) syn gas.

Solution:

Water-gas is $CO+H_2$.

It is used for the synthesis of methanol. So it is called syn gas.

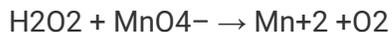
Hence option (4) is the answer.

11. Hydrogen peroxide acts both as an oxidising and as a reducing agent depending upon the nature of the reacting species. In which of the following cases does H_2O_2 act as a reducing agent in acid medium?

- (1) MnO_4^-
- (2) SO_3^{2-}
- (3) KI
- (4) $Cr_2O_7^{2-}$

Solution:

Reducing agent is an element or compound that loses or donates an electron to an electron recipient, oxidizing agent in a redox chemical reaction.



Hence option (1) is the answer.

12. Which one of the following processes will produce hard water?

- (1) Saturation of water with $CaCO_3$
- (2) Saturation of water with $MgCO_3$
- (3) Saturation of water with $CaSO_4$
- (4) Addition of Na_2SO_4 to water

Solution:

Hard water contains calcium and Magnesium salt in the form of hydrogen carbonate, chloride and sulphate. Permanent hardness is introduced when water passes over rocks containing the sulphates or chlorides of both calcium and magnesium.

Hence option (3) is the correct answer.

13. The isotopes of hydrogen are

- (1) protium, deuterium and tritium
- (2) protium and deuterium only
- (3) deuterium and tritium only
- (4) tritium and protium only.

Solution:

The isotopes of hydrogen are protium, deuterium and tritium.

Hence option (1) is the answer.

14. Very pure hydrogen (99.9%) can be made by which of the following processes?

- (1) Reaction of salt like hydrides with water
- (2) Reaction of methane with steam
- (3) Mixing natural hydrocarbons of high molecular weight
- (4) Electrolysis of water

Solution:

Very pure hydrogen (99.9%) can be made by electrolysis of water using platinum electrodes in the presence of a small amount of acid or alkali.



Hence option (4) is the answer.

15. The correct statements among (A) to (D) regarding H₂ 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 NaNi₅.
 - (D) On combustion, values of energy released per gram of liquid dihydrogen and LPG are 50 and 142 kJ, respectively.
- (1) (A), (B) and (C) only
 - (2) (B), (C) and (D) only
 - (3) (A) and (C) only
 - (4) (B) and (D) only

Solution:

On combustion, the value of energy released per gram of liquid dihydrogen is 142kJ.

The energy released per gram of LPG is 50kJ. Statement D is wrong.

Hence option (1) is the answer.

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