Hydrogen and It's Compounds

Question1

Which of the following is used in preparation of hydrogen peroxide by Merck process?

MHT CET 2025 25th April Morning Shift

Options:

A. $CaCO_{3(s)}$

B. $BaO_2 \cdot 8H_2O$

C. $CaCl_{2(s)}$

D. $Na_2O_{2(aq)}$

Answer: D

Solution:

Merck process:

$$Na_2O_{2(aq)} + H_2SO_{4(aq)} \xrightarrow{273\ K} Na_2SO_{4(aq)} + H_2O_{2(aq)}$$

Question2

Identify the correct decreasing order of boiling point for hydrides of halogens.

MHT CET 2025 20th April Evening Shift

Options:

A. $HF > HCl > HBr > HI$

B. $HI > HBr > HCl > HF$

C. $HF > HI > HBr > HCl$

D. $HI > HF > HBr > HCl$

Answer: C

Solution:

Hydrides	HF	HCI	HBr	HI
Boiling point	293	189	206	238

Order of boiling point: $HF > HI > HBr > HCl$

Question3

Which of the following methods is used to prepare dihydrogen with purity greater than 99.5 ?

MHT CET 2025 19th April Evening Shift

Options:

A. Electrolysis of pure water

B. Action of NaOH on zinc

C. From hydrocarbons

D. Electrolysis of warm $Ba(OH)_2$ solution

Answer: D

Solution:

The correct answer is:

Option D: Electrolysis of warm $Ba(OH)_2$ solution

Explanation (NCERT method):

- Dihydrogen of high purity (greater than 99.5%) is obtained by the electrolysis of warm aqueous $Ba(OH)_2$ solution using **nickel electrodes**.
- **Why not pure water?** Pure water is a poor conductor of electricity, so electrolysis is inefficient.
- **Why $Ba(OH)_2$?** Barium hydroxide provides good conductivity without forming interfering ions like sodium ions in NaOH, leading to very pure hydrogen gas.

Hence, option D is correct.

Question4

Which of the following is not a property of hydrogen peroxide?

MHT CET 2024 10th May Evening Shift

Options:

A. It is immiscible in water.

B. It is pale blue coloured liquid in pure state.

C. It's strength is explained in volume unit.

D. It is mild oxidising as well reducing agent.

Answer: A

Solution:

Option A is the correct choice.

Hydrogen peroxide is miscible in water, meaning it can mix with water in all proportions to form a homogeneous solution. The remaining options signify true properties of hydrogen peroxide:

Option B: In its pure state, hydrogen peroxide is indeed a pale blue liquid.

Option C: Its strength or concentration is often described in volume units, such as "20 volume" or "100 volume," which indicates the volume of oxygen gas released at standard temperature and pressure by a given volume of the hydrogen peroxide solution.

Option D: Hydrogen peroxide can act as both an oxidizing and reducing agent, depending on the reaction context, making it a mild oxidizing and reducing agent.

Question5

Which of the following compounds is recovered in solvay's process when NH_4Cl is treated with slaked lime?

MHT CET 2024 10th May Morning Shift

Options:

A. $NaCl$

B. NH_4HCO_3

C. NH_3

D. CO_2

Answer: C

Solution:

In the Solvay process, NH_4Cl is treated with slaked lime to recover NH_3.

$$\underset{\text{Ammonium chloride}}{2NH_4Cl} + \underset{\text{Slaked lime}}{Ca(OH)_2} \rightarrow \underset{\text{Calcium chloride}}{CaCl_2} + \underset{\text{Ammonia}}{2H_2O} + \underset{\text{Amme}}{2NH_3}$$

Question6

Which from following combinations represents water gas?

MHT CET 2024 3rd May Morning Shift

Options:

A. $CO_{(g)} + H_{2(\ g)}$

B. $CO_{(g)} + 3H_{2(g)}$

C. $CO_{2(g)} + 3H_{2(g)}$

D. $CO_{2(g)} + 2H_{2(g)}$

Answer: B

Solution:

Water-gas is a mixture of $CO_{(g)}$ and hydrogen. It is formed by the following reaction.

$$\underset{\substack{\text{Methane}\\\text{(Hydrocarbon)}}}{CH_{4(g)}} + \underset{\text{Steam}}{H_2O_{(g)}} \xrightarrow{1270\ K} \underbrace{CO_{(g)} + 3H_{2(g)}}_{\text{Water-gas (syngas)}}$$

Question7

Which from following elements is most abundant on earth?

MHT CET 2023 10th May Evening Shift

Options:

A. N

B. C

C. O

D. H

Answer: C

Solution:

The most abundant element on Earth is oxygen (O). It is a major component of the Earth's crust and also a significant part of the atmosphere in the form of molecular oxygen (O_2). Therefore, the correct option is :

Option C : O

Question8

Pure dihydrogen (99.5%) is obtained by the electrolysis of

MHT CET 2021 22th September Evening Shift

Options:

A. $NaOH_{(aq)}$ using Zn electrode

B. pure water

C. dil. H_2SO_4 using cadmium electrodes

D. warm barium hydroxide using Ni electrodes

Answer: D

Solution:

The process of electrolysis involves using an electric current to bring about a chemical change and often breaks compounds into its elements. The purity and process efficiency of hydrogen produced via electrolysis can depend significantly on the electrolyte used and the materials of the electrodes.

Option A suggests using sodium hydroxide ($NaOH_{(aq)}$) with zinc electrodes. The electrolysis of sodium hydroxide can indeed produce hydrogen gas at the cathode, but the choice of electrodes, in this case, zinc, is not necessarily optimized for producing pure dihydrogen without specific conditions or purifications.

Option B talks about using pure water for the electrolysis. Pure water without any electrolytes has a very low electrical conductivity, making it a poor medium for electrolysis. Additionally, the electrolysis of pure water without added electrolytes is inefficient and rarely results in a high purity of dihydrogen because of its low ion concentration.

Option C mentions dilute H_2SO_4 using cadmium electrodes. While dilute sulfuric acid is a common electrolyte for hydrogen production due to its good conductive properties and the resulting hydrogen purity, the use of cadmium electrodes is not the most common. Typically, platinum or other non-reactive electrodes are preferred to avoid electrode contamination or deterioration, which could affect the purity of the hydrogen produced.

Option D presents warm barium hydroxide ($Ba(OH)_2$) using nickel (Ni) electrodes. Electrolysis of barium hydroxide is efficient for producing high-purity hydrogen. The use of nickel electrodes is advantageous due to their good conductivity, stability in alkaline solutions, and resistance to corrosion. Furthermore, the electrolysis of warm barium hydroxide can increase the efficiency of hydrogen production due to increased ion mobility at higher temperatures.

Considering the best option for producing pure dihydrogen at 99.5%, Option D stands out as the most effective. The combination of warm barium hydroxide with nickel electrodes is known to be an efficient and effective method for generating high-purity hydrogen gas. Therefore, **Option D** is the correct answer.

Question9

Identify correct composition of water gas from following.

MHT CET 2021 22th September Morning Shift

Options:

A. $CO_{(g)} + H_2O_{(g)}$

B. $NO_{(g)} + 2H_{2(\ g)}$

C. $CO_{2(\ g)} + 3H_{2(\ g)}$

D. $CO_{(g)} + H_{2(\ g)}$

Answer: D

Solution:

The correct composition of water gas is a mixture of carbon monoxide (CO) and hydrogen (H_2). Let's analyze each option to identify the correct composition:

Option A:

$CO_{(g)} + H_2O_{(g)}$

This option includes carbon monoxide (CO) and water vapor (H_2O), which is not the correct composition of water gas.

Option B:

$NO_{(g)} + 2H_{2(\ g)}$

This option includes nitric oxide (NO) and hydrogen (H_2), which is not the correct composition of water gas.

Option C:

$CO_{2(\ g)} + 3H_{2(\ g)}$

This option includes carbon dioxide (CO_2) and hydrogen (H_2), which is not the correct composition of water gas.

Option D:

$CO_{(g)} + H_{2(\ g)}$

This option includes carbon monoxide (CO) and hydrogen (H_2), which is the correct composition of water gas.

Therefore, the correct answer is:

Option D

$CO_{(g)} + H_{2(g)}$

Question10

Which of the following processes does NOT involve use of dihydrogen?

MHT CET 2021 20th September Evening Shift

Options:

A. Gasification of coal

B. Formation of vanaspati ghee

C. Preparation of HCl

D. Preparation of metal hydride

Answer: A

Solution:

The process that **does NOT involve the use of dihydrogen (H_2)** is:

✅ **A) Gasification of coal**

Explanation:

- **Gasification of coal** involves reacting coal with **steam and oxygen** to produce *water gas* (CO + H_2). Here, dihydrogen is **produced**, not used as a reactant.
- **Formation of vanaspati ghee** → hydrogenation of oils (**uses H_2**)
- **Preparation of HCl** → $H_2 + Cl_2 \rightarrow 2HCl$ (**uses H_2**)
- **Preparation of metal hydride** → direct reaction of metals with H_2

✔ **Correct answer: A) Gasification of coal**

Question11

How many hydrogen atoms are surrounding each oxygen atom in structure of ice?

MHT CET 2020 19th October Evening Shift

Options:

A. 2

B. 3

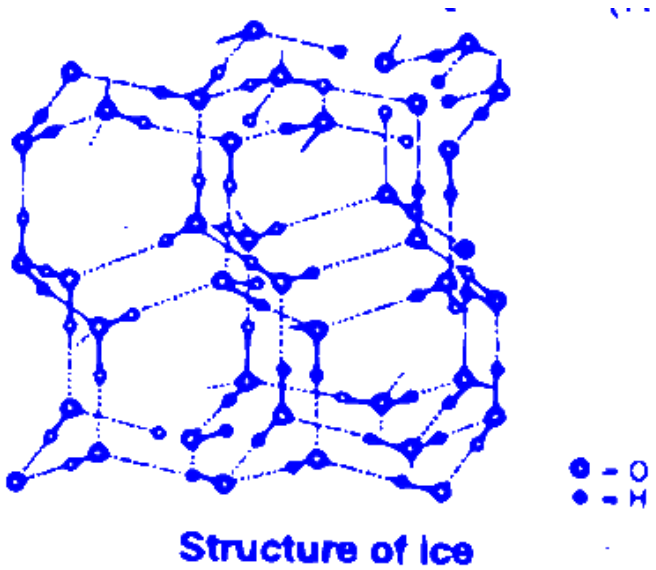
C. 4

D. 1

Answer: C

Solution:

Four hydrogen atoms are surrounding each oxygen atom in structure of ice. It possesses a regular crystalline structure based on the molecule of water, which consists of a single oxygen atom covalently bonded to two hydrogen atom (H – O – H).



Structure of Ice

Question12

Which of the following formula represents lithium imide?

MHT CET 2020 16th October Evening Shift

Options:

A. $LiNH_2$

B. Li_2NH

C. Li_3N

D. $LiNH$

Answer: B

Solution:

Lithium imide is an inorganic compound with the chemical formula Li_2NH. This white solid can be formed by a reaction between lithium amide and lithium hydride.

$$\underset{}{LiH_2} + LiH \longrightarrow \underset{\text{Lithium imide}}{Li_2NH} + H_2$$

The product is light sensitive and can undergo disproportionation to form lithium nitride.

Question13

The bond angle $H-O-O$ in H_2O_2 in gaseous phase is

MHT CET 2019 2nd May Evening Shift

Options:

A. 90.2°

B. 111.5°

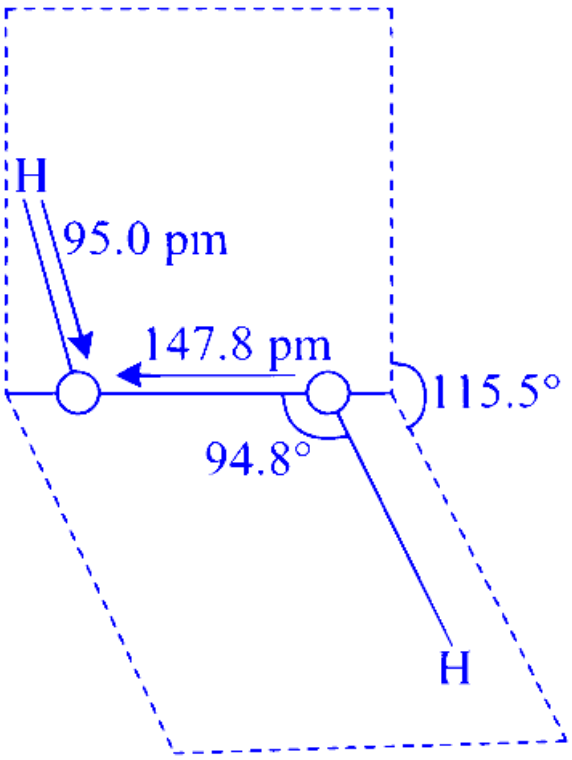
C. 101.9°

D. 94.8°

Answer: D

Solution:

The molecular dimensions of H_2O_2 in the gaseous phase is shown in the following figure.



H_2O_2 structure in gas phase

Thus, the bond angle $H - O - O$ in H_2O_2 in gaseous phase is 94.8°.
