Hydrogen and It's Compounds

Question1

Which one of the following properties is generally not applicable to ionic hydrides?

KCET 2024

Options:

A. Non-volatile

B. Non-conducting in solid state

C. Crystalline

D. Volatile

Answer: D

Solution:

Ionic hydrides are generally non-volatile in nature, due to its high melting point. Thus, option (d) is not applicable to ionic hydrides.

Question2

The correct decreasing order of boiling point of hydrogen halides is

KCET 2024

Options:

A. $HF > HCl > HBr > HI$

B. $HI > HBr > HCl > HF$

C. $HF > HI > HBr > HCl$

D. $HI > HF > HBr > HCl$

Answer: C

Solution:

HF is hydrogen bonded, thus it has highest boiling point. The remaining hydrogen halides are gaseous and their boiling points depend on the van der Waals' forces. Greater the molecule mass, greater will be the van der Waals' forces. Hence higher is the boiling point. Thus, the correct order is $HF > HI > HBr > HCl$.

Question3

The composition of water gas is

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Options:

A. $CO(g) + N_2(g)$

B. $CH_4(g)$

C. $CO(g) + H_2O(g)$

D. $CO(g) + H_2(g)$

Answer: D

Solution:

Water gas is primarily composed of carbon monoxide and hydrogen gas i.e. $CO(g) + H_2(g)$. It is a valuable industrial feedstock and used in production of chemicals, fuels and as a reducing agent in metallurgical applications.

Question4

A 30% solution of hydrogen peroxide is

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Options:

A. '30 volume' hydrogen peroxide

B. '10 volume' hydrogen peroxide

C. '50 volume' hydrogen peroxide

D. '100 volume' hydrogen peroxide

Answer: D

Solution:

30%$(w/v)H_2O_2$ means that 30 grams of H_2O_2 is present in 100 mL of the solution

$\Rightarrow$ It is equal to '100 V' H_2O_2.

Question5

Permanent hardness cannot be removed by

KCET 2021

Options:

A. using washing soda

B. Calgon's method

C. Clark's method

D. ion exchange method

Answer: C

Solution:

Permanent hardness cannot be removed by Clark's method. This method is used for removing temporary hardness.

Question6

Which of the following is not true regarding the usage of hydrogen as a fuel?

KCET 2019

Options:

A. High calorific value

B. The combustible energy of hydrogen can be directly converted to electrical energy in a fuel cell

C. Combusion product is ecofriendly

D. Hydrogen gas can be easily liquefied and stored

Answer: D

Solution:

Hydrogen gas cannot be easily liquified and stored. It can be converted into liquid state by cooling it to 20 K in the expensive insulated tanks. It occupies a large volume. A cylinder of compressed dihydrogen weights about 30 times as much as a tank of petrol possessing the same amount of energy.

Question7

H_2O_2 is

KCET 2018

Options:

A. an oxidising agent

B. a reducing agent

C. both oxidising and reducing agent

D. neither oxidising nor reducing agent

Answer: C

Solution:

In H_2O_2, oxidation number of oxygen is (-1).

As H_2O_2 gives O_2 [in which oxidation number of oxygen $= 0$] and H_2O [in which oxidation number of oxygen is $(-)2$]

$2H_2O_2 \longrightarrow 2H_2O + O_2$

Thus, H_2O_2 behave as both i.e. oxidising and reducing agent.

Question8

Which of the following ions will cause hardness in water?

KCET 2018

Options:

A. Ca^{2+}

B. Na^{+}

C. Cl^{-}

D. K^{+}

Answer: A

Solution:

Water hardness typically arises from the presence of divalent metal ions, primarily calcium (Ca^{2+}) and magnesium (Mg^{2+}). Here's a brief explanation:

Hard water contains high concentrations of Ca^{2+} and/or Mg^{2+} ions.

These ions come from the dissolution of minerals like limestone (calcium carbonate) or dolomite (calcium magnesium carbonate).

Among the options provided, only Option A, Ca^{2+}, is a divalent ion that contributes to water hardness.

The other ions, such as Na^{+}, Cl^{-}, and K^{+}, are either monovalent or anions and do not cause water hardness.

Therefore, the correct answer is:

Option A: Ca^{2+}.

Question9

In the manufacture of hydrogen from water gas $(CO + H_2)$, which of the following is correct statement?

KCET 2017

Options:

A. CO and H_2 are separated based on difference in their densities.

B. H_2 is removed by occlusion with Pd .

C. CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of CO_2 in alkali

D. Hydrogen is isolated by diffusion.

Answer: C

Solution:

In the manufacture of hydrogen from water gas, the process involves the following reactions:

Carbon reacts with water vapor:

$$C(s) + H_2O(g) \longrightarrow CO(g) + H_2(g)$$

Carbon monoxide is further oxidized using steam in the presence of a catalyst:

$$CO + H_2O \xrightarrow{673\ K} CO_2 + H_2$$

In this second reaction, carbon monoxide (CO) is oxidized to carbon dioxide (CO_2) with steam. The CO_2 is then removed by being absorbed in an alkali solution, effectively separating it from the hydrogen gas.