

1. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: Loss of electron from hydrogen atom results in nucleus of $\sim 1.5 \times 10^{-3}$ pm size.

Reason R: Proton (H^+) always exists in combined form.

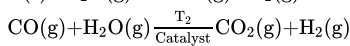
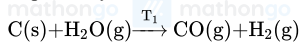
In the light of the above statements, choose the most appropriate answer from the options given below:

[2023 (06 Apr Shift 1)]

- (1) Both A and R are correct and R is the correct explanation of A
 - (2) A is correct but R is not correct
 - (3) A is not correct but R is correct
 - (4) Both A and R are correct but R is NOT the correct explanation of A
2. Which of the following can reduce decomposition of H_2O_2 on exposure to light

[2023 (08 Apr Shift 2)]

- (1) Urea
 - (2) Alkali
 - (3) Glass containers
 - (4) Dust
3. Given below are two reactions, involved in the commercial production of dihydrogen (H_2). The two reactions are carried out at temperature " T_1 " and " T_2 ", respectively



The temperatures T_1 and T_2 are correctly related as

[2023 (10 Apr Shift 1)]

- (1) $T_1 = T_2$
 - (2) $T_1 < T_2$
 - (3) $T_1 = 100$ K, $T_2 = 1270$ K
 - (4) $T_1 > T_2$
4. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Physical properties of isotopes of hydrogen are different.

Reason R : Mass difference between isotopes of hydrogen is very large.

In the light of the above statements, choose the correct answer from the options given below:

[2023 (10 Apr Shift 2)]

- (1) Both A and R are true and R is the correct explanation of A
 - (2) A is false but R is true
 - (3) A is true but R is false
 - (4) Both A and R are true but R is NOT the correct explanation of A
5. Which hydride among the following is less stable?

[2023 (11 Apr Shift 2)]

- (1) BeH_2
 - (2) HF
 - (3) NH_3
 - (4) LiH
6. Match List I with List II

	List I Type of Hydride		List II Example
A	Electron deficient hydride	I	MgH_2
B	Electron rich hydride	II	HF
C	Electron precise hydride	III	B_2H_6
D	Saline hydride	IV	CH_4

Choose the correct answer from the options given below :

[2023 (12 Apr Shift 1)]

- (1) A-III, B-II, C-IV, D-I
- (2) A-II, B-III, C-I, D-IV
- (3) A-II, B-III, C-IV, D-I
- (4) A-III, B-II, C-I, D-IV

7. Given below are two statements:
Statement I: Permutit process is more efficient compared to the synthetic resin method for the softening of water.
Statement II: Synthetic resin method results in the formation of soluble sodium salts.
In the light of the above statements, choose the most appropriate answer from the options given below:

[2023 (13 Apr Shift 1)]

- (1) Both the statements I and II are incorrect
 - (2) Statement I is incorrect but statement II is correct
 - (3) Both the statements I and II are correct
 - (4) Statement I is correct but statement II is incorrect
8. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Isotopes of hydrogen have almost same chemical properties, but difference in their rates of reactions.

Reason R: Isotopes of hydrogen have different enthalpy of bond dissociation.

In the light of the above statements, choose the most appropriate answer from the options given below:

[2023 (13 Apr Shift 2)]

- (1) Both A and R are correct but R is NOT the correct explanation of A
- (2) Both A and R are correct and R is the correct explanation of A
- (3) A is not correct but R is correct
- (4) A is correct but R is not correct

9. During water-gas shift reaction

[2023 (15 Apr Shift 1)]

- (1) Carbon monoxide is oxidized to carbon dioxide.
- (2) Water is evaporated in presence of catalyst.
- (3) Carbon is oxidized to carbon monoxide.
- (4) Carbon dioxide is reduced to carbon monoxide.

ANSWER KEYS

1. (4) 2. (1) 3. (4) 4. (1) 5. (1) 6. (1) 7. (1) 8. (2)
9. (1)

1. (4)

Loss of an electron from a hydrogen atom results in a nucleus of very small size as compared to other atoms or ions. Due to its small size it cannot exist free. Loss of the electron from hydrogen atom results in nucleus size (H^+) of 1.5×10^{-3} .

A proton is a positively charged subatomic particle that is present in the nucleus of an atom, and it can exist in various forms, including as a part of an atomic nucleus, as a free particle, or as a constituent of a larger particle such as a molecule. H^+ always exists in combined form.

Both A and R are correct but there is no relation between two statements.

2. (1)

H_2O_2 decomposes on exposure to sunlight or on heating. It also decomposes on standing but at a slow rate. These reactions occur explosively when H_2O_2 is in contact with dust. Urea acts as a negative catalyst to this reaction and slow down the decomposition of hydrogen peroxide.

3. (4)

$C(s) + H_2O(g) \xrightarrow{1270\text{ K } (T_1)} CO(g) + H_2(g)$ is known as coal gasification reaction. The mixture produced in this reaction is called water gas.

$CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{673\text{ K } (T_2)} CO_2(g) + H_2(g)$ is known as water gas shift reaction. Using water gas shift reaction we can increase the concentration of hydrogen gas.

Hence, $T_1 > T_2$

4. (1)

The isotopes of hydrogen are protium, deuterium, and tritium, which have different physical properties. For example, deuterium has a higher boiling point and a lower vapor pressure than protium, while tritium is radioactive and has a much shorter half-life than the other two isotopes.

The mass difference between the isotopes of hydrogen is indeed significant, with protium having a mass of 1 atomic mass unit (amu), deuterium having a mass of 2 amu, and tritium having a mass of 3 amu.

So Both A and R are true and R is the correct explanation of A.

5. (1) BeH_2 is indeed considered to be less stable compared to other hydrides among the given due to its significant covalent character and electron

deficiency. Beryllium, being a small and highly charged cation, attracts the electrons in the $Be - H$ bonds more strongly, resulting in a greater degree of electron sharing between beryllium and hydrogen. This covalent character is in contrast to other alkaline earth metal hydrides, which tend to have more ionic character.

6. (1)

B_2H_6 , known as diborane, is an example of an electron-deficient hydride. HF, or hydrogen fluoride, is an example of an electron-rich hydride. Electron-rich hydrides are molecules that contain more electrons than what would be expected based on the normal valence electron count for the atoms involved.

CH_4 is electrons precise hydride since, there are exact number of electrons to form normal covalent bonds for completing octet.

MgH_2 is saline hydride, as this is the hydride that formed when hydrogen reacts with s-Block elements.

A	Electron deficient hydride	III	B_2H_6
B	Electron rich hydride	II	HF
C	Electron precise hydride	IV	CH_4
D	Saline hydride	I	MgH_2

7. (1)

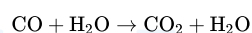
The difference between the zeolite and ion exchange process is that the zeolite process uses the mineral zeolite as the exchanging resin for cations in the hard water whereas the ion exchange process include several different resins for the ion exchange. Synthetic resins method is more efficient as it can exchange both cations and anions.

8. (2) While isotopes of an element have the same electronic configuration, their chemical properties can differ slightly due to differences in their atomic mass.

Isotopes of an element have the same number of protons but varying numbers of neutrons, which affects the overall mass of the atom. The only difference is in their rates of reactions, mainly due to their different enthalpy of bond dissociation.

9. (1)

The reaction between CO of syn gas and steam in presence of catalyst is called water gas shift reaction.



This reaction increases the yield of hydrogen obtained from coal gasification reaction as shown below.

