## Hydrogen

## **Question1**

Which of the following statements are NOT correct?

A. Hydrogen is used to reduce heavy metal oxides to metals.

**B.** Heavy water is used to study reaction mechanism.

C. Hydrogen is used to make saturated fats from oils.

D. The H–H bond dissociation enthalpy is lowest as compared to a single bond between two atoms of any elements.

E. Hydrogen reduces oxides of metals that are more active than iron.

Choose the most appropriate answer from the options given below: [NEET 2023]

#### **Options:**

A.

B, D only

B.

D, E only

C.

A, B, C only

D.

B, C, D, E only

#### Answer: B

#### Solution:

Statement A, B, C are correct

(D) H-H bond dissociation energy is maximum as compared to single bond between two atom of any element.(E) Hydrogen reduces oxides of metal that are less active than iron.

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## **Question2**

### Match List-I with List-II.

List-I	List-II		
(Hydrides)	(Nature)		
(a) <i>MgH</i> <sub>2</sub>	(i) Electron precise		
(b) <i>GeH</i> <sub>4</sub>	(ii) Electron deficient		
(c) $B_2 H_6$	(iii) Electron rich		
(d) HF	(iv) lonic		

## Choose the correct answer from the options given below [NEET-2022]

#### **Options:**

A. (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii) B. (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv) C. (a) – (i), (b) – (ii), (c) – (iv), (d) – (iii) D. (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)

#### Answer: A

#### Solution:

Solution:

List-I	List-II		
(Hydrides)	(Nature)		
(a) <i>MgH</i> <sub>2</sub>	$\rightarrow$ lonic		
(b) <i>GeH</i> <sub>4</sub>	$\rightarrow$ Electron precise		
(c) B <sub>2</sub> H <sub>6</sub>	$\rightarrow$ Electron deficient		
(d) HF	$\rightarrow$ Electron rich		

(a) - (iv), (b) - (i), (c) - (ii), (d) - (iii)

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## **Question3**

The element used for welding metals with high melting points is: [NEET Re-2022]

- A. He
- B.  $Cl_2$
- C. H<sub>2</sub>
- D. Ne

Answer: C

#### Solution:

#### Solution:

The oxy-hydrogen flame can produce the temperature of 4000 K. So atomic hydrogen is used for welding of metals with high melting point.

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## **Question4**

## Tritium, a radioactive isotope of hydrogen, emits which of the following particles? [NEET 2021]

<b>Options:</b>			
A. Beta (β <sup>-</sup> )			

B. Alpha ( $\alpha$ )

C. Gamma (y)

D. Neutron (n)

Answer: A

#### Solution:

#### Solution:

Hydrogen has three isotopes: protium,  $_{1}^{1}H$  deuterium,  $_{1}^{2}H$  or D and tritium  $_{1}^{3}H$  or T. Of these isotopes, only tritium is radioactive and emits low energy beta<sup>-</sup>particles (t<sub>1/2</sub>, 12.33. years)

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## **Question5**

The method used to remove temporary hardness of water is (NEET 2019)

- A. synthetic resins method
- B. Calgon's method
- C. Clark's method
- D. ion-exchange method.

Answer: C

#### Solution:

#### Solution:

Clark's process is used to remove temporary hardness of water. In this method quick lime is added. The bicarbonates present in temporary hard water react with lime water to form insoluble calcium and magnesium carbonates which can be easily filtered off. CaO + 4H<sub>2</sub>O  $\rightarrow$  Ca(OH)<sub>2</sub> Quick lime Lime water Ca(H CO<sub>3</sub>)<sub>2</sub> + Ca(OH)<sub>2</sub>  $\rightarrow$  2CaCO<sub>3</sub>  $\downarrow$  +2H<sub>2</sub>O

 $M g(H CO_3)_2 + 2Ca(OH)_2 \rightarrow 2CaCO_3 \downarrow + M g(OH)_2 \downarrow + 2H_2O$ 

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### **Question6**

The number of hydrogen bonded water molecule(s) associated with  $CuSO_4.5H_2O$  is (Odisha NEET 2019)

#### **Options:**

A. 3

B. 1

C. 2

D. 5

#### Answer: B

#### Solution:

#### Solution:

The ionic formulation of  $CuSO_4.5H_2O$  is  $[Cu(H_2O)_4]H_2O \cdot SO_4$ , in which four  $H_2O$  molecules are coordinated to a central  $Cu^{2+}$  ion while the fifth  $H_2O$  molecule is hydrogen bonded to sulphate group.

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### **Question7**

Which of the following statements about hydrogen is incorrect? (NEET- I 2016)

- A. Hydronium ion, H  $_{3}O^{+}$  exists freely in solution.
- B. Dihydrogen does not act as a reducing agent.
- C. Hydrogen has three isotopes of which tritium is the most common.
- D. Hydrogen never acts as cation in ionic salts.

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#### Answer: C

#### Solution:

#### Solution:

Dihydrogen acts as a powerful reducing agent and reduces metal oxides such as CuO, Z nO, PbO and F  $e_3O_4$  to their respective metals. CuO + H<sub>2</sub>  $\rightarrow$  Cu + H<sub>2</sub>O Z nO + H<sub>2</sub>  $\rightarrow$  Z n + H<sub>2</sub>O F  $e_3O_4 + 4H_2 \rightarrow 3F e + 4H_2O$ Hydrogen has three isotopes of which protium is the most common and tritium is radioactive.

## **Question8**

Some statements about heavy water are given below: (i) Heavy water is used as a moderator in nuclear reactors. (ii) Heavy water is more associated than ordinary water. (iii) Heavy water is more effective solvent than ordinary water. Which of the above statements are correct? (2010 Mains)

#### **Options:**

A. (i) and (ii)

- B. (i),(ii) and (iii)
- C. (ii) and (iii)

D. (i) and (iii)

Answer: A

#### Solution:

Heavy water is used for slowing down the speed of neutrons in nuclear reactors, hence used as moderators. Boiling point of heavy water is greater (374.42 K) than that of ordinary water(373 K), hence heavy water is more associated. Dielectric constant of ordinary water is greater than that of heavy water, hence ordinary water is a better solvent.

## **Question9**

## The structure of H $_2O_2$ is (2003)

#### **Options:**

A. spherical

B. non-planar

C. planar

D. linear.

Answer: B

#### Solution:

**Solution:** Hydrogen peroxide has a non-planar structure.

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## **Question10**

# Which one of the following pairs of substances on reaction will not evolve H $_2$ gas? (1998)

#### **Options:**

A. Copper and HCl (aqueous)

B. Iron and steam

- C. Iron and H  $_2$ SO<sub>4</sub> (aqueous)
- D. Sodium and ethyl alcohol

#### Answer: A

#### Solution:

#### Solution:

Copper is a noble metal, as it lies below hydrogen in the electrochemical series. Therefore it can't displace hydrogen from dilute HCl. While iron and sodium lie above hydrogen in the electrochemical series, so they can liberate H  $_2$  either from steam or H  $_2$ SO $_4$  solution.

 $\begin{array}{l} C_2H_5 - OH + Na \rightarrow C_2H_5 - ONa + 1/2H_2 \\ Fe + H_2SO_4 \rightarrow FeSO_4 + H_2 \\ 3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2 \end{array}$ 

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## **Question11**

## The volume strength of $1.5 \text{N H}_2\text{O}_2$ solution is (1997,1996)

#### **Options:**

A. 8.8

B. 8.4

C. 4.8

D. 5.2

Answer: B

#### Solution:

#### Solution:

Normality (N) = 1.5 We know that equivalent weight of H  $_2O_2$  is 17 and strength of H  $_2O_2$  = Normality × Equivalent weight =  $1.5 \times 17 = 25.5$ 2H  $_2O_2 \rightarrow 2H_2O + O_2$ (234=68g) (22.4)L since 68 grams of H  $_2O_2$  produces 22.4 litres oxygen at NTP, therefore 25.5 grams of H  $_2O_2$  will produce =  $\frac{22.4}{68} \times 25.5 = 8.4$  litre of oxygen. Thus, volume strength of given H  $_2O_2$  solution is 8.4.

## **Question12**

The O – O – H bond angle in  $H_2O_2$  is (1994)

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#### **Options:**

A. 106°

B. 109°28

C. 120°

D. 97°

#### Answer: D

#### Solution:

## **Question13**

## Which of the following groups of ions makes the water hard? (1994)

#### **Options:**

- A. Sodium and bicarbonate
- B. Magnesium and chloride
- C. Potassium and sulphate
- D. Ammonium and chloride

#### Answer: B

#### Solution:

#### Solution:

Hardness of water is due to the presence of chlorides and sulphates of Ca and M g is called permanent hardness. Hence, hard water will consist of M  $g^{2+}$  and  $Cl^-$  ions.

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## **Question14**

One would expect proton to have very large (1993)

#### **Options:**

A. charge

- B. ionization potential
- C. hydration energy
- D. radius.

**Answer: C** 

#### Solution:

#### Solution:

Proton (H  $^{\rm +})$  ion being very small in size would have very large hydration energy.

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## **Question15**

## At its melting point, ice is lighter than water because (1992)

#### **Options:**

A. H<sub>2</sub>O molecules are more closely packed in solid state

B. ice crystals have hollow hexagonal arrangement of H  $_2O$  molecules.

C. on melting of ice the H<sub>2</sub>O molecules shrinks in size

D. ice forms mostly heavy water on first melting.

#### **Answer: B**

#### Solution:

#### Solution:

When ice melts, its molecules move into the holes or open spaces and comes closer to each other than they were in solid state. Thus, ice has lower density than water and there is contraction in volume.

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### **Question16**

## Water gas is produced by (1992)

#### **Options:**

A. passing steam through a red hot coke

B. saturating hydrogen with moisture

C. mixing oxygen and hydrogen in the ratio of 1: 2

D. heating a mixture of  $CO_2$  and  $CH_4$  in petroleum refineries.

#### Answer: A

#### Solution:

 $\begin{array}{c} H_{2}O + C \\ _{steam} \end{array} \rightarrow \begin{array}{c} H_{2} + CO \\ _{water \, gas} \end{array}$ 

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### **Question17**

Hydrogen peroxide molecules are (1991)

- A. monoatomic and form  $X_2^{2-}$  ions
- B. diatomic and form X  $\bar{}$  ions
- C. diatomic and form X  $_2^-$  ions
- D. monoatomic and form X  $\bar{}$  ions.

#### Answer: B

#### Solution:

Solution:  $H_2O_2$  is diatomic and forms  $H^+ + HO_2^-(X^-)$  (hydroperoxide ion).

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### **Question18**

The ionization of hydrogen atom would give rise to (1990)

#### **Options:**

A. hydride ion

B. hydronium ion

C. proton

D. hydroxyl ion.

#### Answer: C

#### Solution:

It gives rise to proton. H  $_{(g)} \rightarrow$  H  $_{(aq)}^{+} + e^{-}$ Proton

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### **Question19**

Which of the following metal evolves hydrogen on reacting with cold dilute H N  $O_3$ ? (1989)

C

- A. Mg
- B. Al
- C. Fe
- D. Cu

#### **Answer:** A

### **Solution:**

 $M\,g$  reacts with nitric acid to give  $M\,g(N\,O_3)_2$  and evolves H  $_2$ M g + 2H N O<sub>3</sub>  $\rightarrow$  M g(N O<sub>3</sub>)<sub>2</sub> + H <sub>2</sub>

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## (1989)

#### **Options:**



**Solution:** 

**Question20** Which of the following is the true structure of H  $_2O_2$ ?



## **Question21**

The reaction of H  $_2O_2$  with H  $_2S$  is an example of .....reaction. (1988)

#### **Options:**

A. addition

B. oxidation

C. reduction

D. acidic

Answer: B

#### Solution:

It is an example of oxidation reaction. H  $_2 \rm S$  + H  $_2 \rm O_2 \rightarrow 2 \rm H _2 \rm O$  + S

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