



## CHEMISTRY

### JEE MAIN AND ADVANCED

## HYDROGEN

#### Example

1. On the basis of electron affinity, comment on the resemblance of hydrogen with halogens.



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2. Which isotope of hydrogen is radioactive in nature?

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3. Which isotope of hydrogen contains equal number of protons and neutrons?

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4. Comment on the reaction of dihydrogen with fluorine.

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5. Explain the use of hydrogen in the formation of vegetable fats.

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6. Which class of covalent hydrides are considered as Lewis acids?



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7. Association of molecules in water is due to:



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8. Describe the nature of ionic hydrides.



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9. Why does alcohol (a covalent compound) dissolve in water (ionic)?

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10. Which properties of hydrogen are responsible for moderation of the climate and body temperature of living beings?

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11. Compare the density of ice and water.

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12. Does water get oxidised in the process of photosynthesis?

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13. What type of water forms scum with soap?



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14. Write the reaction that takes place on adding lime to water containing magnesium bicarbonate.



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15. Explain with the help of reactions that how heavy water is used in the preparation of deuterium compounds?



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16. What is calgon?



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17. Calculate the strength of 30 volume solution of hydrogen peroxide.



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18. What is the percentage strength of a solution of 100 volume  $H_2O_2$ ?

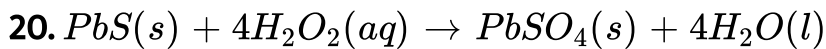


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19. Why  $H_2O_2$  is kept away from dust?



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In the above reaction,  $H_2O_2$  acts as a/an \_\_\_\_ agent.



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### Try Yourself

1. Explain how hydrogen differs from alkali metals on the basis of ionisation energies.



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2. On the basis of their electronic configuration, explain why alkali metals are highly reactive?



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3. Which isotope of hydrogen has no neutron?



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4. Which isotope of hydrogen is known as ordinary hydrogen?



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5. Define isotopes why do isotopes have same atomic number but different mass numbers? Explain with the help of an example.



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6. Comment on the reactions of dihydrogen with (a) chlorine, (b) sodium and (c) copper (II) oxide.



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7. In what ratio is nitrogen and hydrogen required to form ammonia?



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8. In the laboratory preparation of hydrogen, pure zinc is not used because



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9. What is 'syn' gas?



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10. On what basis are the molecular hydrides classified?



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11. a. Would you expect the hydrides of  $N$ ,  $O$  and  $F$  to have lower boiling points than the hydrides of their subsequent group members? Give reason.

b. Can phosphorous with outer electronic configuration  $3s^2 3p^3$  form  $PH_5$ ?

c. How many hydrogen-bonded water molecules(s) are associated with  $CuSO_4 \cdot 5H_2O$ ?

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13. What are non-stoichiometric compounds ?

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14. Which basis class of molecular hydrides act as lewis bases?



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15. How is lithium aluminium hydride prepared? What is its important use?



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16. How many hydrogen-bonded water molecule(s) are associated in  $CuSO_4 \cdot 5H_2O$ ?



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17. Which property of water is responsible for its very strong hydrating tendency?



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18. Water acts as a/an \_\_\_\_\_ when it reacts with ammonia.



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19. Cation exchange resins are generated by treating with \_\_\_\_\_.



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20. Why temporary hardness of water is called so?



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21. Which anions produce permanent hardness in water?



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22. Which of the following pair of ions makes the water hard(temporary) ?



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23. Write few uses of heavy water.



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24. There is a sample of 10 volume of hydrogen peroxide solution . Calculate its strength.



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25.  $H_2O_2$  is always stored in black bottles because



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26. Is  $H_2O_2$  planar in nature?



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27. Explain how hydrogen differs from alkali metals on the basis of ionisation energies.



[Watch Video Solution](#)

28. On the basis of electronic configuration, how hydrogen resembles alkali metals ?



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29. Which isotope of hydrogen has no neutron?



[Watch Video Solution](#)

30. Which isotope of hydrogen is known as ordinary hydrogen?



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31. Write the names of the three isotopes of hydrogen. What is the mass ratio of these isotopes?



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**32.** Define isotopes why do isotopes have same atomic number but different mass numbers? Explain with the help of an example.



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40. What do you understand by the term “non-stoichiometric hydrides”? Do you expect this type of the hydrides to be formed by alkali metals? Justify your answer.

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41. Which basis class of molecular hydrides act as lewis bases?

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42. How is lithium hydride useful ?

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43. How many hydrogen-bonded water molecule(s) are associated in  $CuSO_4 \cdot 5H_2O$ ?



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44. Which property of water is responsible for its very strong hydrating tendency?



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45. Water acts as a/an \_\_\_\_\_ when it reacts with ammonia.



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46. The number of water molecule(s) directly bonded to the metal centre in  $CuSO_{4.5}H_2O$  is

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47. Cation exchange resins are generated by treating with\_\_\_\_\_.

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48. Why temporary hardness of water is called so?

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49. Which anions produce permanent hardness in water?

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50. Which of the following pair of ions makes the water hard(temporary) ?

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51. Write few uses of heavy water.

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52. Calculate the strength of 10 volume solution of hydrogen peroxide.

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53. How is  $H_2O_2$  stored ?



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54. Is  $H_2O_2$  planar in structure ?



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## Assignment Section A

1. The ionisation energy of hydrogen is high as compared to alkali metals because of

A. One electron in outermost shell

B. Small size



C. One proton in its nucleus

D. No neutron

**Answer: B**



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2. Which of the following is the correct statement?

A. Hydrogen has the same I.E. as that of alkali metals

B. Hydrogen has strong tendency to gain one electron same as that of alkali metals

C. Hydrogen molecule is diatomic so are the halogens

D. Electron affinity of hydrogen is same as that of halogens

**Answer: C**



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3. The isotope of hydrogen which is radioactive is

- A. Protium
- B. Tritium
- C. Deuterium
- D. Neutron

**Answer: B**



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4. Hydrogen accepts an electron to form inert gas configuration. In this it resembles

A. halogens

B. Alkali metals

C. Alkaline earth metals

D. Chalcogens

**Answer: A**



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5. The volume of  $O_2$  liberated from 0.96g of  $H_2O_2$  is

A. 224.6 mL

B. 320.5mL

C. 390.0 mL

D. 112.5 mL

**Answer: B**



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**6.** The composition of tritium is

- A. 1 electron, 1 proton, 1 neutron
- B. 1 electron, 2 protons, 1 neutron
- C. 1 electron, 1 proton, 2 neutrons.
- D. 1 electron, 1 proton, 3 neutrons

**Answer: C**



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**7.** Hydrogen acts as a reducing agent and thus resembles

- A. halogen
- B. Noble gas
- C. Radioactive elements
- D. Alkali metals

**Answer: D**



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**8. Which position for hydrogen explain all its properties ?**

- A. At the top of halogens
- B. At the top of alkali metals
- C. At the top of chalcogens
- D. Both 1 and 2

**Answer: D**



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**9.** Ionisation energy of hydrogen is

- A. Equal to that of fluorine
- B. Lower than that of fluorine
- C. slightly higher than that of fluorine
- D. Much higher than that of fluorine

**Answer: B**



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10. Which of the following statements concerning protium, deuterium and tritium is not true ?

- A. They are isotopes of each other
- B. They have similar electronic configurations
- C. they exist in the nature in the ratio of 1:2:3 respectively
- D. Their mass numbers are in the ratio 1:2:3 respectively.

**Answer: C**



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11. Deuterium differs from hydrogen ?

- A. Chemical properties
- B. Physical properties

C. Both chemical and physical properties

D. Their radioactive properties.

**Answer: B**



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12. Number of nucleons in  $D_2$  molecule is

A. 1

B. 2

C. 3

D. 4

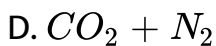
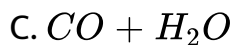
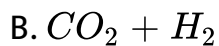
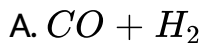
**Answer: D**



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13. Water gas is



**Answer: A**



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14. The catalyst used in the water-gas shift reaction is

A. Sodium arsenite

B. Nickel

C. Potassium permanganate

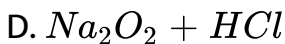
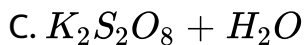
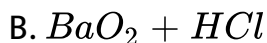
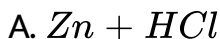
D. Iron chromate

**Answer: D**



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**15.** The reaction between which of the following reactants produces hydrogen?



**Answer: A**



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16. High purity dihydrogen is obtained by electrolysing

- A. Warm aqueous barium hydroxide
- B. Brine solution
- C. Acidified sulphate solution
- D. Water gas

**Answer: A**



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17. Hydrogen is not obtained when zinc reacts with

- A. Cold water

- B. Hot NaOH solution
- C. Conc. Sulphuric acid
- D. Dilute HCl

**Answer: C**



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**18.** The process by which ammonia is formed from nitrogen and hydrogen is

- A. Contact process
- B. Haber process
- C. Ostwald process
- D. Hydrogenation process

**Answer: B**



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**19. Hydroformylation of olefins yields**

A. Alkanes

B. Alkynes

C. Aldehydes

D. Carboxylic acids

**Answer: C**



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**20. Which of the following is not the use of dihydrogen?**

- A. It is used as a bleaching agent
- B. It is used in the preparation of ammonia
- C. It is used in the preparation of methanol
- D. It is used as a rocket fuel

**Answer: A**



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**21. Alkali metal hydrides react with water to give**

- A. Acidic solution
- B. Basic solution
- C. Neutral solution
- D. Hydride ion

**Answer: B**



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**22.** Ionic hydrides are usually

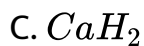
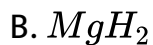
- A. Good conductors of electricity in solid state
- B. Stoichiometric compounds
- C. Volatile
- D. Non-crystalline

**Answer: B**



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**23.** Group 2 hydrides with significant covalent character is/are



D. Both 1 and 2

**Answer: D**



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**24.** In which of the compounds does hydrogen have an oxidation state of -1?





D.  $CaH_2$

**Answer: D**

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25. The  $H - O - H$  angle in water molecule is about

A.  $90^\circ$

B.  $180^\circ$

C.  $109^\circ 28'$

D.  $104.5^\circ$

**Answer: D**

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26. The low density of ice compared to water is due to

- A. Intense covalent bonding
- B. Dipole-induced dipole interaction
- C. Intense hydrogen bonding
- D. Dipole-dipole interactions

**Answer: C**



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27. Hardness of water cannot be removed by

- A. Treating with washing soda
- B. Boiling
- C. Adding calgon

D. Addition of chlorine.

**Answer: D**



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28. Temporary hardness may be removed from water adding.

A.  $CaCO_3$

B.  $Ca(OH)_2$

C.  $CaSO_4$

D.  $HCl$

**Answer: B**



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29.  $H_2O_2$  is stored in

- A. Glass containers
- B. Metallic vessels
- C. Plastic vessels
- D. Containers exposed to sunlight.

**Answer: C**



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30. Permanent hardness can be removed by adding

- A. Slaked lime
- B. Sodium bicarbonate
- C. Washing soda

D. Calcium hydroxide

**Answer: C**



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**31.** Which of the following statements is not true?

- A. the temporary hardness is due to presence of Ca and Mg bicarbonates
- B. permanent hardness is removed by adding lime
- C. permanent hardness is due to the presence soluble Ca and Mg sulphates and chlorides
- D. Temporary hardness is removed by boiling

**Answer: B**



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**32.** Permutit is :

- A. Hydrated sodium aluminium silicate
- B. Sodium hexaphosphate
- C. Sodium bicarbonate
- D. Calcium hydroxide

**Answer: A**



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**33.** In cation exchange process for removing hardness of water, the resulting water turns

A. Acidic

B. Basic

C. Neutral

D. Both 1 and 2

**Answer: A**



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**34.** Heavy water is

A. De-mineralised water

B. De-ionized water

C. Ordinary water containing dissolved salts of heavy metals

D. It is the compounds of heavier isotope of hydrogen with oxygen ( $D_2O$ )

**Answer: D**



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35. The structure of  $H_2O_2$  is

- A. Open book like
- B. Closed book like
- C. Pyramidal
- D. Linear

**Answer: A**



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36. The dihedral angle in gaseous  $H_2O_2$  is

A.  $111.5^\circ$

B.  $90.2^\circ$

C.  $94.8^\circ$

D.  $101.9^\circ$

**Answer: B**



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## Assignment Section B

1. Dipole moment of  $H_2O_2$  is non-zero as

- A. Two dipole moments are opposite but unequal
- B. Two dipole moments are opposite and equal
- C. Two dipole moments are equal but not at  $180^\circ$
- D. Two dipole moments are equal but non-planar.

**Answer: D**



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2. An orange coloured solution acidified with  $H_2SO_4$  and treated with a substance 'X' gives a blue coloured solution of  $CrO_5$ . The substance 'X' is

A.  $H_2O$

B. Dil. HCl

C.  $H_2O_2$

D. Conc. HCl

**Answer: C**



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3. Number of  $H -$  bonds formed by a water molecule is:

A. 2

B. 8

C. 1

D. 4

**Answer: D**



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4. When 1 mole of PbS reacts completely with  $H_2O_2$

A.  $H_2$  is liberated

B.  $O_2$  is liberated

C. 4 moles of  $H_2O_2$  consumed

D. Sulphur is converted to sulphite

**Answer: C**



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5. The term hydride gap refers to which region of periodic table?

A. Groups 6 to 9

B. groups 7 to 9

C. groups 7 to 10

D. groups 5 to 7

**Answer: B**



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**6. Which one is true about nascent hydrogen?**

A. More reactive than molecular hydrogen

B. can be produced in situ

C. Show similarity exactly with hydrogen in reduction reactions

D. both 1 and 2

**Answer: D**



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7. 2-Ethyl anthraquinol when oxidised in air produces

A.  $O_3$

B.  $H_2O_2$

C.  $H_2O$

D.  $C_2H_5OH$

**Answer: B**



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8. In alkaline medium, which elements can produce hydrogen?

A. Zn, Si

B. Cu, Ag

C. Cu,  $N_2$

D. Al, C

**Answer: A**



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**9. Select the incorrect statement**

A. Ortho and para hydrogen are different due to difference in their nuclear spins

B. Ortho and para hydrogen are different due to difference in their electron spins

C. Para hydrogen has a lower internal energy than that of ortho hydrogen

D. Para hydrogen is more stable at lower temperature

**Answer: A**



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**10.** Hydride ion is a

A. Strong conjugate acid of  $H_2$

B. Strong conjugate base of  $H_2$

C. Strong conjugate acid of  $H^+$

D. Strong conjugate base of  $H^-$

**Answer: B**





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11. Ionic hydrides react with water to

- A. Give acidic solutions
- B. Give basic solutions
- C. Produce hydride ions
- D. Produce protons

**Answer: B**



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12. The boiling point of water is exceptionally high because

- A. Covalent bond between H and O

B. Linear shape

C. Hydrogen bonding

D. Non-linear shape

**Answer: C**



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### 13. Metallic Hydrides

A. Are also called interstitial hydrides

B. Are non-stoichiometric, being deficient in hydrogen

C. are poor conductors of electricity, exhibit less paramagnetism and have hydrogen as atom and not as a molecular.

D. Have all properties given above

**Answer: D**



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14. In the following reaction using isotopic  $^{18}\text{O}$  in  $\text{H}_2\text{O}_2$ ,  $2\text{MnO}_4^- + 3\text{H}_2\text{O}_2^{18} \rightarrow 2\text{MnO}_2 + 3\text{O}_2 + 2\text{H}_2\text{O} + 2\text{OH}^-$

isotopic oxygen goes

A. Both with  $\text{O}_2$

B. Both with  $\text{MnO}_2$

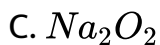
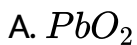
C. Both with  $\text{OH}^-$

D. One with  $\text{O}_2$  and one with  $\text{MnO}_2$

**Answer: A**

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15.  $H_2O_2$  can be obtained when following reacts with  $H_2SO_4$  excepts with



**Answer: A**

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16. Consider  $LiH$ ,  $MgH_2$  and  $CuH$ :

A. All are ionic hydrides

B. LiH,  $MgH_2$  are ionic and CuH is covalent hydride

C. All are covalent hydrides

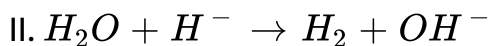
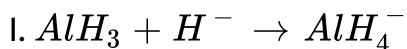
D. LiH is ionic,  $MgH_2$  and CuH are intermediate hydrides.

**Answer: D**



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**17.** Consider the following reactions



Select the correct statement based on these reactions.

A.  $H^-$  is a lewis acid in I and lewis base in II

B.  $H^-$  is a lewis base in I and brosted base in II

C.  $H^-$  is a lewis acid in I and brosted acid in II

D.  $H^-$  is a lewis base in I and II

**Answer: B**



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**18.** Which among the following is interstitial hydride?

A.  $ScH_2$

B.  $LaH_2$

C.  $TiH_{1.7}$

D. All of these

**Answer: D**



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19. Heavy water is

A.  $H_2O$  with dissolved  $Mg(HCO_3)_2$

B.  $D_2O$

C.  $D_2O$  with heavy metal impurities

D.  $H_2O$  with  $CaCO_3$

**Answer: B**



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## Assignment Section C

1. Which compound/s is/are saline hydride?

A.  $CaH_2$

B.  $HCl$

C.  $ScH_2$

D.  $SrH_2$

**Answer: A::D**



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2. Which compound/s is/are metallic hydrides?

A.  $KH$

B.  $VH$

C.  $PH_3$

D.  $TiH_3$



**Answer: B::D**



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**3. Which compound/s is/are covalent hydrides?**



**Answer: A::C**



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**4. Examples of polymeric hydrides are**



**Answer: A::B**



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5. Which group element of d-block do not form hydride at all?

A. 7

B. 8

C. 9

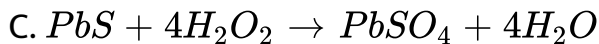
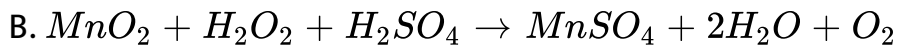
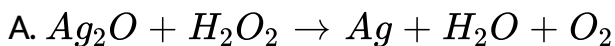
D. 10

Answer: A::B::C

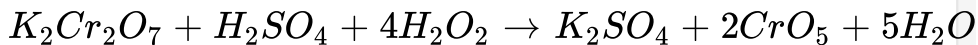


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6. Which reaction shows oxidising nature of  $H_2O_2$ ?



D.



Answer: C



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7.  $H_2O_2$  is

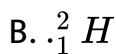
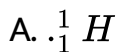
- A. Lighter than water
- B. Denser than water
- C. More viscous than water
- D. Less viscous than water

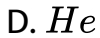
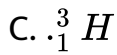
**Answer: B::C**



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8. Radio-activity can be detected in hydrogen due to the presence of





**Answer: C**



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**9. The soaps contain salts of higher fatty acids like**

A. Stearic acid

B. oxalic acid

C. Palmitic acid

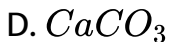
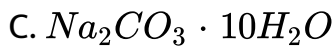
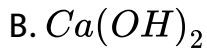
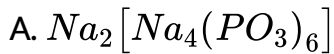
D. Oleic acid

**Answer: A::C::D**



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10. Chemical additive which can be used to remove water hardness is



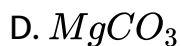
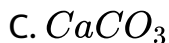
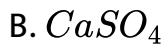
Answer: A::B::C



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11.  $Ca(OH)_2$  removes temporary hardness by forming





**Answer: C::D**



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12. In ortho  $H_2$  the correct statement/s is/are

A. The two nuclei have same spin

B. The two nuclei have oppsite spin

C. The two electrons have same spin

D. The two electrons have opposite spin

**Answer: A::D**



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13. Consider the following reversible conversion:



this equilibrium will shift in forward direction

- A. On increasing temperature
- B. On increasing ortho concentration
- C. On decreasing temperature
- D. On decreasing ortho concentration

**Answer: B::C**



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14.  $H_2O_2$  can act as

- A. oxidising agent
- B. Reducing agent
- C. Bleaching agent
- D. Acid

**Answer: A::B::C::D**



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15. Correct among the following is/are

- A. Ortho hydrogen is thermodynamically more stable
- B. Parahydrogen is kinetically more stable

C. At room temperature para hydrogen is major component

D. Ortho and para hydrogens always present in 50:50 ratio

**Answer: A::B**



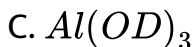
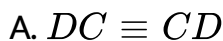
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## Assignment Section D

1. Heavy water is the oxide of heavy hydrogen (deuterium) and is also called deuterium oxide. It is represented as  $D_2O$ . Heavy water is chemically similar to ordinary water heavy water is used for the neutron moderatory, as a trracer compound and for the preparation of deuterium. Reaction of heavy water with alkali metals liberates heavy hydrogen. heavy water can also be used for exchanging labile hydrogen with deuterium completely or

partially. heavy water reacts slower than ordinary water but forms stronger bonds with other elements as compared to hydrogen.

Q. The products of the reaction  $Al_4C_3 + D_2O \rightarrow \text{---}$  is



D. Both 2 and 3

**Answer: D**



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2. Heavy water is the oxide of heavy hydrogen (deuterium) and is also called deuterium oxide. It is represented as  $D_2O$ . Heavy

water is chemically similar to ordinary water heavy water is used for the neutron moderatory, as a trracer compound and for the preparation of deuterium. Reaction of heavy water with alkali metals liberates heavy hydrogen. heavy water can also be used for exchanging labile hydrogen with deuterium completely or partially. heavy water reacts slower than ordinary water but forms stronger bonds with other elements as compared to hydrogen.

Q. Reaction of  $N_2O_5$  and  $D_2O$  produces



**Answer: A**



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3. Heavy water is the oxide of heavy hydrogen (deuterium) and is also called deuterium oxide. It is represented as  $D_2O$ . Heavy water is chemically similar to ordinary water heavy water is used for the neutron moderatory, as a trracer compound and for the preparation of deuterium. Reaction of heavy water with alkali metals liberates heavy hydrogen. heavy water can also be used for exchanging labile hydrogen with deuterium completely or partially. heavy water reacts slower than ordinary water but forms stronger bonds with other elements as compared to hydrogen.

Q. Which property of heavy water is lesser in magnitude as that compared with normal water?

A. Molecular mass

B. Density

C. Boiling point

D. Ionisation constant

**Answer: D**



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4. Size of nucleus increases from protium to tritium so in  $H_2, D_2$  &  $T_2$  area of overlapping also increases in the same order.

Q. Which overlapping is responsible for bond formation in  $H_2, D_2, T_2$  respectively?

A. 1s-1s in each

B. 2s-2s in each

C. 1s-2s in each

D.  $1s-2s$  |  $T_2$ ,  $1s-1s$  in rest

**Answer: A**



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5. Size of nucleus increases from protium to tritium so in  $H_2$ ,  $D_2$  &  $T_2$  area of overlapping also increases in the same order.

Q.  $H_2$ ,  $D_2$  &  $T_2$  show their bond-enthalpies as

A.  $H_2 = D_2 = T_2$

B.  $H_2 > D_2 > T_2$

C.  $H_2 < D_2 < T_2$

D.  $D_2 < H_2 < T_2$

Answer: C



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## Assignment Section E

1. Statement-1:  $H_2O_2$  liberates  $O_2$  when it reacts with acidified  $KMnO_4$  solution

Statement-2:  $KMnO_4$  oxidised  $H_2O_2$  to  $O_2$ .

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false



D. Statement-1 is false, statement-2 is true

**Answer: A**



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2. Statement-1: The  $O - O$  bond length in  $H_2O_2$  is longer than that of  $O_2F_2$ .

Statement-2:  $H_2O_2$  is a polar covalent molecule.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

**Answer: B**

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3. Statement-1: Complete hydrolysis of one mole of peroxydisulphuric acid gives one mole of  $H_2O_2$  and moles of  $H_2SO_4$ .

Statement-2: Peroxydisulphuric acid has one peroxy linkage.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true

**Answer: A**



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4. Statement-1: Zinc hydroxide dissolves in excess of  $NaOH$  solution to evolve dihydrogen gas.

Statement-2: Zinc hydroxide is amphoteric in nature.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true

**Answer: D**



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5. Statement-1: Hydrogen gas is liberated by the action of aluminium with a concentrated solution of NaOH

Statement-2: Aluminium with NaOH forms sodium metaaluminate.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true

**Answer: B**

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6. Statement-1: With non-metals covalent hydrides are formed.

Statement-2: For covalent hydrides electronegativity difference should be less.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true

**Answer: A**

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7. Valence factor of  $H_2O_2$  is always 2.

Statement-2: In redox reaction change of oxidation state per molecule is 2.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is not correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true

**Answer: D**



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## 1. Match the following

### Column-I

- (A) Ionic hydride
- (B) Covalent hydride
- (C) Interstitial hydride
- (D) Intermediate hydride

### Column-II

- (p) Salt like structure
- (q) Polymeric structure
- (r) Stoichiometric
- (s) Non-stoichiometric



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## 2. Match the following

### Column-I

- (A)  $\text{Ca}(\text{HCO}_3)_2$
- (B)  $\text{MgCl}_2$
- (C)  $\text{CaSO}_4$
- (D)  $(\text{NaPO}_3)_x$

### Column-II

- (p) Cause of permanent hardness in water
- (q) Used for removal of hardness of water
- (r) Does not exist in crystalline state
- (s) Ionised in water
- (t) Can be removed from water by using washing soda



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### 3. Match the following

#### Column-I

- (A)  $H^+$
- (B)  $H$
- (C)  $H_2$
- (D)  $H^-$

#### Column-II

- (p) Cation of hydrogen
- (q) Free radical
- (r) Hydrogen
- (s) Anion of hydrogen
- (t) Proton



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## Assignment Section G

1. In liquid water, the number of  $H_2O$  molecules surrounded to one  $H_2O$  molecule are \_\_\_\_\_.



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2. When  $H_2O_2$  is decomposed to  $O_2$  gas, its  $n_{\text{factor}}$  is \_\_\_\_\_.





## Assignment Section H

1. Statement-1:  $H_2O_2$  is more polar than  $H_2O$

Statement-2:  $D_2O$  has higher boiling point than  $H_2O$

Statement-3:  $H_2$  bond bond energy is less than  $D_2$ .

A. TTT

B. TTF

C. TFF

D. FFT

**Answer: A**



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2. Statement-1: Tritium is radioactive form of hydrogen.

statement-2: NaCl is more soluble in water as compared to  $D_2O$

Statement-3: pH of water depends on temperature.

A. TTT

B. TTF

C. TFF

D. FFF

**Answer: A**



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3. Statement 1: Highest adsorption tendency of H is on Pt.

Statement-2: In  $H_2$ , protium is 99% by mass.

statement 3:  $H_2$  &  $O_2$  react only under vigorous conditions

A. TFT

B. FTT

C. TTF

D. FFT

**Answer: A**



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## Assignment Section I

1. How many grams of barium hydride must be treated with water to obtain 4.36L of hydrogen at  $20^\circ C$  and 0.975 atm pressure (Ba=137)?

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2. When a substance A reacts with water it produces a combustible gas B and a solution of substance C in water. When another substance D reacts with this solution of C, it also produces the same gas B on warming but D can produce gas B on reaction with dilute sulphuric acid at room temperature. A imparts a deep golden yellow colour a smokeless flame to Bunsen burner. A,B,C, and D respectively are :

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3. An element X reacts with  $H_2$  gas at  $200^\circ C$  to form compound Y. when Y is heated to a higher temperature, it decomposes to element X and  $H_2$  gas in the ratio of 559 ml of  $H_2$  (measured at STP) for 1.00 g of X reacted. X also combines

with  $Cl_2$  to form a compound Z which contains 63.89 percent mass of chlorine. identify X, Y and Z.

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4. Hydrogen peroxide acts both as an oxidising agent and as reducing agent in alkaline solution towards certain first row transition metal ions. illustrate both these properties of  $H_2O_2$  using chemical equation.

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5. Give reasons in one or two sentences for the following: The mixture of hydrazine and hydrogen peroxides with a copper (II) catalyst is used as a rocket propellant.

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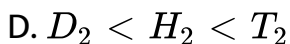
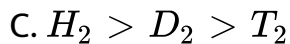
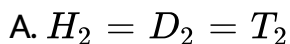
6. To a 25 mL  $H_2O_2$  solution excess of an acidified solution of potassium iodide was added. The iodine liberated required 20 mL of 0.3 N sodium thiosulphate solution. Calculate the volume strength of  $H_2O_2$  solution.

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7. 1 mega litre water (density 1g/cc) needs 106 kg of  $Na_2CO_3$  for removal of its permanent hardness. Determine its hardness in the multiples of 20 ppm.

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1. Order of bond length can be given as

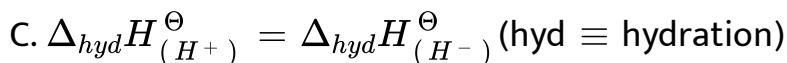


**Answer: C**



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2. Incorrect among the following



D. H exist in water as  $H_2O$ .

**Answer: C::D**



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3. Not incorrect among the following

A.  $N_2$  &  $H_2$  are two non-reacting gases

B.  $O_2$  &  $H_2$  are two non-reacting gases

C.  $N_2$  &  $D_2$  are reactive towards each other

D.  $D_2$  &  $O_2$  are non-reactive to each other

**Answer: C**



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4. Which of the following reactions is defines  $\Delta_f H^\ominus$ ?

A.

B.

C.

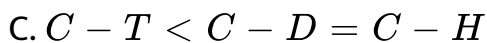
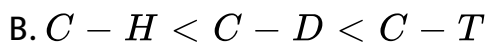
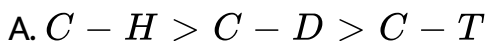
D.

**Answer:**



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5. Correct regarding bond-strength is



$$D. C - D > C - H = C - T$$

**Answer: B**

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## Examples

1. On the basis of electron affinity, comment on the resemblance of hydrogen with halogens.

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2. Which isotope of hydrogen is radioactive ?

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3. Which isotope of hydrogen contains equal number of protons and neutrons ?



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4. Comment on the reaction dihydrogen with fluorine.



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5. Explain the use of hydrogen in the formation of vegetable fats.



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6. Which class of covalent hydrides are considered as Lewis acids?



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7. Association of molecules in water is due to:



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8. Describe the nature of ionic hydrides.



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9. Why does alcohol (a covalent compound) dissolve in water (ionic)?



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10. Which properties of hydrogen are responsible for moderation of the climate and body temperature of living beings?



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11. Compare the density of ice and water.



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12. Does water get oxidised in the process of photosynthesis?



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13. What type of water forms scum with soap?



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14. Write the reaction that takes place on adding lime to water containing magnesium bicarbonate.



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15. Explain with the help of reactions that how heavy water is used in the preparation of deuterium compounds?



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16. What is calgon?



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17. Calculate the strength of 30 volume solution of hydrogen peroxide.



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18. What is the percentage strength of a solution of 100 volume  $H_2O_2$ ?

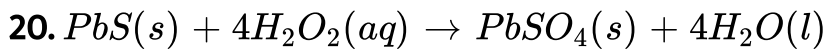


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19. Why  $H_2O_2$  is kept away from dust?



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In the above reaction,  $\text{H}_2\text{O}_2$  acts as a/an \_\_\_\_ agent.



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## Exercise

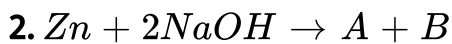
1. What is the half life period of tritium ?

- A. 13.33 year
- B. 12.33 year
- C. 12 years
- D. 22.33 years

**Answer: B**



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A.  $NaH$  and  $H_2$

B.  $Na_2Zn$  and  $H_2$

C.  $Na_2ZnO_2$  and  $H_2$

D. Reaction rarely occurs

**Answer: C**

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3. Which element from electron rich hydride ?

A. C

B. O

C. B

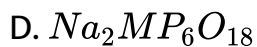
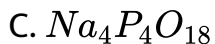
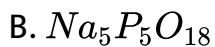
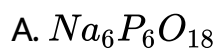
D. Al

**Answer: B**



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**4. The formula of Calgon is :**



**Answer: A**



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5. What is the amount of  $O_2$  liberated at STP by "30 volume" 1 L solution of  $H_2O_2$ ?

A. 1.5 L

B. 2.5 L

C. 30 L

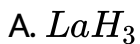
D. 3 L

**Answer: C**



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6. Among the following which is/are interstitial hydride ?

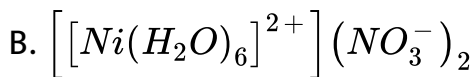
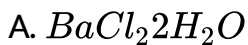


**Answer: A**



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7. Among the following in which hydrates  $H_2O$  molecules only occupy the interstitial site



D. All of these

**Answer: A**

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8. In which of the following property hydrogen does not resemble with halogen:

A. Hydrogen has strong affinity for non-metals

B. Hydrogen has high ionisation potential

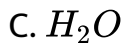
C. Hydrogen has low value of electron affinity

D. Hydrogen acts as reducing agent

**Answer: B**

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9. Which of the following is electron precise hydride ?



**Answer: B**



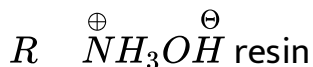
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10. Demineralised  $H_2O$  is obtained when

A. Water is passed through  $R - SO_3H$  resin

B. Water is passed through  $R - \overset{+}{N}H_3\overset{\ominus}{O}H$  resin

C. Water is passed through both  $RSO_3H$  resin and



D. We can't get demineralised  $H_2O$  artificially by resins

**Answer: C**



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### Assignment Section A Objective Type Question

1. The ionisation energy of hydrogen is high as compared to alkali metals because of

A. One electron in outemost shell

B. Small size

C. One proton in its nucleus

D. No neutron

**Answer: B**



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2. Which of the following is the correct statement ?

A. Hydrogen has the same I.E. as that of alkali metals

B. Hydrogen has strong tendency to gain one electron same as that of alkali metals

C. Hydrogen molecules is diatomic so are the halogens

D. Electron affinity of hydrogen is same as that of halogens

**Answer: C**



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3. The isotope of hydrogen which is radioactive is

- A. Protium
- B. Tritium
- C. Deuterium
- D. Neutron

**Answer: B**



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4. Hydrogen accepts an electron to form inert gas configuration. In this it resembles

- A. Halogens

B. Alkali metals

C. Transition metals

D. Chalcogens

**Answer: A**



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5. Hydrogen acts as a reducing agent and thus resembles

A. Halogens

B. Noble gas

C. Radioactive elements

D. Alkali metals

**Answer: D**



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6. Which position for hydrogen explain all its properties ?

- A. At the top of halogens
- B. At the top of alkali metals
- C. At the top of chalcogens
- D. Both (1) & (2)

**Answer: D**



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7. Ionisation energy of hydrogen is

- A. Equal to that of fluorine

- B. Lower than that of fluorine
- C. Slightly higher than that of fluorine
- D. Much higher than that of fluorine

**Answer: B**



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8. Which of the following statements concerning protium, deuterium and tritium is not true ?

- A. They are isotopes of each other
- B. They have similar electronic configurations
- C. They exist in the nature in the ratio of 1 : 2 : 3 respectively
- D. Their mass numbers are in the ratio 1 : 2 : 3 respectively

**Answer: C**



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**9.** Number of nucleons in  $D_2$  molecule is

A. 1

B. 2

C. 3

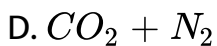
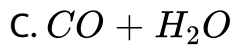
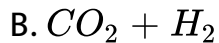
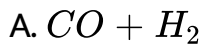
D. 4

**Answer: D**



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**10.** Water gas is



**Answer: A**



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**11.** The catalyst used in the water-gas shift reaction is

A. Sodium arsenite

B. Nickel

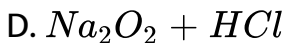
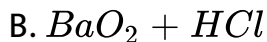
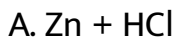
C. Potassium permanganate

D. Iron chromate

**Answer: D**

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12. The reaction between which of the following reactants produces hydrogen?



**Answer: A**

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13. High purity dihydrogen is obtained by electrolysis

A. Warm aqueous barium hydroxide

B. Brine solution

C. Acidified sulphate solution

D. Water gas

**Answer: A**



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14. Hydrogen is not obtained when sodium reacts with

A. Cold water

B. Dilute  $H_2SO_4$



C. Molten NaCl

D. Dilute HCl

**Answer: C**



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**15.** The process by which ammonia is formed from nitrogen and hydrogen is

A. Contact process

B. Haber process

C. Ostwald process

D. Hydrogenation process

**Answer: B**



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16. Hydrogenation of alkenes yields

A. Alkanes

B. Alkynes

C. Aldehydes

D. Carboxylic acids

**Answer: A**



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17. Ionic hydrides are usually

A. Good conductors of electricity in solid state

B. Stoichiometric compounds

C. Volatile

D. Non-crystalline

**Answer: B**



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**18.** Group 2 hydrides with significant covalent character is/are

A.  $BeH_2$

B.  $MgH_2$

C.  $CaH_2$

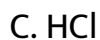
D. Both (1) & (2)

**Answer: D**



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19. In which of the compounds does hydrogen have an oxidation state of -1 ?



Answer: D



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20. The  $H - O - H$  angle in water molecule is about

A.  $90^\circ$

B.  $180^\circ$

C.  $109^\circ 28'$

D.  $104.5^\circ$

**Answer: D**



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**21. Hardness of water cannot be removed by**

A. Treating with washing soda

B. Boiling

C. Adding calgon

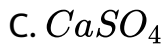
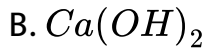
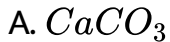
D. Addition of chlorine

**Answer: D**



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**22.** Temporary hardness may be removed from water adding.



**Answer: B**



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**23.** Permanent hardness of water is due to the presence of

- A. Sulphates of Mg and Ca
- B. Bicarbonates of mg and Ca
- C. Sulphates of Na and K
- D. Bicarbonates of Na and K

**Answer: A**



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**24.** Permanenet hardness of water is removed by adding

- A. Sodium bicarbonate
- B. Washing soda
- C. Calcium hydroxide
- D. Sodium chloride

**Answer: B**



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**25. Pemunt is chemically.**

- A. Hydrated sodium aluminium silicate
- B. Sodium hexaphosphate
- C. Sodium bicarbonate
- D. Calcium hydroxide

**Answer: A**



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26. In Clark's process for removing hardness of water, the reagent used is

- A. Acidic
- B. Basic
- C. Neutral
- D. Both (1) & (2)

**Answer: B**



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27. Heavy water is

- A. De-mineralised water
- B. De-ionized water

C. Ordinary water containing dissolved salts of heavy metals

D. The compounds of heavier isotope of hydrogen with oxygen ( $D_2O_2$ )

**Answer: D**



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**28.** The structure of  $H_2O_2$  is

A. Open book like

B. Closed book like

C. Pyramidal

D. Linear

**Answer: A**



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29. The dihedral angle of  $H_2O_2$  in solid phase is

A.  $111.5^\circ$

B.  $90.2^\circ$

C.  $94.8^\circ$

D.  $101.9^\circ$

**Answer: B**



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30. The volume of  $O_2$  liberated from 0.96g of  $H_2O_2$  is

A. 224.6 mL

B. 316.2 mL

C. 390.0 mL

D. 112.5 mL

**Answer: B**



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## Assignment Section B Objective Type Question

1.  $H_2O_2$  can act as

A. Oxidising agent

B. Reducing agent

C. Bleaching agent

D. All of these

**Answer: D**



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2. Hydrogen can be prepared by

A. Electrolysis of acidified water

B. Bosch's process

C. Lane's process

D. All of these

**Answer: D**



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3. Commercial hydrogen is obtained from

A. Coal gas

B. Water gas

C. Air

D. Producer gas

**Answer: B**



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4. Which is a sources of nascent hydrogen?

(i)  $Zn + \text{dil HCl}$

ii  $CH_3OH + Na$

(iii) Electrolysis of  $H_2O$

(iv) Silent electric discharge of  $H_2O_2$

A. I & II

B. II & III

C. I, II, III

D. IV

**Answer: A**



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5. Electrolysis of 50%  $H_2SO_4$  gives

A.  $H_2O$

B.  $D_2O$

C.  $H_2O_2$

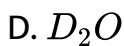
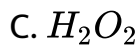
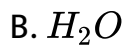
D.  $H_2$

**Answer: C**



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**6.** Lane's process is for the preparation of



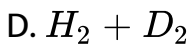
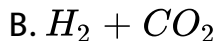
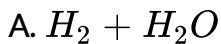
**Answer: A**



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**7.** In water gas shift reaction reactant is





**Answer: C**



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**8.** In Ortho and Para hydrogen, the nuclear spin respectively are

A. Parallel and opposite

B. Opposite and parallel

C. It may be parallel or opposite

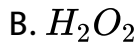
D. They do not differ in nuclear spin

**Answer: A**



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**9.** When hydrolith is treated with water it yields



**Answer: A**



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**10.** Interstitial hydrides are formed by

A. s-block metals

B. p-block metals

C. d-block metals

D. All of these

**Answer: C**



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**11.** The group of elements responsible for hydride gap

A. Mn, Ca, Ni

B. Mn, Fe, Li

C. Mn, Fe, Co

D. Mn, Cu, Cl

**Answer: C**



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**12. Which of the following is interstitial hydride?**



**Answer: B**



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13. Hydrogen exists in atomic state in which of the following compounds?

A. Metallic hydrides

B. Ionic hydride

C. Molecular hydrides

D.  $H_2O$

**Answer: A**



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14. The velocity of neutrons in nuclear is slowed down by

A. Heavy water

B. Ordinary water

C. Zinc rod

D. Fused caustic soda

**Answer: A**



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**15.** Heavy water has maximum density at

A.  $4^{\circ}C$

B.  $11.6^{\circ}C$

C.  $0^{\circ}C$

D. 273 K

**Answer: B**



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16. Heavy water is

A.  $H_2O$

B.  $D_2O$

C. Water at  $4^\circ C$

D. Water obtained by repeated distillation

**Answer: B**



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17. Which of the following will determine whether the given colourless liquid is water or not ?

A. Melting

B. Tasting

C. Phenolphthalein

D. Adding a pinch of anhydrous  $CuSO_4$

**Answer: D**



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**18.** Selecte the correct statement.

A. O-H bond is stronger than O-D bond

B. O-H bond is weaker than O-D bond

C. Permanent hardness of water is due to the presence of bicarbonates of calcium and magnesium

D. O-H and O-D bond strenght is same



**Answer: B**



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**19.** Heavy water is called as heavy because it is

- A. A heavy liquid
- B. An oxide of heavier isotope of oxygen
- C. An oxide of deuterium
- D. Less denser than  $H_2O$

**Answer: C**



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**20.** Blue vitriol has

A. Coordinate bond

B. Covalent bond

C. Hydrogen bond

D. All of these

**Answer: D**



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**21.** Both cation and impurities can be removed from hard water by using

A. Zeolites

B. Organic ion exchanges

C. Calgon

D. All of these

**Answer: B**



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22. Which of the following is correct?

A. LiH is thermally more stable than CsH

B. Density of  $H_2$  is about  $\frac{1}{14}$ th of that of air

C. Atomic hydrogen is much more reactive than ordinary hydrogen

D. All of these

**Answer: D**



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23. When the same amount of zinc is treated separately with excess of sulphuric acid and excess of sodium hydroxide, the ratio of volume of hydrogen evolved is

A. 1 : 1

B. 1 : 2

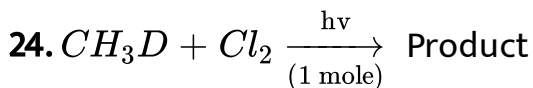
C. 2 : 1

D. 9 : 4

**Answer: A**



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The product is

A.  $CH_2DCl$

B.  $CH_3Cl$

C.  $CDCl_3$

D.  $CCl_4$

**Answer: A**



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25. Hydrogen peroxide is used as

A. Oxidising agent only

B. Reducing agent only

C. Both as oxidising and reducing agent

D. Drying agent

**Answer: C**



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**26.**  $H_2O_2$  is manufactured these days

- A. By the action of  $H_2O_2$  on BaO
- B. By the action of  $H_2SO_4$  on  $Na_2O$
- C. By electrolysis of 50%  $H_2SO_4$
- D. By burning hydrogen in excess of oxygen

**Answer: C**



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**27.** Which of the following is most reactive ?

A.  $H_2$

B. H (nascent)

C.  $D_2$

D. H (atomic)

**Answer: D**



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**28.**  $H_2O_2$  restores the colour of old lead paintings, blackened by the action of  $H_2S$  gas by :

A. Converting  $PbO_2$  to Pb

B. Oxidising  $PbS$  to  $PbSO_4$

C. Converting  $PbCO_3$  to Pb

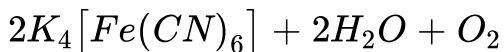
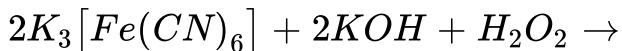
D. Oxidising  $PbSO_3 \rightarrow PbSO_4$

**Answer: B**



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**29.** In the reaction



$H_2O_2$  acts as

A. Reducing agent

B. Oxidising agent

C. Knocking agent

D. Bleaching agent



**Answer: A**



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**30.** Decomposition of  $H_2O_2$  can be slowed down by addition of small amount phosphoric acid which act as

- A. Stopper
- B. Inhibitor
- C. Detainer
- D. Promotor

**Answer: B**



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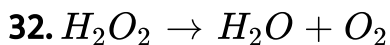
31. When 50% solution of  $H_2SO_4$  is electrolysed by passing a current of high density at low temperature the main products of electrolysis are:

- A. Oxygen & Hydrogen
- B.  $H_2$  and peroxy disuphuric acid
- C.  $H_2$  and  $SO_2$
- D.  $O_2$  and peroxy disulphuric acid

**Answer: B**



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This represents

- A. Oxidation of  $H_2O_2$
- B. Reduction of  $H_2O_2$
- C. Disproportionation of oxygen
- D. Acidic nature of  $H_2O_2$

**Answer: C**



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**33.** 20 volume hydrogen peroxide means

- A. 1 ml of  $H_2O_2$  solution gives 20 L of  $O_2$  at NTP
- B. 1 mole of  $H_2O_2$  solution gives 20 L of  $O_2$  at NTP
- C. 1 g of  $H_2O_2$  give 20 ml of  $O_2$  at NTP
- D. 1 ml of  $H_2O_2$  solution give 20 ml of  $O_2$  at NTP

**Answer: D**



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**34.** 1 ml of  $H_2O_2$  solution given 10 ml of  $O_2$  at NTP. It is :

A. 10vol  $H_2O_2$

B. 20 vol  $H_2O_2$

C. 30 vol  $H_2O_2$

D. 40 vol  $H_2O_2$

**Answer: A**



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35. Volume strength of  $H_2O_2$  labelled is  $10vol.$  What is normality of  $H_2O_2$ ?

A. 2.1

B. 3.4

C. 1.7

D. 5.1

**Answer: C**



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36. The amount of  $H_2O_2$  present in 1 L of  $1.5NH_2O_2$  solution is

A. 2.5 g

B. 25.5 g

C. 3.0

D. 8.0

**Answer: B**



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37.  $H_2O$  and  $H_2O_2$  resemble in

A. Hybridisation of oxygen

B. Oxidation state of oxygen

C. Structure

D. Bond angle

**Answer: A**



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38. Boiling point of  $D_2O$  is

A.  $100^\circ\text{C}$

B.  $105.5^\circ\text{C}$

C.  $101.4^\circ\text{C}$

D.  $102.6^\circ\text{C}$

Answer: C



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Assignment Section C Previous Type Questions

1. Which of the following statements about hydrogen is incorrect ?

- A. Dithydrogen does not act as a reducing agent
- B. Hydrogen has three isotopes of which tritium is the most common
- C. Hydrogen never acts as cation in ionic salts
- D. Hydronium ion,  $H_3O^+$  exists freely in solution

**Answer: A::B**



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2. In acidic medium,  $H_2O_2$  changes  $Cr_2O_7^{2-}$  to  $CrO_5$  which has two (-O-O-) bonds. Oxidation state of Cr in  $CrO_5$  is



A. +5

B. +3

C. +6

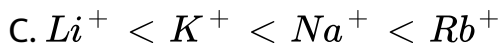
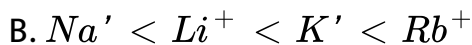
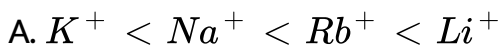
D. -10

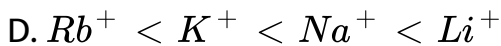
**Answer: C**



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**3.** The ease of adsorption of the hydrated alkali metal ions on ion-exchange resins follows the order:





**Answer: C**



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4. 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 ?

A. a and b

B. a, b and c

C. b and c

D. a and c

**Answer: A**



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5. Hydrogen is prepared from  $H_2O$  by adding

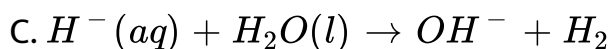
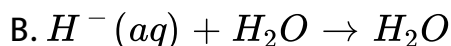
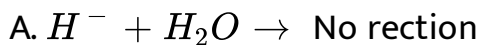
- A. Ca, which acts as reducing agent
- B. Al. which acts as oxidising agent
- C. Ag. Which acts as reducing agent
- D. Au. Which acts as oxidising agent

**Answer: A**



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6. The hydride ion  $H^-$  is a stronger base than its hydroxide ion  $OH^-$ . Which of the following reactions will occur if sodium hydride (NaH) is dissolved in water?



D. None of these

**Answer: C**



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7. Which of the following statements about the interstitial compounds is incorrect?

- A. They are chemically reactive
- B. They are much harder than the pure metal
- C. They have higher melting points than the pure metal
- D. They retain metallic conductivity

**Answer: A**



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**8. The volume strength of 1 · 5 N  $H_2O_2$  solution is**

- A. 8.8
- B. 8.4
- C. 4.8`
- D. 5.2

**Answer: B**



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9. Which one of the following pairs of substances on reaction will not not evolve  $H_2$  gas?

- A. Copper and HCl (aqueous)
- B. Iron and steam
- C. Iron and  $H_2SO_4$  (aqueous)
- D. Sodium and ethyl alcohol

**Answer: A**



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10. *Zn* gives  $H_2$  gas with  $H_2SO_4$  and  $HCl$  but not with  $HNO_3$  because

- A. *Zn* act as oxidizing agent when react with  $HNO_3$
- B.  $HNO_3$  is weaker acid than  $H_2SO_4$  and  $HCl$
- C. In electrochemical series *Zn* is above hydrogen
- D.  $NO_3^\ominus$  is reduced in preference to hydronium ion

**Answer: D**



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11. The pair that yields the same gaseous product on reaction with water :

- A. *K* and  $KO_2$

B. Ba and  $BaO_2$

C. Ca and  $CaH_2$

D. Na and  $Na_2O_2$

**Answer: C**



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**12.** Ortho and para-hydrogen differ in the

A. Proton spin

B. Electron spin

C. Nuclear charge

D. Nuclear reaction

**Answer: A**





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13. Action of water or dilute mineral acids on metals can give

A. Monohydrogen

B. Tritium

C. Dihydrogen

D. Trihydrogen

**Answer: C**



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14. Deuterium resembles hydrogen in chemical properties but reacts

A. More vigorously than hydrogen

B. Faster than hydrogen

C. Slower than hydrogen

D. Just as hydrogen

**Answer: C**



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**15.** Spin isomerism is shown by

A. Dichloro benzene

B. Hydrogen

C. Dibasic acid

D. n-butane

**Answer: B**



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**16.** Hydrogen can be fused to form helium at

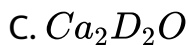
- A. High temperature and high pressure
- B. High temperature and Low pressure
- C. Low temperature and high pressure
- D. Low temperature and low pressure

**Answer: A**



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17. What is formed when calcium carbide reacts with heavy water?



**Answer: A**



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18. The maximum possible number of hydrogen bonds in which an  $H_2O$  molecule can participate is

A. 1

B. 2

C. 3

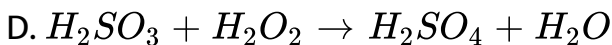
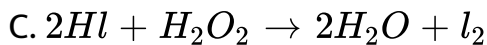
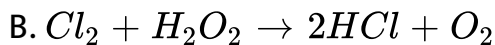
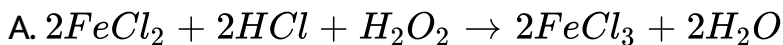
D. 4

**Answer: D**



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**19.** In which of the following reaction hydrogen peroxide is a reducing agent



**Answer: B**



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20. There is a sample of 10 volume of hydrogen peroxide solution. Calculate its strength.

A. 3.00 %

B. 4.045 %

C. 2.59 %

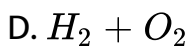
D. 3.035 %

**Answer: D**



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21. In lab  $H_2O_2$  is prepared by



**Answer: A**



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22.  $H_2O_2$  acts as an oxidising agent in

A. Acidic medium only

B. Alkaline medium only

C. Neutral medium only

D. Acidic and alkaline medium

**Answer: D**



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**23.** Hydrogen peroxide is reduced by

A. Ozone

B. Barium peroxide

C. Acidic solution of  $KMnO_4$

D. Lead sulphide suspension

**Answer: D**



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24. The volume of oxygen liberated from  $15\text{ml}$  of 20 volume  $\text{H}_2\text{O}_2$  is

A. 250 ml

B. 300 ml

C. 150 ml

D. 200 ml

**Answer: B**



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25. The volume of oxygen liberated from  $0.68\text{g}$  of  $\text{H}_2\text{O}_2$  is

A. 112 ml

B. 224 ml

C. 56 ml

D. 336 ml

**Answer: B**



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**26.** 20 volume  $H_2O_2$  solution has a strength of about

A. 0.3

B. 0.06

C. 0.03

D. 0.1

**Answer: B**



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27. The H - O - O bond angle in  $H_2O_2$  (g) is

A.  $107.28^\circ$

B.  $109.28^\circ$

C.  $104.5^\circ$

D.  $94.8^\circ$

**Answer: D**



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Assignment Section D Assertion Reason Type Question

1. A :  $ScH_2$  is an example of ionic hydride.

R : All metal forms ionic hydride.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: D**



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2. A : Temporary hardness is due to  $\text{HCO}_3^-$  ions.

R : permanent hardness is due to  $\text{CaCl}_2$

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: B**



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3. A : The molarity of 20 volume  $H_2O_2$  is 3.58 M.

R : Volume strength =  $5.6 \times M$ .

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: D**



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4. A : Permanent hardness of water is due to the presence of chlorine or sulphates of Ca or Mg.

R : Permanent hardness is removed by boiling

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: C**



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5. A : Atomic hydrogen is more reactive than nascent hydrogen.

R : The energy content of atomic hydrogen is more than nascent hydrogen,

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: A**





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6. Assertion (A) The O-O bond length in  $H_2O_2$  is shorter than that in  $O_2$ .

Reason (R)  $H_2O_2$  is ionic compound.

- A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)
- B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)
- C. If assertion is true statements but Reason is false, then mark (3)
- D. If both Assertion and Reason are false statements, then mark (4)

Answer: D



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7.A:  $H_2O_2$  reacts with  $K_2Cr_2O_7$  to give blue colour.

$H_2O_2$  can act as reducing agent.

- A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)
- B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)
- C. If assertion is true statements but Reason is false, then mark (3)
- D. If both Assertion and Reason are false statements, then mark (4)

**Answer: B**



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**8. A :** Water is a poor solvent for non polar compounds.

**R :** Covalent compounds interact weakly that even van der Wall forces cannot be broken.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanantion of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then

mark (4)

**Answer: A**



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9. A : Zn dissolve in excess of NaOH solution so as to give  $H_2$

R :  $Zn(OH)_2$  is neutral in nature.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then  
mark (3)

D. If both Assertion and Reason are false statements, then  
mark (4)

**Answer: C**



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10. A : Complete hydrolysis of one mole of peroxydi-sulphuric acid gives one omle of  $H_2O_2$  and 2 mole  $H_2SO_4$ .

R : Peroxydisulphuric acid has zero peroxy linkage.

A. If both Assertion & Reason are true and the reason is the  
correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: C**



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11. A :  $H_2O$  liberate  $O_2$  an reaction with  $KMnO_4$  in acidic medium.

R :  $KMnO_4$  oxidises  $H_2O_2$  to  $O_2$ .

- A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)
- B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)
- C. If assertion is true statements but Reason is false, then mark (3)
- D. If both Assertion and Reason are false statements, then mark (4)

**Answer: A**



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**12. Statement-1:** Hydrogen gas is liberated by the action of aluminium with a concentrated solution of NaOH

Statement-2: Aluminium with NaOH forms sodium metaaluminate.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: B**



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13. A : pH of water temperature dependent.

R : Boiling water has pH less than 7.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: B**



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14. A :  $H_2O_2$  decomposes on exposure to light.

R : It is stored in dark waxlined plastic vessel.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: B**



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15. A : Dihedral angle of  $H_2O_2$  in gas phase is greater than in solid phase.

R :  $H_2O_2$  has planar structure.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If assertion is true statements but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4)

**Answer: C**



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