CHEMISTRY

BOOKS - GRB CHEMISTRY (HINGLISH)

HYDROGEN AND ITS COMPOUNDS

Straight Objective Type

1. The sum of the number of neutrons and proton in the isotope of hydrogen is

A. 3

B. 4

C. 5

D. 6

Answer: A

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2. The catalyst used in Bosch process for manufacture of H_2 O is :

A. finely divided Ni

B. V_2O_5

C. Pb

D. $Fe_2O_3Cr_2O_3$

Answer: D

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3. The most abundant isotope of hydrogen is :

A. tritium

B. deuterium

C. protium

D. para hydrogen

Answer: C

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4. The n/p ratio for ${}_1H^1$ is :

A. 1

B. 2

C. 3

D. Zero

Answer: D

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5. Ordinary hydrogen at high temperature is a mixture of :

A. 75% o-Hydrogen+25% p-Hydrogen

B. 25% o-Hydrogen+75% p-Hydrogen

C. 50% o-Hydrogen +50% p-Hydrogen

D. 1% o-Hydrogen+99% p-Hydrogen

Answer: A

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6. Hydrogen is :

A. electropositive

B. electronegative

C. both electropositive as well as electronegative

D. neither electropositive nor electronegative

Answer: C

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7. At high temperature, para hydrogen is :

A. less stable than ortho hydrogen

B. more stable than ortho hydrogen

C. as stable as ortho hydrogen

D. none of the above

Answer: A

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8. When the same amount of zinc is treated separately with excess of sulphric 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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9. Which is the lightest gas ?

A. nitrogen

B. helium

C. oxygen

D. hydrogen

Answer: D

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10. The ratio of electron, proton and neutron in tritium is :

A. $1:1:1$

B. $1:1:2$

C. $2:1:1$

D. $1:2:1$

Answer: B

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11. The nuclei of tritium $\left(H^3\right)$ atom would contain neutrons :

A. 1

B. 2

C. 3

D. 4

Answer: B

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12. The adsorption of hydrogen by metals is called :

A. dehydrogenation

B. hydrogenation

C. occlusion

D. adsorption

Answer: C

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13. At absolute zero :

A. only para hydrogen exists

B. only ortho hydrogen exists

C. both para and ortho hydrogen exist

D. none of the above

Answer: A

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14. Only temporary hardness in water is removed by :

A. boiling

B. filtration

C. Calgon's process

D. none of these

Answer: A

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15. Both temporary and permanent hardness is removed on boiling with

A. $Ca(OH)_2$

B. Na_2CO_3

C. $CaCO_3$

D. CaO

Answer: B

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16. Temporaty hardness of water is caused due to the presence of

A. $CaSO_4$

B. $CaCl_2$

C. $CaCO_3$

D. $Ca(HCO_3)_2$

Answer: D

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17. High boiling point of water is due to :

A. its high specific heat

B. hydrogen bonding

C. high dielectric constant

D. low dissociation constant

Answer: B

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18. Calgon is an industrial name given to

A. normal sodium phosphate

B. sodium meta-aluminate

C. sodium hexametaphosphate

D. hydrated sodium aluminium silicate

Answer: C

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19. Permutit is :

A. hydrated sodium aluminium silicate

B. sodium hexametaphosphate

C. sodium silicate

D. sodium meta-aluminate

Answer: A

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20. Heavy water is used in atomic reactor as

A. coolant

B. moderator

C. both coolant and moderator

D. neither coolant nor moderator

Answer: C

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21. Calgon (a water softener) is :

A. $Na_2\left[Na_4(PO_3)_6\right]$

B. $Na[Na_2(PO_3)]_6$

C. $Na_2\left[Na_4(PO_4)_6\right]$

D. $Na_4\left[Na_2(PO_4)_6\right]$

Answer: A

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22. The hardness of water is due to.....metal ions.

A. Ca^{2+} and Na^{+}

B. Mg^{2+} and K^{+}

C. Ca^{2+} and Mg^{2+}

D. Zn^{2+} and Ba^{2+}

Answer: C

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23. The formula of heavy water is :

A. H_2O^{18}

B. D_2O

C. T_2O

D. H_2O^{17}

Answer: B

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24. Pure de-mineralised water can be obtained by :

A. Na^+ cation exchanger and Cl^- anion exchanger

B. H^+ cation exchanger only

C. H^+ cation exchanger and OH^- anion exchanger

D. Na^+ cation exchanger only

Answer: C

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25. The bleaching of H_2O_2 are due to its :

A. reducing properties

B. oxidising properties

C. unstable nature

D. acidic nature

Answer: B

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26. Hydrogen peroxide has a:

A. linear structure

B. pyramidal structure

C. closed book type structure

D. half open book type structure

Answer: D

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27. Hydrogen peroxide is a:

A. liquid

B. gas

C. solid

D. semi-solid

Answer: A

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28. Which of the following is a true structure of H_2O_2 ?

A. 

B. 

C. 

D. 

Answer: B

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29. Decomposition of H_2O_2 is retarded by :

$2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$

A. acetanilide

B. MnO_2

C. zinc

D. finely divided metals

Answer: A

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30. H_2O_2 is :

A. an oxidising agent

B. both oxidising and reducing agent

C. reducing agent

D. none of the above

Answer: B

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31. H_2O_2 is always stored in black bottles because

A. it is highly unstable

B. its enthalpy of decomposition is high

C. it undergoes auto-oxidation on prolonged standing in light

D. none of the above

Answer: C

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32. Acidified solution of $K_2Cr_2O_7$ on treatment with H_2O_2 yields :

A. $CrO_3 + H_2O + O_2$

B. $Cr_2O_2 + H_2O + O_2$

C. $CrO_5 + H_2O + K_2SO_4$

D. $H_2Cr_2O_7 + H_2O + O_2$

Answer: C

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33. 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. by oxidising PbS to $PbSO_4$

C. converting $PbCO_3$ to Pb

D. oxidising $PbSO_3$ to $PbSO_4$

Answer: B

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34. The reaction of $H_2S + H_2O_2 \rightarrow S + 2H_2O$ manifests

A. acidic nature of H_2O_2

B. alkaline nature of H_2O_2

C. oxidising nature of H_2O_2

D. reducing nature of H_2O_2

Answer: C

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35. Hydrogen peroxide is now generally prepared on industrial scale by the

A. action of H_2SO_4 on barium peroxide

B. action of H_2SO_4 on sodium peroxide

C. electrolysis of 50% H_2SO_4

D. burning hydrogen in excess of oxygen

Answer: C

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36. The gas(es) used in the hydrogenation of oils in presence of nickel as a catalyst is/are:

A. methane

B. ethane

C. ozone

D. hydrogen

Answer: D

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37. Which of the following produces hydrolith with dihydrogen ?

A. Mg

B. Al

C. Cu

D. Ca

Answer: D

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38. Which process is/are used to remove permanent hardness ?

A. Boiling

B. Clark's method

C. On reaction with NaOH

D. Permutit process

Answer: D

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39. Ionic hydrides is/are usually :

A. good electrical conductors when solid

B. easily reduced

C. good reducing agents

D. liquid at room temperature

Answer: C

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40. Ortho-hydrogen and para-hydrogen resembles in which of the following peroperty ?

A. Thermal conductivity

B. Magnetic properties

C. Chemical properties

D. Heat capacity

Answer: C

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41. Ionic hydrides are formed by :

A. transition metals

B. elements of very high electropositivity

C. elements of very low electropositivity

D. metalloids

Answer: B

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42. Which hydride is/are an ionic hydride ?

A. NH_3

B. H_2S

C. $TiH_{1.73}$

D. NaH

Answer: D

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43. Which of the following hydride is/are "electron-precise" type ?

A. HF

B. H_2O

C. SiH_4

D. PH_3

Answer: C

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44. Which will produce hard water ?

A. Saturation of water with $CaSO_4$

B. Addition of Na_2SO_4 of water

C. Saturation of water with $CaCO_3$

D. Saturation of water with $MgCO_3$

Answer: A

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45. Very pure hydrogen $(99.9\,\%)$ can be made by which of the following processes ?

A. Reaction of salt like hydrides with water

B. Reaction of methane with steam

C. Mixing natural hydrocarbons of high molecular weight

D. Electrolysis of water

Answer: D

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46. In which of the following reaction H_2O_2 acts as a reducing agents?

$A.\ H_2O_2 + 2H^{\oplus} + 2e^- \rightarrow 2H_2O$

$B.\ H_2O_2 - 2e^{-2} \rightarrow O_2 + 2H^{\oplus}$

$C.\ H_2O_2 + 2e^- \rightarrow 2OH^{\ominus}$

D. $H_2O_2 + 2OH^{\ominus} - 3e^- \rightarrow O_2 + 2H_2O$

A. P, R

B. Q,S

C. P,Q

D. R,S

Answer: B

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47. Which of the following statements about Na_2O_2 is not correct ?

A. Na_2O_2 oxidises Cr^{3+} to CrO_4^{2-} in acid medium

B. It is diamagnetic in nature

C. It is the super oxide of sodium

D. It is a derivative of H_2O_2

Answer: C

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48. Hydrogen peroxide acts both as an oxidising and as a reducing agent depending upon the nature of the reacting species. In which of the following cases H_2O_2 acts as a reducing agent in acid medium ?

A. MnO_4^-

B. SO_3^{2-}

C. KI

D. $Cr_2O_7^{2-}$

Answer: A,B

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49. Permanent hardness in water cannot be curved by :

A. treatment with washing soda

B. Calgon's method

C. boiling

D. ion exchange method

Answer: C

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50. From the following statements regarding H_2O_2, choose the incorrect statements:

A. it has to be stored in plastic or wax lined glass bottles in dark

B. it has to kept away from dust

C. it can act only as an oxidizing agent

D. it decomposes on exposure to light

Answer: C

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51. When zeolite, which is hydrated sodium aluminium silicate, is treated with hard water, the sodium ions are are exchanged with

A. H^+ ions

B. Ca^{2+} ions

C. SO_4^{2-} ions

D. OH^- ions

Answer: B

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52. Which of the following statement is correct ?

A. Hydrogen has same ionisation potential as sodium

B. H has same electronegativity as halogens

C. It will not be liberated at anode

D. H has oxidation state +1, zero and -1

Answer: D

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53. Polyphosphates are used for softening agents because they

A. form soluble complexes with anionic species

B. precipitate anionic species

C. form soluble complexes with cationic species

D. precipitate cationic species

Answer: C

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54. Hydrogen peroxide in its reaction with KIO_4 and NH_2OH respectively, is acting as a

A. reducing agent, oxidising agent

B. reducing agent, reducing agent

C. oxidising agent, oxidising agent

D. oxidising agent, reducing agent

Answer: A

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55. Which is correct about the reaction between H_2O_2 and O_3?

A. It is a case of mutual reduction

B. O_3 will oxidise H_2O_2 into O_2

C. It is not a redox reaction

D. H_2O_2 being a stronger oxidising agent will decompose ozone into oxygen

Answer: B

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56. Which physical property of dihydrogen is wrong?

A. Tasteless gas

B. Odourless gas

C. Non-inflammable gas

D. Colourless gas

Answer: C

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57. An element having electronic configuration $1s^2 2s^2 2p^6 3s^1$ will form:

A. acidic oxide

B. basic oxide

C. amphoteric oxide

D. neutral oxide

Answer: B

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58. In which of the following reactions does hydrogen act as an oxidising agent ?

A. $H_2 + F_2 \rightarrow$

B. $H_2 + SiCl_4 \rightarrow$

C. $Ca + H_2 \rightarrow$

D. $CuO + H_2 \rightarrow$

Answer: C

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59. The reagent(s) used for softening the temporary hardness of water is (are):

A. $Ca_3(PO_4)_2$

B. $Ca(OH)_2$

C. Na_2CO_3

D. $NaOCl$

Answer: B

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60. $BaO_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O_2$

In the above method of preparation of H_2O_2, now-a-days H_3PO_4(conc.) is used instead of conc. H_3SO_4 because :

A. H_2SO_4 catalyses the backward reaction

B. H_2SO_4 catalyses the decomposition of H_2O_2

C. H_3PO_4 catalyses the backward reaction

D. none of the above

Answer: B

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61. The treatment of alkali $(NaOH)$ with beryllium hydroxide causes geometrical change of product from :

A. linear to trigonal planar

B. linear to tetrahedral

C. trigonal planar to tetrahedral

D. linear to octahedral

Answer: B

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62. In aqueous solution, the largest ion is :

A. Na^+ (aq)

B. Cs^+ (aq)

C. Rb^+ (aq)

D. Li^+ (aq)

Answer: D

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63. Which metal reacts most vigorously with water ?

A. Al

B. Ca

C. Fe

D. K

Answer: D

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64. A dilute solution of which acid is most likely to produce a reduction product other than H_2 when it reacts with a metal ?

A. HF

B. HCl

C. HNO_3

D. H_2SO_4

Answer: C

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65. Which transformation demonstrates that the bonds between water molecules are water than the bonds within a water molecule ?

A. Freezing water

B. Electrolysis water

C. Boiling water

D. Reaction of water with Na(s)

Answer: C

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66. Permanent hardness due to Mg^{2+} ions is best removed by

A. $Ca(OH)_2$

B. $Ca(OCl)Cl$

C. $2(CaSO_4).H_2O$

D. Na_2CO_3

Answer: D

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Multiple Objective Type

1. Which of the followig is/are same for ortho and para hydrogen ?

A. In the number of protons

B. In the molecules mass

C. In the nature of spins of nucleus

D. In the nature of spins of electrons

Answer: A::B::D

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2. In Bosch's process, which gas is utilised for the production of hydrogen gas

A. Producer gas

B. Water gas

C. Coal gas

D. Natural gas

Answer: A::C::D

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3. Water softening by Clarke's process uses

A. calcium bicarbonate

B. sodium bicarbonate

C. potash alum

D. calcium hydroxide

Answer: A::B::C

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4. Which of the following will produce hydrogen gas ?

A. Reaction between Fe and dil. HCl

B. Reaction between Zn and conc. H_2SO_4

C. Reaction between Zn and $NaOH$

D. Electrolysis of $NaCl$ (aq) Nelson's cell

Answer: A::C::D

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5. 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 $1:2:3$

D. Their mass numbers are in the ratio of $1:2:3$

Answer: A::B::D

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6. Which of the following statements is/are correct ?

A. Atomic hydrogen is obtained by passing hydrogen gas through an electric arc

B. 30% (w/v) or $100VH_2O_2$ solution is called perhydrol

C. Finely divided palladium adsorbs large volume of hydrogen gas

D. Ortho and para hydrogen have same physical properties

Answer: A::B::C

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7. Hydrogen peroxide can act as:

A. a reducing agent

B. an oxidising agent

C. a dehydrating agent

D. a bleaching agent

Answer: A::B::D

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8. The oxide that gives H_2O_2 on treatment with a dilute acid is

A. PbO_2

B. MnO_2

C. NaO_2O_2

D. BaO_2

Answer: C::D

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9. Hydrogen can be obtained by :

A. $Zn + dil.\ H_2SO_4$

B. $Zn + conc.\ HCl$

C. $Zn + conc.\ HNO_3$

D. $Mg + H_2O$ (hot)

Answer: A::B::D

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Comprehension Type

1. Hydrogen accounts for approximately $75\ \%$ of the mass of the universe. Hydrogen serves as the nuclear fuel of our Sun and other stars, and these are mainly composed of hydrogen. On the earth, though hydrogen is rarely found in the uncombined state. Since the earth's gravity is too weak to hold such light molecules, nearly all the H_2 originally present in the earth's atmosphere has been lost to space. In the earth's crust and oceans, hydrogen is found in water, petroleum, proteins, carbohydrates and other compounds and it is the ninth most abundant element on a mass basis. Hydrogen has three isotopes : hydrogen or protium $()$, deuterium or heavy hydrogen (D or), tritium $(T\ \text{or}\ )$. The physical properties of the three isotopes are different due to the difference in their masses, i.e. isotope effect. The chemical properties of the three

isotopes are similar as they have the same electronic configuration. Reaction between hydrogen and oxygen is highly exothermic, and gas mixtures that contain as little as 4% by volume hydrogen in oxygen (or in air) are highly flammable and potentially explosive.

$2H_{2(g)} + O_{2(g)}, \Delta H^{\ominus} = -485kJmol^{-1}$

As hydrogen is environmentally clean it is an enormously attractive fuel. 'Hydrogen economy' is an emerging field in which it is thought that our energy needs can be met by gaseous, liquid and solid hydrogen. As hydrogen is no a naturally occuring substance such as coal, oil or natural gas, energy must be exploaded to produce hydrogen before it can be used.

Which of the following is radioactive in nature?

A. Hydrogen only

B. Deuterium only

C. Tritium only

D. Deuterium and tritium

Answer: C

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2. Hydrogen accounts for approximately $75\,\%$ of the mass of the universe. Hydrogen serves as the nuclear fuel of our Sun and other stars, and these are mainly composed of hydrogen. On the earth, though hydrogen is rarely found in the uncombined state. Since the earth's gravity is too weak to hold such light molecules, nearly all the H_2 originally present in the earth's atmosphere has been lost to space. In the earth's crust and oceans, hydrogen is found in water, petroleum, proteins, carbohydrates and other compounds and it is the ninth most abundant element on a mass basis. Hydrogen has three isotopes : hydrogen or protium $()$, deuterium or heavy hydrogen (D or), tritium $(T \text{ or })$. The physical properties of the three isotopes are different due to the difference in their masses, i.e. isotope effect. The chemical properties of the three isotopes are similar as they have the same electronic configuration. Reaction between hydrogen and oxygen is highly exothermic, and gas mixtures that contain as little as $4\,\%$ by volume hydrogen in oxygen (or in air) are highly flammable and potentially explosive.

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Hydrogen, H_2 is very less abundant in the atmosphere due to

A. inflammable nature of H_2

B. weak earth's gravity which is not able to hold light H_2 molecules

C. diatomic nature of hydrogen

D. very rapid reaction between hydrogen and atmospheric oxyegn

Answer: B

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Liquid H_2 has been used as rocket fuel as

A. its reaction with oxygen is highly exothermic

B. it occupies small space

C. it has high thrust

D. all of the above

Answer: D

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Match The Column Type

1. 

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2. 

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Subjective Type

1. What is the sum of protons, electrons and neutrons in the heaviest isotope of hydrogen?

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2. Find out the number of following orders which are correct against the mentioned properties:

(a) $H_2 < D_2 < T_2$ (Number of protons)

(b) $H_2 < D_2$ (Bonding energy)

(c) $H_2 < D_2 < T_2$ (Boiling point)

(d) $H_2 < D_2 < T_2$ (Number of neutrons)

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3. Find out the number of following orders which are not correct against the mentioned properties:

(a) $CaH_2 < BeH_2$ (Electircal conductance in molten condition

(b) $LiH < NaH < CsH$ (Ionic character)

(c) $H_2 < D_2 < F_2$ (Bond dissociation enthalpy)

(d) $NaH < MgH_2 < H_2O$ (Reducing property)

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4. The oxidation state of oxygen of H_2O_2 in the final products when it reacts with $ClO_3^{\ominus}$ is

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5. Find out the value of x in ion $[H_xO_4]^+$.

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6. Total number of reagents which do not oxidize water into oxygen: $H_2O_2, F_2, FeCl_3, I_2, K_2Cr_2O_7$

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7. Choose total number of correct statements about H_2O_2 :

(a) in the pure state, H_2O_2 is almost colourless (very pale blue)

(b) hydrogen peroxide has non-planar structure in both gas phase and solid phase

(c) 2-ethylanthraquinol react with water to give H_2O_2

(d) H_2O_2 is used in pollution control

(e) dihedral angle of H_2O_2 is larder in gas phase compared to that in solid phase

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8. Total number of methods which can remove permanent hardness of water:

(a) Clark's method , (b) Ion-exchange method

(c) synthetic resin method

(d) Calgon method

(e) treatment with sodium carbonate

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