CHEMISTRY

BOOKS - PRADEEP CHEMISTRY (HINGLISH)

HYDROGEN

Sample Problem

1. The normality of 20 volume hydrogen peroxide solution is

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2. Find the volume strength of 1.6 N H_2O_2 solution.

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3. Calculate the volume strength of a 3% solution of H_2O_2 .

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4. What is the mass of hydrogen peroxide present in 1 litre of a 2M solution ? Calculate the volume of oxygen at S.T.P. liberated upon the complete decomposition at 100 cm^3 of the above solution.

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5. 30 mL of a H_2O_2 solution after acidification required 30 mL of N/10 $KMnO_4$ solution for complete oxidation . Calculate the percentage and volume strength of H_2O_2 solution.

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Advanced Problems For Competitions

1. 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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2. Hydrogen peroxide solution $(20mL)$ reacts quantitatively with a solution of $KMnO_4(20mL)$ acidified with dilute of H_2SO_4. The same volume of the $KMnO_4$ solution is just decolourised by $10mL$ of $MnSO_4$ in neutral medium simultaneously forming a dark brown precipitate of hydrated MnO_2. The brown precipitate is dissolved in $10mL$ of $0.2M$ sodium oxalate under boiling condition in the presence of dilute H_2SO_4. Write the balanced equations involved in the reactions and calculate the molarity of H_2O_2.

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Curiosity Questions

1. Normally pure substance and reagents are used in chemical reactions. Explain why in the preparation of dihydrogen by actiion of dilute sulphuric acid on zinc metal, impure zinc is preferred?

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2. Concentrated sulphuric acid cannot be used for drying H_2. Why?

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3. (a) Why are people living in West Bengal prone to black foot disease?

(b) What is blue-baby syndrome ? Explain.

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Problems For Practice

1. Calculate the concentration in gram/litres of a 20 volume H_2O_2 solution.

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2. The volume strength of 2.0 N H_2O_2 solution is _____.

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3. Calculate the amount per litre of 10 mL of a solution of hydrogen peroxide labelled 20 volumes.

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4. Calculate the strenght of 5 volumes H_2O_2 solution.

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Test Your Grip Multiple Choice Questions

1. The oxidation states exhibites by hydrogen in its various compounds are :

A. -1 only

B. zero only

C. $+1,\ -1$ and zero

D. $+1$ only

Answer: C

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2. Metal, which gives H_2 on treatment with acid as well as alkali, is _____.

A. Fe

B. Cu

C. Zn

D. Hg

Answer: C

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

A. $H^-(aq) + H_2O(l) \rightarrow H_3O^+(aq)$

B. $H^-(aq) + H_2O(l) \rightarrow OH^-(aq) + H_2(g)$

C. $H^- + H_2O \rightarrow$ No reaction

D. None of these

Answer: B

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4. Which of the following is the correct order of increasing enthalpy of vaporisation ?

A. $NH_3 < PH_3 < AsH_3$

B. $ArH_3 < PH_3 < NH_3$

C. $PH_3 < AsH_3 < NH_3$

D. $NH_3 < AsH_3 < PH_3$

Answer: C

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5. The bond angle and dipole moment of water respectively are :

A. $109.5^\circ, 1 \cdot 84$ D

B. $107 \cdot 5^\circ, 1 \cdot 56$ D

C. $104 \cdot 5^{\circ}, 1 \cdot 84$ D

D. $102.5^{\circ}, 1 \cdot 56$ D

Answer: C

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6. What is heavy water ?

A. $H_2^{18}O$

B. $H_2^{16}O$

C. H_2O_3

D. D_2O

Answer: D

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7. Which of the following is used as a moderator in nuclear reactors ?

A. Hard water

B. Heavy water

C. Deionized water

D. Mineral water.

Answer: B

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8. Which of the following statement/s is/are correct about H_2O_2 ?

A. It trus blue litmus red

B. It neutralises NaOH (aq)

C. It liberates CO_2 from $NaHCO_3$ solution

D. All statements are correct.

Answer: D

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9. The volume strength of $1 \cdot 5$ N H_2O_2 solution is

A. 4.8

B. 5.2

C. 8.8

D. 8.4

Answer: D

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10. When hydrogen peroxide is added to acidified potassium dichromate, a blue colour is produced due to formation of :

A. CrO_3

B. Cr_2O_3

C. CrO_5

D. CrO_4^{2-}

Answer: C

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11. Which one of the following processes will produce permanent hard water ?

A. Addition of Na_2SO_4 to water

B. Saturation of water with $CaCO_3$

C. Saturation of water with $MgCO_3$

D. Saturation of water with $CaSO_4$

Answer: D

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Test Your Grip Fill In The Blanks

1. The electrolysis of molten sodium hydride liberates . . . . . gas it the . . . . . .

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2. The radioactive isotope of hydrogen is called ..... And its nucleus contains ..... Proton and ..... Neutrons.

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3. Hydrogen gas is liberated the action of aluminium with concentrated solution of_____.

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4. Hardness of water is due to the presence of ....., ... and ..... Of calcium of magnesium

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5. Calgon is the trade name of ..... .

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6. Heavy water is used as a ..... in nuclear reactors.

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7. Hydrogen peroxide is manufactured by autoxidation of ..... .

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8. Hydrogen peroxide is ..... In nature and acts as an ..... as well as a ..... agent both in ..... And ..... Media .

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9. Bleaching action of H_2O_2 is due to its :

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10. A mixture of hydrazine and ..... With a copper (II) catalyst is used as rocket propellant.

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Conceptual Questions Dihydrogen

1. Which isotope of hydrogen is used commoly as a tracer in organie reactions ?

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2. There are three isotopes of hydrogen and three naturally occuring isotopes of oxygen $\left({}^{16}O, {}^{17}O \text{ and } {}^{18}O\right)$. How many kinds of water molecules are possible . Write their formulae.

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3. How is heavy hydrogen manufactured ?

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4. Name one example of a reaction in which dihydrogen acts (i) as an oxidising agent and (ii) as a reducing agent.

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5. a. A solution of ferric chloride acidified with HCl is unaffacted when hydrogen is bubbled through it, but gets reduced when zinc is added to acidified solution. Explain.

b. When sodium hydride in fused state is electrolysed, hydrogen is discharged at the anode. Explain.

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6. (i) Distinguish between ortho and para-hydrogens.

(ii) What is the composition of ortho-and para hydrogens in ordinary hydrogen at room temperature ? Can this composition be changed?

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7. What is nascent hydrogen ? How is it produced ? Give some reasons in which it differs from ordinary hydrogen .

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Conceptual Questions Water

1. Name one reaction in which water acts (i) as an oxidising agent and (ii) as a reducing agent.

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2. a. What does $[H_9O_4]^{\oplus}$ stand for ? Draw its structures.

b. Can sodium bicarbonate make water hard?

c. Hard water is softened before using in boilers. Why?

d. What is sequestration? How is hard water made soft by sequestration?

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3. An aqueous compound of an inorganic compound (X) shows the following reactions:

a. it decolourises and acidified $KMnO_4$ solution accompanied by the evolution of oxygen.

b. it liberates I_2 from an acidified KI solution.

c. It gives a brown precipitate with alkaline $KMnO_4$ solution with evolution of oxygen.

d. It removes black stains from old oil paintings. Identify (X) and give chemical equations for the reaction at steps (a) to (d).

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4. Why is hydrated barium peroxide used in the preparation of hydrogen peroxide instead of anhydrous barium peroxide ?

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5. A white solid is either Na_2O or Na_2O_2. A piece of red litmus paper turns white when it is dipped into a freshly made aqueous solution of the white solid.

a. Identify the substance and explain the balanced equation.

b. Explain what would happen to the red litmus if the white solid were the other compound.

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6. Status coated with white lead on long exposure to atmosphere turn black and the original colour can be restored on treatment with H_2O_2 . Why ?

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7. A mixture of hydrazine and H_2O_2 with Cu(II) catalyst is used as a rocket prepellant . Why ?

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Ncert Questions And Exercises With Answers Ncert Intext Solved Questions

1. Comment upon the reactions of dihydrogen with

(i) Chlorine

(ii) Sodium and

(iii) Copper (II) oxide

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2. a. Would you except 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 $CuSO_4.5H_2O$?

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3. Can phosphorus with outer electronic configureation $3s^2 3p^3$ form PH_5?

Watch Video Solution

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

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5. Calculate the strength of 18 volume hydrogen peroxide solution.

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6. Write the names of isotopes of hydrogen . What is the mass of these isotopes ?

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7. Why does hydrogen occur in a diatomic from rather than in a monoatomic form under normal conditions?

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8. How can the production of dihydrogen, obtained from 'Coal gasification', be increased?

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9. Describe the bulk preparation of dihydrogen by electrolytic method. What is the role of an electrolyte in this process?

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10. Complete the following reactions:

a. $H_2(g) + M_mO_o(s) \xrightarrow{\Delta}$

b. $CO(g) + H_2(g) \xrightarrow[catalyst]{\Delta}$

c. $C_3H_8(g) + 3H_2O(g) \xrightarrow[catalyst]{\Delta}$

d. $Zn(s) + NaOH(aq) \xrightarrow{Heat}$

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11. Discuss the consequences of high enthalpy of $H - H$ bond in terms of chemical reactivity of dihydrogen.

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12. What do you understand by (i) electron-deficient, (ii) electron-precise and (iii) electron-rich compounds of hydrogen? Provide justification with suitable examples.

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13. What characteristics do you expect from an electron-deficient hydride with respect to its structure and chemical reactions ?

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14. Do you expect the carbon hydrides fo the type (C_nH_{2n+2}) to act as 'Lewis' acid or base? Justify your answer.

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15. 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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16. How do you expect the metallic hydrides to be useful for hydrogen storage? Explain.

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17. How does the atomic hydrogen or oxy-hydrogen torch funtion for cutting and welding purposes? Explain.

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18. Among NH_3, H_2O, and HF, which would you expect to have highest magnitude of hydrogen bonding and why?

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19. Saline hydrides are known to react with water violently producing fire. Can CO_2 a well known fire extinguisher, be used in this case? Explain.

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20. Arrange the following (i) CaH_2, BeH_2 and TiH_2 in order of increasing electrical conductance.

(ii) LiH, NaH and CsH in order of increasing ionic character.

(iii) H–H, D–D and F–F in order of increasing bond dissociation enthalpy.

(iv) NaH, MgH_2 and H_2O in order of increasing reducing property.

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21. Compare the stuctures of H_2O and H_2O_2.

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22. What do you understand by the term 'auto-prolysis' of water ? What is its significance ?

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23. Consider the reacton of water with F_2 and suggest, in terms of oxidation and reduction, which species are oxidised/reduced.

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24. Complete the following chemical reactions.

$(i) PbS(s) + H_2O_2(aq) \rightarrow$

$(ii) MnO_4^-(aq) + H_2O_2(aq) \rightarrow$

$(iii) CaO(s) + H_2O(l) \rightarrow$

$(iv) AlCl_3(s) + H_2O(l) \rightarrow$

$(v) Ca_3N_2(s) + H_2O(l) \rightarrow$

Classify the above into (a) hydrolysis, (b) redox and (c) hydration reactions.

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25. Describe the structure of the common form of ice.

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26. What causes the temporary and permanent hardness of water ?

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27. Discuss the principle and method of softening of hard water by synthetic ion- exchange resins.

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28. Write chemical reactions to show the amphoteric nature of water.

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29. Write chemical reactions to justifty that hydrogen peroxide can function as an oxidising as well as reducing agent.

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30. What is meant by 'demineralised water' and how it can be obtained?

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31. Is demineralised or distilled water useful for drinking purpose? If not, how can it be made useful?

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32. Describe the usefulness of water in bioshphere and biological systems.

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33. What properties of water make it useful as a solvent? What types of compound can it (i) dissolve and (ii) hydrolyse?

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34. Knowing the properties of H_2O and D_2O, do you think that D_2O can be used for drinking purpose?

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35. What is the difference between hydrolysis and hydration?

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36. How can saline hydrides remove traces of water from organic compouds?

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37. What do you expect the nature of hydrides is, it formed by elements of atomic numbers $15, 19, 23$ and 44 with dihydrogen? Compare their behaviour towards water.

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38. Do you expect different products in solution when aluminium (III) chloride and potassium chloride treated separately with (a) normal water, (b) acidified water and (c) alkaline water? Write equations wherever necessary.

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39. How does H_2O_2 behave as a bleaching agent?

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40. What do you understand by the terms: (i) hydrogen economy (ii) hydrogenation (iii) 'syngas' (iv) water-gas shift reaction (v) fuel-cell ?

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Ncert Questions And Exercises With Answers Ncert Exercises

1. Justify the position of hydrogen in the periodic table on the basis of its electronic configuration.

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Ncert Exemplar Problems With Answer Hints And Solutions Ncert Exemplar Problems Chapter 9 Hydrogen Multiple Choice Question I

1. Hydrogen resembles halogens in many respects for which several factors are responsible. Of the following factors which one is most important in this respect ?

A. Its tendency to lose an electron to form a cation.

B. Its tendency to gain a single electron in its valence shell to attain stable electronic configuration 1

C. its low negative electron gain enthalpy value.

D. Its small size.

Answer: B

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2. Why does H^+ ion always get associated with other atoms or molecules?

A. Ionisation enthalpy of hydrogen resembles that of alkali metals.

B. Its resembles is similar to halogens

C. It resembles both alkali metals and halogens

D. Loss of an electron from hydrogen atom results in a nucleus of very small size as compared to other atoms or ions. Due to small size , it cannot exist free.

Answer: D

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3. Metal hydrides are ionic, covalent or molecular in nature. Among LiH, NaH, KH, RbH, CsH the correct order of increasing ionic character is

A. $LiH > NaH > CsH > KH > RbH$

B. $LiH < NaH < KH < RbH < CsH$

C. $RbH > CsH > NaH > KH > LiH$

D. $NaH > CsH > RbH > LiH > KH$

Answer: B

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4. Which of the following hydrides is electron-precise hydride ?

A. B_2H_6

B. NH_3

C. H_2O

D. CH_4

Answer: D

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5. Radioactive elements emit α, β and γ rays and are characterised by their half-lives. The radioactive isotope of hydrogen is

A. Protium

B. Deuterium

C. Tritium

D. Hydronium

Answer: C

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6. Cosider the reactions

(i) $H_2O_2 + 2HI \rightarrow I_2 + 2H_2O$

(ii) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

Which of the following statements is correct about H_2O_2 with reference to these reactions ? Hydrogen peroxide is â€¦â€¦â€¦

A. an oxidising agent in both (A) and (B)

B. an oxidising agent in (A) and reducing agent in (B)

C. a reducing agent in (A) and oxidising agent in (B)

D. a reducing agent in both (A) and (B)

Answer: B

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7. The oxide that give H_2O_2 on treatment with dilute H_2SO_4 is

A. PbO_2

B. $BaO_2.8H_2O$

C. MnO_2

D. TiO_2

Answer: B

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8. Which of the following equations depict theoxidising nature of H_2O_2 ?

A. $2MnO_4^- + 6H^+ + 5H_2O_2 \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$

B. $2Fe^{3+} + H_2O_2 \rightarrow 2Fe^{2+} + 2H^+ + O_2$

C. $2I^- + 2H^+ + H_2O_2 \rightarrow I_2 + 2H_2O$

D. $KIO_4 + H_2O_2 \rightarrow KIO_3 + H_2O + O_2$

Answer: C

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9. Which of the following equation depicts reducing nature of H_2O_2?

A. $2\left[Fe(CN)_6\right]^{4-} + 2H^+ + H_2O_2 \rightarrow 2\left[Fe(CN)_6\right]^{3-} + 2H_2O$

B. $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$

C. $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2OH^-$

D. $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

Answer: B

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10. Hydrogen peroxide is

A. an oxidising agent

B. a reducing agent

C. both an oxidising and a reducing agent

D. neither oxidising nor reducing agent

Answer: C

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11. Which of the following reaction increases, production of dihydrogen from synthesis gas ?

A. $CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270K} CO(g) + 3H_2(g)$

B. $C(s) + H_2O(g) \xrightarrow{1270K} CO(g) + H_2(g)$

C. $CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{673K} CO_2(g) + H_2(g)$

D. $C_2H_6 + 2H_2O \xrightarrow[Ni]{1270K} 2CO + 5H_2$

Answer: C

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12. When sodium peroxide is trated with the dilute sulphuric acid, we getâ€¦â€¦

A. sodium sulphate and water

B. sodium sulphate and oxygen

C. sodium sulphate , hydrogen and oxygen

D. sodium sulphate and hydrogen peroxide

Answer: D

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13. Hydrogen peroxide is obtained by the electrolysis of â€¦â€¦â€¦

A. water

B. sulphuric acid

C. hydrochloric acid

D. fused sodium peroxide

Answer: B

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14. Which of the following reaction is an example of use of water gas in the synthesis of other compounds ?

A. $CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270K} CO(g) + H_2(g)$

B. $CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{673K} CO_2(g) + H_2(g)$

C. $C_nH_{2n+2} + H_2O(g) \xrightarrow[Ni]{1270K} nCO + (2n+1)H_2$

D. $CO(g) + 2H_2(g) \xrightarrow[\text{Catalyst}]{\text{Cobalt}} CH_3OH(l)$

Answer: D

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15. Which of the following ions will cause hardness in water sample?

A. Ca^{2+}

B. Na^{+}

C. Cl^{-}

D. K^+

Answer: A

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16. Which of the following compounds is used for water softening ?

A. $Ca_3(PO_4)_2$

B. Na_3PO_4

C. $Na_6P_6O_{18}$

D. Na_2HPO_4

Answer: C

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17. Elements of which of the following group(s) of periodic table do not form hydrides?

A. Groups 7,8,9

B. Group 13

C. Groups 15,16, 17

D. Group 14

Answer: A

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18. Only one element of â€¦â€¦.from hydride.

A. group 6

B. group 7

C. group 8

D. group 9

Answer: A

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Ncert Exemplar Problems With Answer Hints And Solutions Ncert Exemplar Problems Chapter 9 Hydrogen Multiple Choice Questions Ii

1. Which of the following statements are not true for hydrogen ?

A. It exists as diatomic molecul.

B. It has one electron in the outermost shell.

C. It can lose an electron to form a cation which can freely exist.

D. It forms a large number of ionic compounds by losing an electron.

Answer: C::D

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2. Dihydrogen can be perpared on commerical scale by different methods. In its prepration by the action of steam on hydrocarbons , a mixture of CO and H_2 gas is formed. It is know asâ€¦â€¦

A. Water gas

B. Syngas

C. Producer gas

D. Industrial gas

Answer: A::B

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3. Which of the following statement(s) is/are correct in the case of heavy water ?

A. Heavy water is used as a moderator in nuclear reactor

B. Heavy water is more effective as solvent than ordinary water.

C. Heavy water is more associated than ordinary

D. Heavy water has lower boiling point than ordinary water.

Answer: A::C

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4. Which of the following statements about hydrogen are corrent ?

A. Hydrogen has three isotopes of which protium is the most common.

B. Hydrogen never acts as cation in ionic salts.

C. Hydrogen ions, H^+, exists freely in ionic solutions

D. Dihydrogen does not act as a reducing agent.

Answer: A::B

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5. Some of the properties of water are described below. Which of the is /are not correct ?

A. Water is known to be a universal solvent

B. Hydrogen bonding is present to a large extent in liquid water.

C. There is no hydrogen bonding in the frozen state of water

D. Frozen water is heavier than liquid water.

Answer: C::D

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6. Hardness of water may be tempoarary or permanent .Permanent hardness is due to the presence of

A. Chlorides of Ca and Mg in water

B. Sulphates of Ca and Mg in water

C. Hydrogen carbonates of Ca and Mg in water

D. Carbonates of alkali metals in water

Answer: A::B

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7. Which of the following statements is correct?

A. Elements of group 15 form electron deficient hydrides

B. All elements of group 14 form electron precise hydrides.

C. Electron precise hydrides have tetrahedral geometries.

D. Electron rich hydrides can act as Lewis acids.

Answer: B::C

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8. Which of the following statements is correct ?

A. Hydrides of group 13 act as Lewis acids.

B. Hydrides of group 14 are electron deficient hydrides.

C. Hydrides of group 14 act as Lewis acids.

D. Hydrides of group 15 act as Lewis bases.

Answer: A::D

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9. Which of the following statements is correct ?

A. Metallic hydrides are deficient of hydrogen?

B. Metallic hydrides conduct heat and electricity

C. Ionic hydrides do not conduct electricity in solid state.

D. Ionic hydrides are very good conductors of electricity in solid state.

Answer: A::B::C

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Ncert Exemplar Problems With Answer Hints And Solutions Short Answer Questions

1. How can production of hydrogen from water gas be increased by using water gas shift reaction ?

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2. What are metallic or interstitial hydrides? How do they differ from molecular hydrides?

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3. Name the classes of hydrides to which H_2O, B_2H_6 and NaH belong.

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4. If same mass of liquid water and a piece of ice is taken, then why is the density of ice less than that of liquied water ?

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5. Complete the following equations

(i) $PbS(s) + H_2O_2(aq) \rightarrow$

(ii) $CO(g) + 2H_2(g) \xrightarrow[\text{catalyst}]{\text{cobalts}}$

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6. Given reasons

(i) Lakes freeze form top towards bottom.

(ii) Ice floats on water.

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7. What do you understand by the term 'auto-protolysis of water' ? What is significance ?

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8. Dicuss briefly de- mineralistion of water by ion exchange resin.

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9. Moleular hydrides are classified as electron deficient, electron precise and electron rich compounds. Explain each type with two examples.

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10. How is heavy water prepared? Compare its physical properties with those of ordinary water.

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11. Write one chemical reactions for the preparation of D_2O_2.

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12. Calculate the strenght of 5 volumes H_2O_2 solution.

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13. (i) Draw the gas phase and solid phase structure of H_2O_2.

(ii) H_2O_2 is a better oxidising agnet than water . Explain .

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14. Melting point, enthalpy of vaporisation and viscosity data of H_2O and D_2O is given below:

viscosity data of H_2O and D_2O is given below :

	H_2O	D_2O
Melting point / K	373.0	374.4
Enthalpy of vaporisation at (373 K)/kJ mol^{-1}	40.66	41.61
Viscosity / centipoise	0.8903	1.107

On the basis of this data explain in which of

On the basis of this data explain in which of these liquids intermolecular forces are stronger?

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15. Dihydrogen reacts with dioxygen (O_2) to from water .Write the name and formule of the product when the isotope of hydrogen which has one proton and one neutron in its nucles is treated with oxygen. Will the reactivity of both the isotopes be the same towards oxygen ? Justify your answer.

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16. Explain why HCl is a gas and HF is a liquid ?

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17. When the first element of the periodic table is treated with dioxgyen , it gives a compound whose soilds state floats on its liquid state. This compound has an ability to act as an well as a base. What products will be formed when this compound undergoes autoionsation?

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18. Rohan heard that instructions were given to the laboratory attendent to store a particular chemical, i.e., keep it in the dark room,add some urea in it, and keep it away keep form dust. This chemical acts as an oxidising as well as a reducing agent in both acidic and alkaline media. This chemical is important for use in the pollution contral teratment of domestic and industrial effluents .

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19. Given reason why hydrogen resembles alkali metals ?

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20. Hydrogen generally form covalent compounds. Give reason

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21. Why is the ionisation enthalpy of hydrogen higher than that of sodium ?

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22. Basic pricinple of hyrogen economy is transpotation and storage of enery in the form of liquid or gaseous hydrogen. Which property of hydrogen may be useful for this purpose ? Support your answer with the chemical equations if required.

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23. What is the importance of heavy water ?

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24. Write the Lewis structure of hydrogen peroxide .

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25. An acidic solution of hydrogen peroxide behaves as an oxidising as well as reducing agent. Illustrate it with the help of a chemical equation.

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26. With the help of suitable examples, explain the property of H_2O_2 that is responsible for its bleaching action ?

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27. Why is water molecule polar ?

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28. Why does water show high boiling points as compared to hydrogen sulphide? Given reason for answer.

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29. Why can dilute solutions of hydrogen peroxide not be concentrated by heating? How can a conentrated solution of hydrogen peroxide be obtanied ?

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30. Why is hydrogen peroxide stored in wax lined bottles?

Watch Video Solution

31. Why does hard water not from lather with soap ?

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32. Phosphoric acid is perferred over sulphuric acid in perparing hydrogen peroxide form peroxides. Why ?

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33. How will you accout for 104.5° bond angle in water ?

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34. Write redox reactions between fluorine and water.

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35. Write two reactions to explain amphoteric nature of water .

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Ncert Exemplar Problems With Answer Hints And Solutions Matching Type Questions

1. Correlate the items listed in Column I with those listed in Column II .

Find out as many correlations as you can.

Column I	Column II
(*i*) Synthesis gas	(*a*) $Na_2[Na_4(PO_3)_6]$
(*ii*) Dihydrogen	(*b*) Oxidising agent
(*iii*) Heavy water	(*c*) Softening of water
(*iv*) Calgon	(*d*) Reducing agent
(*v*) Hydrogen peroxide	(*e*) Stoichiometric compounds of *s*-block elements
(*vi*) Salt like hydrides	(*f*) Prolonged electrolysis of water
	(*g*) Zn + NaOH
	(*h*) Zn + dil. H_2SO_4
	(*i*) Synthesis of methanol
	(*j*) Mixture of CO and H_2

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2. Match Column I with Column II for the given properties/applications mentioned therein.

Column I	Column II
(*i*) H	(*a*) Used in the name of perhydrol.
(*ii*) H_2	(*b*) Can be reduced to dihydrogen by NaH.
(*iii*) H_2O	(*c*) Can be used in hydroformylation of olefin
(*iv*) H_2O_2	(*d*) Can be used in cutting and welding.

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3. Match the terms in Column I with the relevant item in Column II.

Column I	Column II
(*i*) Electrolysis of water produces	(*a*) atomic reactor
(*ii*) Lithium aluminium hydride is used as	(*b*) polar molecule
(*iii*) Hydrogen chloride is a	(*c*) recombines on metal surface to generate high temperature
(*iv*) Heavy water is used in	(*d*) reducing agent
(*v*) Atomic hydrogen	(*e*) hydrogen and oxygen

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4. Match the items in Column I with the relevant item in Column II.

Column I	Column II
(*i*) Hydrogen peroxide is used as a	(*a*) zeolite
(*ii*) Used in Calgon method	(*b*) perhydrol
(*iii*) Permanent hardness of hard water is removed by	(*c*) sodium hexametaphosphat
	(*d*) propellant

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Ncert Exemplar Problems With Answer Hints And Solutions Assertion And Reason Type Questions

1. Assertion (A) Permanent hardness of water is removed by treatment with washing soda.

Reson (R) Washing soda reacts with soluble magnesium and calcium sulphate to from insolube carbonates.

A. Statements A and R both are correct and R is the correct explanation of A.

B. A is correct but R is not correct

C. A and R both are correct but R is not the correct explanation of A.

D. A and R both are false.

Answer:

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2. Assertion (A) Some metals like platinum and palladium, can be used as storage media for hydrogen.

Reason (R) Platnium and palladium can absorb large volumes of hydrogen.

A. Statements A and R both are correct and R is the correct explanation of A.

B. A is correct but R is not correct

C. A and R both are correct but R is not the correct explanation of A.

D. A and R both are false.

Answer:

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Ncert Exemplar Problems With Answer Hints And Solutions Long Answer Questions

1. Atomic hydrogen combaines with almost all elements but molecular hydrogen does not. Explain.

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2. How can D_2O_2 prepared form water ? Mention the physcial properties in which D_2O differs from H_2O. Given at least three reaction of D_2O showing the exchange of hydrogen with deuterium.

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3. How will you concentrate H_2O_2 ? Show difference between structures of H_2O_2 and H_2O by darwing their spatial structures . Also mention three important uses of H_2O_2.

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4. Give a method for the manufacture of hydrogen peroxide and explain the reactions involved therein .

(ii) Illustrate oxidising, reducing and acidic properties of hydrogen peroxide with equations.

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5. (i) What mass of hydrogen peroixde will be present in 2 L of a 5 molar solution ?

(ii) Caluclate the mass of oygen which will be liberated by the decomposition of 200 mL of this solution.

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6. A colourless liquid. 'A' contains H and O elements only. It decomposes on exposure to light. It is stablished by mixing urea to store in the presence of light.

(i) Suggest possible structure of A.

(ii) Write chemical equation for its decompositions reaction by light.

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7. An ionic hydride of an alkali metal has significant covalent character and is almost unreactive towards oxygen and chlorine . This is used in the synthesisi of other useful hydrides. Write the formula of this is used in the synthesis of other hydrides. Write the formula of this hydride. Write its reaction with Al_2Cl_6.

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8. Sodium forms a crystallisation ionic solid with dihydrogen. The solid is non-conducting in nature. It reacts violently with water to produce dihydrogen gas. Write the formula of this compond and its reaction with water. What will happen on electrolysis of the melt of this solid.

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Additional Questions Very Short Answer Questions Dihydrogen

1. Which isotope of hydrogen (a) does not contain neutron, (b) contains equal number of protons and neutrons, (c) is radioactive.

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2. Give an example of a compound in which hydrogen exists in (a) $+1$, (b) -1, (c) zero oxidation state.

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3. Name one example of a reaction in which dihydrogen acts (i) as an oxidising agent and (ii) as a reducing agent.

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4. What is syngas ? Why is it called so ?

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5. What is water gas? How it is prepared?

Watch Video Solution

6. What is understood by hydrogenation?

Watch Video Solution

7. Why is dihydrogen not preferred in weather balloons these days?

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8. Give an example of (i) ionic hydride, (ii) covalent hydride.

Watch Video Solution

9. What is hydrolith? How is it prepared?

Watch Video Solution

10. Name two complex metal hydrides which are used as reducing agents in organic reactions.

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11. What type of elements form interstitial hydrides ?

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12. Write two uses of interstitial hydrides .

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13. What is hydride gap?

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14. Explain why beryllium forms a covalent hydride while calcium forms an ionic hydride.

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15. The boiling point of H_2O is higher than that of H_2S. Explain.

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16. What is meant by the term auto-protolysis of water ?

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17. A sample of hard water is allowed to pass through anion exchange resin. Will it produce lather with soap easily?

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18. Is it possible to remove completely by boiling the temporary hardness due to $Mg(HCO_3)_2$?

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19. What is the chemical compositon of zeolite ?

Watch Video Solution

20. Can distilled water be the called as deionised water ?

Watch Video Solution

21. Can marine species live in distilled water?

Watch Video Solution

22. How is heavy water produced from ordinary water ?

Watch Video Solution

23. Why is sodium chloride less soluble in heavy water than in ordinary water ?

Watch Video Solution

24. What happens when heavy water is added to calcium carbide?

Watch Video Solution

25. What happens when chloroform is treated with heavy water in presence of an alkali ?

Watch Video Solution

26. What is the importance of heavy water with regard to nuclear power generation ?

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Additional Questions Very Short Answer Questions Hydrogen Peroxide

1. Anhydrous BaO_2 is not used for preparing H_2O_2 . Why ?

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2. Presence of water is avoided in the preparation of H_2O_2 from Na_2O_2. Explain.

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3. How is D_2O_2 prepared?

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4. When H_2O_2 is added to blood, rapid evolution of gas occurs. Explain.

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5. Explain why oxide ion is called a hard ion ?

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6. Complete the following reactions

$$(i)O_2^{2-} + H_2O \rightarrow (ii)O_2^{-} + H_2O \rightarrow$$

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7. Calculate the molarity strength of H_2O_2 solution marked '30 volume'.

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8. What do you mean by 15 volume H_2O_2 solution?

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9. Calculate the amount of H_2O_2 present in 10 mL of 25 volume H_2O_2 solution.

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10. $10mL$ of a given solution of H_2O_2 contains $0.91g$ of H_2O_2. Express its strength in volume.

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11. Name two compounds which retard the decomposition of H_2O_2.

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12. Hydrogen peroxide is used to restore the colour of old oil paintings containing lead oxide. Write a balanced equations of the reaction that takes place in this process.

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13. What is perhydrol ?

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Additional Questions Short Answer Questions Dihydrogen

1. Write the allotropes of dihydrogen .

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2. Discuss the characteristics in which hydrogen resembles halogens.

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3. Discuss the characteristics in which hydrogen resembles alkali metals.

Watch Video Solution

4. Explain why hydrogen is best placed separately in the periodic table.

Watch Video Solution

5. Name the isotopes of hydrogen. What is importance of the heavier isotopes of hydrogen?

Watch Video Solution

6. How is dihydrogen obtained from

(a) dilute sulphuric acid (b) sodium hydroxide (c) water? Give one equation in each case .

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7. How will you prepare heavy hydrogen in the laboratory ?

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8. How is dihydrogen prepared

a. from water by using a reducing agent?

b. in the laboratory in pure form?

c. from hydrocarbons?

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9. Give one method (other than electrolysis) for large scale preparation of dihydrogen .

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10. What is meant by 'water gas shift reaction' ? Describe its use for the preparation of dihydrogen.

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11. Complete the following reactions : (i) $CuO(s) + H_2(g) \xrightarrow{\text{Heat}}$ $(ii) CO(g) + H_2O(g) \xrightarrow{\text{Heat}}$.

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12. How does dihydrogen react with (i) Blue litmus solution (ii) chlorine (iii) flourine (iv) nitrogen (v) sulphur (vi) carbon (vii)sodium (viii) ferric-ferro oxide (magnetic oxide) (ix) carbon monoxide ?

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13. Describe the industrial applications of hydrogen dependent on : a. the heat liberated when its atoms are made to combine on the surface of a metal.

b. its effect on unsaturated organic system in presence of a catalyst.

c. its ability to combine with nitrogen under specific conditions.

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14. Name the different ways in which hydrogen forms compounds ? Give exmaples.

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15. Discuss industrial uses of dihydrogen .

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16. Explain the correct context in which the following terms are used:

a. Diprotium , b. Dihydrogen , c. Proton, d. Hydrogen

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17. What are metallic or interstitial hydrides? How do they differ from molecular hydrides?

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18. Hydrogen forms compounds with elements having atomic numbers : 9,11,12, 17 and 20 . What are their chemical formulae ? Compare their

chemical behaviour.

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19. Name the class of hydrides to which H_2O, B_2H_6, NaH and LaH_3 belong. What is understood by 'hydrogen gap'?

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20. Distinguish between salt like and covalent hydrides .

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21. What are interstitial hydrides ? Discuss their important uses.

Watch Video Solution

22. Discuss briefly the characteristics of salt like hydrides.

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Additional Questions Short Answer Questions Water

1. Why do lakes freeze from top towards bottom ?

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2. Why is ice less denser than water and what kind of attractive force must be overcome to melt ice?

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3. Explain the structure of the common form of ice.

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4. Explain :(i) water has maximum density at 227 K, (ii) ice floats over water.

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5. Why is water an excellent solvent for ionic and polar compounds?

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6. Explain the amphoteric nature of water.

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7. Describe some unusual properties of water.

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8. What is the action of water on (i) calcium carbide (ii) calcium phosphide (iii) magnesium nitride ?

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9. complete the following reactions :

$(i) CaO(s) + H_2O(l) \rightarrow$ $(ii) Na_2O(s) + H_2O(l) \rightarrow$ $(iii) Fe(s) +$

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10. What are the ways in which water molecules are bonded to the anhydrous salts to form hydrate ?

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11. Distinguish between :

a. Hard water and soft water

b. Temporary hardness and permanent hardness

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12. Discuss the principle and method of softening of hard water by organic ion exchange resins.

Watch Video Solution

13. Describe permutit process for softening of hard water.

Watch Video Solution

14. Discuss briefly de-mineralisation and de-ionisation of water by ion exchange resins.

Watch Video Solution

15. Describe the principle of sequestration for softening of hard water.

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16. Calculate the hardness of a water sample which contains 0.001 mole of $MgSO_4$ dissolved perr litre of the solution.

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17. How is heavy water prepared ? Compare its physical properties with that of ordinary water.

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18. What is the action of heavy water on (i) sodium (ii) sodium hydroxide (iii) ammounium chloride and (iv) sulphur trioxide ?

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19. Name the following compounds and write down how can they be prepared from heavy water ?

(i) $CDCl_3$ (ii) DCl (iii) (iv) C_2D_2 (v) CD_4

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20. Discuss the importance of heavy water in nuclear reactor.

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Additional Questions Short Answer Questions Hydrogen Peroxide

1. What happens when

(a) Barium peroxide is treated with cold dilute sulphuric acid.

(b) Sodium peroxide is treated with cold dilute sulphuric acid and the resulting mixture is cooled below 273 K

(c) Barium peroxide is treated with phosphoric acid.

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2. Write equations for the following reactions :-

(a) A solution of 2-ethylanthraquinol in a mixture of benzene and cyclohexane is oxidised

(b) The organic product obtained in (a) is treated with hydrogen in the presence of palladium catalyst

(c) Peroxydisulphuric acid is hydrolysed.

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3. How is a solution of H_2O_2 prepared by electrolysis of an aqueous solution of ammonium sulphate and H_2SO_4 ?

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4. Justify the statement "An aqueous solution of hydrogen peroxide is weakly acidic".

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5. Explain : $(i) H_2O_2$ has a higher boiling point than water.

(ii) H_2O_2 cannot be stored for prolonged periods.

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6. Name the compound of hydrogen and oxygen which acts both as an oxidising as well as a reducing agent. Give one method for its preparation.

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7. Hydrogen peroxide is a strong oxidizing agent both in acidic and alkaline medium". Justify giving suitable reactions

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8. Hydrogen peroxide is used to restore the colour of old oil paintings containing lead oxide. Write a balanced equations of the reaction that takes place in this process.

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9. Complete the following equations :

$(i) PbS(s) + H_2O_2(aq) \rightarrow \qquad (ii) MnO_4^{2-}(aq) + H_2O_2(aq) \rightarrow$

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10. What happens when H_2O_2 is treated with ?

(a) acidified potassium permanganate

(b) lead sulphide

(c) alkaline potassium ferrocyanide

(d) acidified ferrous sulphate

(e) sulphurous acid.

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11. Give three uses of hydrogen peroixde ?

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12. What is understood by hydrogen economy ?

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13. What are advantages of using hydrogen as a fuel over gasoline or coal ?

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14. Discuss two methods for storing hydrogen.

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Additional Questions Long Answer Questions

1. Discuss the position of hydrogen in the periodic table.

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2. What are isotopes ? Discuss briefly the structure, properties and uses of isotopes of hydrogen .

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3. What are hydrides ? Discuss their various types. How are they formed ?

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Analytical Questions And Problems With Answers Solutions Question

1. Dihydrogen is a strong reducing agent. Can you thick of a reaction in which it acts as an oxidising agent ?

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2. The process 1/2 $H_2(g) + e^- \rightarrow H^-(g)$ is endothermic $\left(\Delta H = +151 KJ \text{mol}^{-1}\right)$, yet salt like hydrides are known. How do you account for this ?

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3. Although dihydrogen is the third most abundant element on the surface of the globe yet it is not found in our atmosphere . Why so ?

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4. Under what conditions, hydrogen behaves as a metal?

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5. Do water gas and syn gas mean the same gaesous mixture ? Explain .

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6. Although dihydrogen can be prepared by electrolysis of water but in fertilizer industry, dihydrogen needed for making urea is prepared froom natural gas or naphtha. Why so ?

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7. Which is a better name for pure H_2, diprotium or dihydrogen ?

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8. Which is a solid fuel ?

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9. Can interstitial hydrides be used for storing hydrogen gas ? Comment .

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10. Biomass gasification rather than coal gasification can be used to control environmental pollution Justify ?

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11. Ionic hydrides are frequently used to remove last traces of water from organic compounds. How does it happen ? Explain.

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12. Can marine species live in distilled water ? Justify .

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13. Fishes are more comfortable in cold water than in hot water. Justify.

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14. What is demineralized water? How is it obtained ?

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15. Explain why electrolysis of ordinary water occurs faster than heavy water ?

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16. Although D_2O resembles H_2O chemically yet it is a toxic substance. Explain

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17. $CDCl_3$ is extensively used as a solvent for scanning NMR spectra. How can it be prepared from $CHCl_3$?

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18. Water extinguishes most fires, but it does not extinguish petrol fire. Explain.

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Analytical Questions And Problems With Answers Solutions Prbolems

1. Calculate the volume of 10 volume H_2O solution that will react with 200 mL of 2N $KMnO_4$ in acidic medium.

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2. The degree of hardness of a given sample of hard water is 40 ppm. If the entire hardness in due to $MgSO_4$, how much of $MgSO_4$ is present per kg of water ?

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Competition Focus Multiple Choice Questions With One Correct Answer Dihydrogen

1. HCl gas is covalent and NaCl is an ionic compound. This is because

A. sodium is highly electropositive

B. hydrogen is a non metal

C. HCl is a gas

D. Electronegativity difference H and Cl is less than 2.1 .

Answer: D

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2. Select the correct statements

A. H^+ can exist as $H_9O_4^+$ in water

B. Electrolysis of fused sodium hydride produces H_2 at the anode

C. Hydride ion is larger that any of the halide ions except iodide ion

D. All are correct

Answer: D

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3. ${}_{6}C^{12}$ and ${}_{1}T^{3}$ are formed in nature due to the nuclear reaction of neutron with

A. ${}_{7}N^{14}$

B. ${}_{6}C^{13}$

C. ${}_{2}He^{4}$

D. $_3Li(6)$

Answer: A

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4. Hydrogen can be prepared by the action of dil. H_2SO_4 on

A. copper

B. iron

C. lead

D. mercury

Answer: B

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5. Which of the following combination will produce H_2 gas ?

A. Cu metal and conc. HNO_3

B. Zn metal and NaOH (aq)

C. Au metal and NaCN (aq) in the presence of air

D. Fe metal and conc. HNO_3

Answer: B

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6. Which of the following can produce hydrogen from water

A. Heated stannic oxide

B. Heated iron

C. Heated aluminium oxide

D. Heated copper oxide

Answer: B

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

A. $Na, H_2, NaOH, Zn$

B. K, H_2, KOH, Al

C. $Ca, H_2, Ca(OH)_2, Sn$

D. $CaC_2, C_2H_2, Ca(OH)_2, Fe$

Answer: A

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8. Which of the following pairs of substance on reaction will not evolve H_2 gas ?

A. Fe and H_2SO_4 (aqueous)

B. Copper and HCl (aqueous)

C. Sodium and ethyl alcohol

D. Iron and steam

Answer: B

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

A. Mixing natural hydrocarbons of high molecular mass

B. Electrolysis of water

C. Reaction of salt like hydrides with water

D. Reaction of methane with steam

Answer: B

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10. Syngas is a mixture of

A. $CO_2 + H_2$

B. $CO + H_2$

C. $CO + CO_2$

D. $CO + N_2$

Answer: B

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11. In context with the industrial preparation of hydrogen from water gas $(CO + H_2)$, which of the following is the correct statement ?

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

B. CO and H_2 are fractionally separated using differences in their densities

C. CO is removed by absorption in aqueous Cu_2Cl_2 solution

D. H_2 is removed through occlusion with Pd

Answer: A

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12. Water gas is produced by

A. passing steam over the red hot coke

B. Passing steam and air over red hot coke

C. burning coke in excess of air

D. burning coke in limited supply of air

Answer: A

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13. The production of dihydrogen gas via water-gas shift reaction of given below :

$$CO(g) + H_2O(g) \xrightarrow[\text{catalyst}]{\Delta} CO_2(g) + H_2(g)$$

The CO_2 gas is removed by scrubbing with solution of

A. sodium arsenite

B. calcium oxide

C. sodium phosphite

D. aluminium oxide

Answer: A

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14. H_2 will not reduce which of the following oxide

A. Aluminium oxide

B. calcium oxide

C. Ferrous oxide

D. None of the above

Answer: D

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15. Hydrogen combines with other elements by

A. losing an electron

B. gaining an electron

C. sharing an electron

D. losing, gaining and sharing of an electron

Answer: D

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16. Which of the following statements is most applicable to hydrogen ? It can act

A. as a reducing agent

B. as an oxidising agent

C. both as oxidising and reducing agents

D. neither as an oxidising nor as a reducing agent.

Answer: C

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17. The various types of hydrides and examples of each type are given below :

A. (A)-(ii),(B)-(iv),(C)-(v),(D)-(iii)-(E)-(i)

B. (A)-(iv),(B)-(i),(C)-(ii),(D)-(v),(E)-(iii)

C. (A)-(iv),(B)-(iii),(C)-(v),(D)-(ii),(E)=(i)

D. (A)-(v),(B)-(iii),(C)-(iv),(D)-(ii),(E)-(i)

Answer: B

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18. The hydrides of the first elements in groups 15-17, namely NH_3, H_2O and HF respectively show abnormally high values for melting and boiling points. This is due to

A. small size of N,O,F

B. the ability to form extensive intermolecular H-bonding

C. the ability to form extensive intramolecular

D. effective van der Waals interaction

Answer: B

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19. The least stable hydride of 15th group is

A. NH_3

B. PH_3

C. AsH_3

D. BiH_3

Answer: D

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20. Which of the following hydrides of group 16 elements has the highest boiling point ?

A. H_2O

B. H_2S

C. H_2Se

D. H_2Te

Answer: A

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21. Acidity of diprotic acids in aqueous solutions increases in the order

A. $H_2S < H_2Se < H_2Te$

B. $H_2Se < H_2S < H_2Te$

C. $H_2Te < H_2S < H_2Se$

D. $H_2Se < H_2Te < H_2S$

Answer: A

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22. Hydride ion is a strong

A. conjugate acid of H_2

B. conjugate base of H_2

C. conjugate acid of H^-

D. conjugate base of H^+

Answer: B

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23. Consider the following reactions:

I : $AIH_3 + H^- \rightarrow AlH_4^-$

II : $H_2O + H^- \rightarrow H_2 + OH^-$

Select the correct statement from the following :

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

B. H^- is a Lewis acid in I and Bronsted base in II

C. H^- is a Lewis acid in I and Bronsted base in II

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

Answer: B

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24. Nascent hydrogen consists of

A. hydrogen atoms with excess energy

B. hydrogen molecules with excess energy

C. hydrogen ions in the excited state

D. solvated protons.

Answer: B

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25. Spin isomerism is shown by

A. dichlorobenzene

B. hydrogen

C. dibasic acid

D. n-butane

Answer: B

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26. Para and ortho hydrogen differ in

A. atomic number

B. atomic mass

C. spins of protons

D. number of neutrons

Answer: C

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Competition Focus Multiple Choice Questions With One Correct Answer Water

1. Which one of the following statements about water is false ?

A. Water is oxidized to oxygen during photosynthesis

B. water can act both as an acid and as a base

C. There is extensive intramolecular hydrogen bonding in the condensed phase

D. Ice formed by heavy water sinks in normal water

Answer: C

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2. Which of the following disproportionates when treated with water ?

A. SO_3

B. F_2

C. N_2

D. Cl_2

Answer: D

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

A. 5

B. 1

C. 4

D. 3

Answer: B

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4. The salt responsible for permanent hardness of H_2O is

A. Na_2SO_4

B. $Mg(HCO_3)_2$

C. $NaCl$

D. $MgCl_2$

Answer: D

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5. Which of the following ions will cause hardness in water ?

A. Ca^{2+}

B. Na^{+}

C. Cl^{-}

D. K^{+}

Answer: A

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6. Water softening by Clarke's process uses

A. $NaHCO_3$

B. $Ca(OH)_2$

C. $Ca(HCO_3)_2$

D. Na_2CO_3

Answer: B

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7. Pure water can be obtained from sea water by

A. cetrifugation

B. plasmolysis

C. reverse osmosis

D. sedimentation

Answer: C

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8. In the calgon process of softening of water, which of the following is used ?

A. Sodium polymetaphosphate

B. Hydrated sodium aluminium silicate

C. Cation exchange resins

D. Anion exchange resins

Answer: A

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9. The reagent commonly used to determine hardness of water titrimetrically is :

A. oxalic acid

B. disodium salt of EDTA

C. sodium citrate

D. sodium thiosulphate

Answer: B

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10. The hardness of water sample containing 0.002 of water is expressed as :

A. 20 ppm

B. 200 ppm

C. 2000 ppm

D. 120 ppm

Answer: B

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11. The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na(mol.\ Wt.\ 206)$. What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin?

A. $2/3009$

B. $1/412$

C. $1/103$

D. $1/206$

Answer: B

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Competition Focus Multiple Choice Questions With One Correct Answer Hydrogen Peroxide

1. Which of the following compounds is a peroxide ?

A. KO_2

B. BaO_2

C. MnO_2

D. NO_2

Answer: B

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2. How many peroxy linkages are present in CrO_5 ?

A. 1

B. 2

C. 3

D. 4

Answer: B

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3. The inorganic compound obtained by the auto oxidation of 2-alkylanthraquinol is

A. H_2O

B. H_2O_2

C. H_2

D. O_2

Answer: B

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4. Commerical sample of H_2O_2 is labeled as 10 V. its % strength is nearly

A. 3

B. 6

C. 9

D. 12

Answer: A

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5. 30 volume H_2O_2 means _____.

A. 30 % H_2O_2

B. $30cm^3$ of the solution contains 1 g of H_2O_2

C. $1cm^3$ of the solution liberates $30cm^3$ of O_2 at STP

D. $30cm^3$ of the solution contain one mole of H_2O_2

Answer: C

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6. The volume of oxygen liberated at STP from 15 mL of 20 volume H_2O_2 is

A. 100 mL

B. 150 mL

C. 200 mL

D. 300 mL

Answer: D

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7. 10 mL of H_2O_2 solution is treated with KI and titration of liberated I_2 required 10 mL of 1 N hypo . Thus H_2O_2 is

A. 1N

B. 5.6 volume

C. $17gL^{-1}$

D. all are correct

Answer: D

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8. The strength of H_2O_2 (in g/litre) in 11.2 volume solution of H_2O_2 is

A. 17

B. 51

C. 34

D. 85

Answer: C

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9. From the following statement regarding H_2O_2, choose the incorrect statement.

A. It has to the stored in plastic or wax lined glass bottles in dark

B. It has to be kept away from dust

C. It can act only as an oxidising agent

D. It decomposes on exposure to light .

Answer: C

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10. What is false about H_2O_2 ?

A. Acts as both oxidising and reducing agent

B. Two OH bonds lie in the same plane

C. Pale blue liquid

D. Can be oxidised by O_3

Answer: B

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11. Which of the following molecules can act as an oxidating as well as a reducing agent?

A. H_2S

B. SO_3

C. H_2O_2

D. F_2

Answer: C

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12. In the reaction

$Ag_2O + H_2O_2 \rightarrow 2Ag + H_2O + O_2$,$H_2O_2$ acts as

A. reducing agent

B. oxidising agent

C. bleaching agent

D. none of these

Answer: A

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13. In which of the following reactions, H_2O_2 is acting as a reducing agent?

A. $SO_2 + H_2O_2 \rightarrow H_2SO_4$

B. $2Kl + H_2O_2 \rightarrow 2KOH + I_2$

C. $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

D. $Ag_2O + H_2O_2 \rightarrow 2Ag + H_2O + O_2$

Answer: D

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14. In which of the following reactions H_2O_2 acts as reducing agent?

(A) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

(B) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

(C). $H_2O_2 + 2e^- \rightarrow 2OH^-$

(D) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

A. (ii) and (iv)

B. (i) and (ii)

C. (iii) and (iv)

D. (i) and (iii)

Answer: A

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15. The reaction of aqueus $KMnO_4$ with H_2O_2 in acidic conditions gives

A. Mn^{4+} and O_2

B. Mn^{2+} and O_2

C. Mn^{2+} and O_3

D. Mn^{4+} and MnO_2

Answer: B

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16. The gaseous product formed when HOCl reacts with H_2O_2 in acidic medium is

A. H_2

B. Cl_2

C. O_2

D. $HClO_2$

Answer: C

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17. I. $H_2O_2 + O_2 \rightarrow H_2O + 2O_2$

$II.\ H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Role of hydrogen peroxide in the above reactions is respectively

A. oxidising in (I) and reducing in (II)

B. reducing in (I) and oxidising in (II)

C. reducing in (I) and (II)

D. oxidising in (I) and (II)

Answer: C

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18. 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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19. In alkaline medium, H_2O_2 reacts with Fe^{3+} and Mn^{2+} respectively to give

A. Fe^{4+}, and Mn^{4+}

B. Fe^{2+} and Mn^{2+}

C. Fe^{2+} and Mn^{4+}

D. Fe^{4+} and Mn^{2+}

Answer: C

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20. In transforming 0.01 mole of PbS to $PbSO_4$, the volume of '10 volume H_2O_2 required will be :

A. 11.2 mL

B. 22.4 mL

C. 33.6 mL

D. 44.8 mL

Answer: D

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21. Blackened oil painting can be restored into original form by the action of

A. Chlorine

B. BaO_2

C. H_2O_2

D. MnO_2

Answer: C

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22. In the following reaction using isotopic $.^{18}O$ in H_2O_2, $2MnO_4^- + 3H_2O_2^{18} \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$ isotopic oxygen goes

A. both in O_2

B. both in MnO_2

C. both in OH^-

D. One in O_2 and one in MnO_2

Answer: A

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23. H_2O_2 cannot oxidise :

A. Na_2SO_3

B. KI

C. PbS

D. O_3

Answer: D

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24. Bond angles $H-O-H$ and $H-O-O-$ in water and H_2O_2 respectively are

A. $104.5^\circ, 104.5^\circ$

B. $94.8^\circ, 94.8^\circ$

C. $104.8^{\circ}, 94.8^{\circ}$

D. $94.8^{\circ}, 104.5^{\circ}$

Answer: C

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25. The correct order in which the O-O bond length increases in the respectively are

A. $O_3 < H_2O_2 < O_2$

B. $O_2 < O_3 < H_2O_2$

C. $O_2 < H_2O_2 < O_3$

D. $H_2O_2 < O_2 < O_3$

Answer: B

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26. The product of $NH_3 - NH_2 + H_2O_2 \xrightarrow{Cu^{2+}}$ is

A. O_2

B. H_2

C. NH_3

D. N_2

Answer: D

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Competition Focus Multiple Choice Questions With One Or More Than One Correct Answers

1. Which of the following will not liberate dihydrogen ?

A. $Zn + H_2SO_4$ (di.)

B. $Zn + NaOH(aq)$

C. $Cu + H_2SO_4$(conc.)

D. $F_2 + H_2O$

Answer: C::D

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

A. Hydrogenium ion, H_3O^+ exists freedly in solution

B. Dihydrogen does not act as a reducing agent

C. Hydrogen has three isotopes of which tritium is the most common

D. Hydrogen never acts as a cation in ionic salts

Answer: B::C

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3. Water can act as

A. an acid

B. base

C. reductant

D. oxidant

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

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4. The reagents used fro softening of 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::C

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

A. H^+ ions

B. Ca^{2+}

C. SO_4^{2-} ions

D. Mg^{2+} ions

Answer: B::D

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6. Which of the following has lower value of D_2O than for H_2O ?

A. Molecular mass

B. Dielectric constant

C. Ionsization constant

D. Viscosity

Answer: B::C

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7. Fe^{3+} is reduced to Fe^{2+} by using

A. H_2O_2 in presence of NaOH

B. Na_2O_2 in water

C. H_2O_2 in presence of H_2SO_4

D. Na_2O_2 in presence of H_2SO_4

Answer: A::B

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8. Which of the following statements are correct ?

A. H_2O_2 reduces MnO_4^- both in acidic and basic media

B. H_2O_2 oxidises Fe^{2+} ions both in acidic and basic media

C. H_2O_2 oxidises Mn^{2+} to Mn^{4+} ions in basic medium

D. H_2O_2 liberates I_2 from acidified KI solution and reduces I_2 to I^- ions in basic medium.

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

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Competition Focus Multiple Choice Questions Based On The Given Passages Comprehension

1. Hydrogen peroxide can be preapared by the action of dil. H_2SO_4 or H_3PO_4 on barium peroxide or by bubbling peroxide . On an industrial

scale, it can be prepared by hydrolysis of peroxodisulphuric acid obtained by electrolysis of 50% H_2SO_4 or an equimolar mixture of H_2SO_4 and ammonium sulphate . The strength of H_2O_2 solution can be expressed in a number of ways namely normality , molarity , percentage strength and volume strength . Volume strength refers to the volume of O_2 produced at N.T.P. by decomposition of 1 mL of H_2O_2 solution. H_2O_2 acts as an oxidising as well as reducing agent both in acidic and basic media.

The correct increasing order of the acidity of CO_2, H_2O and H_2O_2 is

A. $CO_2 < H_2O_2 < H_2O$

B. $H_2O < H_2O_2 < CO_2$

C. $H_2O < H_2O_2 > CO_2$

D. $H_2O_2 > CO_2 > H_2O$

Answer: b

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2. Hydrogen peroxide can be preapared by the action of dil. H_2SO_4 or H_3PO_4 on barium peroxide or by bubbling peroxide . On an industrial scale, it can be prepared by hydrolysis of peroxodisulphuric acid obtained by electrolysis of 50% H_2SO_4 or an equimolar mixture of H_2SO_4 and ammonium sulphate . The strength of H_2O_2 solution can be expressed in a number of ways namely normality , molarity , percentage strength and volume strength . Volume strength refers to the volume of O_2 produced at N.T.P. by decomposition of 1 mL of H_2O_2 solution. H_2O_2 acts as an oxidising as well as reducing agent both in acidic and basic media.

The volume of 10 volume H_2O_2 solution that decolourises 200 mL of 2N $KMnO_4$ solution in acidic medium is :

A. 112 mL

B. 336 mL

C. 200 mL

D. 224 mL

Answer: d

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3. Hydrogen peroxide can be preapared by the action of dil. H_2SO_4 or H_3PO_4 on barium peroxide or by bubbling peroxide . On an industrial scale, it can be prepared by hydrolysis of peroxodisulphuric acid obtained by electrolysis of 50% H_2SO_4 or an equimolar mixture of H_2SO_4 and ammonium sulphate . The strength of H_2O_2 solution can be expressed in a number of ways namely normality , molarity , percentage strength and volume strength . Volume strength refers to the volume of O_2 produced at N.T.P. by decomposition of 1 mL of H_2O_2 solution. H_2O_2 acts as an oxidising as well as reducing agent both in acidic and basic media.

Hydrolysis of one mole of peroxodisulphuric acid produces

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4. Hydrogen peroxide can be preapared by the action of dil. H_2SO_4 or H_3PO_4 on barium peroxide or by bubbling peroxide . On an industrial scale, it can be prepared by hydrolysis of peroxodisulphuric acid obtained

by electrolysis of 50% H_2SO_4 or an equimolar mixture of H_2SO_4 and ammonium sulphate . The strength of H_2O_2 solution can be expressed in a number of ways namely normality , molarity , percentage strength and volume strength . Volume strength refers to the volume of O_2 produced at N.T.P. by decomposition of 1 mL of H_2O_2 solution. H_2O_2 acts as an oxidising as well as reducing agent both in acidic and basic media.

100 volume hydrogen peroxide solution means

A. 17.86 N

B. 30.36% H_2O_2

C. $8.93M$

D. all are correct

Answer: d

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5. Hydrogen peroxide can be preapared by the action of dil. H_2SO_4 or H_3PO_4 on barium peroxide or by bubbling peroxide . On an industrial

scale, it can be prepared by hydrolysis of peroxodisulphuric acid obtained by electrolysis of 50% H_2SO_4 or an equimolar mixture of H_2SO_4 and ammonium sulphate . The strength of H_2O_2 solution can be expressed in a number of ways namely normality , molarity , percentage strength and volume strength . Volume strength refers to the volume of O_2 produced at N.T.P. by decomposition of 1 mL of H_2O_2 solution. H_2O_2 acts as an oxidising as well as reducing agent both in acidic and basic media.

Which of the following substances on treatment with H_2O_2 gives MnO_2

A. acidified $KMnO_4$

B. alkaline $KMnO_4$

C. alkaline $MnSO_4$

D. both (b) and (c)

Answer: d

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Competition Focus Integer Type Questions

1. Number of isotopes of hydrogen are

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2. How many of the following metals dissolve in boiling alkali to produce H_2 gas ?

$Cu, Ni, Zn, Be, Ag, Fe, Mn, Sn, Al.$

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3. Number of electron-rich hydrides among the following are :

$CH_4, NH_3, PH_3, H_2O, H_2S, BH_3, HF, AlH_3, AsH_3.$

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4. Presence of which of the following compounds makes water hard ?

$Na_2SO_4, Ca(HCO_3)_2, MgCl_2, Na_2CO_3, CaSO_4, KCl, NaHCO_3, MgSO_4$

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5. How many of the following oxides would liberate H_2O_2 on treatment with dil. H_2SO_4 ?

$PbO_2, Na_2O_2, MnO_2, BaO_2, TiO_2, CO_2, NO_2, SnO_2$ and Ag_2O.

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Competition Focus Numerical Value Type Questions

1. A $5.0mL$ of solution of H_2O_2 liberates $0.508g$ of iodine from acidified KI solution. Calculate the strength of H_2O_2 solution in terms of volume strength at STP.

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Competition Focus Assertion Reason Type Questions Type 1

1. Statement-1. Electrolysis of NaH in the fused state liberates H_2 at the anode.

Statement -2. NaH contains H^- ions.

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2. Statement-1. HF is an electron-deficient hydride.

Statements-2. In HF,F has three lone pairs of electrons.

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3. Assertion : Demineralised water does not contain any ions.

Reason : Permutit process for water softening gives demineralised water.

A. Statement-1 is true, Statement-2 is True , Statement-2 is a correct explanation for statement-3

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for statement-3

C. Statement-1 is True, Statement -2 is False

D. Statement -1 is False , Statement-2 is True.

Answer: C

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4. Assertion : H_2O_2 decomposes carbonates and bicarbonates to evolve CO_2 gas.

Reason : H_2CO_3 is stronger acid than H_2O_2.

A. Statement-1 is true, Statement-2 is True , Statement-2 is a correct explanation for statement-4

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for statement-4

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. Assertion:- The colour of old lead paintings can be restored by washing with dilute solution of H_2O_2

Reason:- Black lead sulphide is oxidised by H_2O_2 to white lead sulphate.

A. Statement-1 is true, Statement-2 is True , Statement-2 is a correct explanation for statement-5

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for statement-5

C. Statement-1 is True, Statement -2 is False

D. Statement -1 is False , Statement-2 is True.

Answer: A

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6. Statement-1.H_2O_2 reduces potassium ferricyanide in alkaline medium. Statement-2. Whenever H_2O_2 acts as a reducing agent, O_2 is always produced.

A. Statement-1 is true, Statement-2 is True , Statement-2 is a correct explanation for statement-6

B. Statement-1 is True, Statement-2 is True, Statement-2 is not a correct explanation for statement-6

C. Statement-1 is True, Statement -2 is False

D. Statement -1 is False , Statement-2 is True.

Answer: B

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Competition Focus Assertion Reason Type Questions Type 2

1. Assertion : The water gas shift reaction can be used to increase the amount of H_2 in the shift ' syn gas ' mixture.

Reason : In this reaction, water is reduced to H_2 by CO.

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2. Assertion (A) Chlorine reacts more rapidly with H_2 in comparison to D_2 .

Reason (R) D -CL bond is stronger in comparison to H - Cl bond .

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3. Assertion. Dihydrogen oxidises sodium to sodium hydride.

Reason. Hydrogen can act only as a reducing agent.

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4. Assertion : Electrolysis of molten CaH_2 produces hydrogen gas at anode.

Reason : In CaH_2, hydrogen is present in the form of hydride H^-.

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5. Assertion. Beryllium hydride is a covalent hydride.

Reason. The electronegativity difference between Be and H is very hig.

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6. Assertion (A) H_2O is the only hydride of group - 16 which is liquid at ordinary temperature.

Reason (R) In ice , each oxygen atom is surrounded by two covalent bonds and two hydrogen bonding.

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7. Assertion. Calgon is used for removing Ca^{2+} and Mg^{2+} ions.

Reason. Calgon forms precipate with Ca^{2+} and Mg^{2+} ions.

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8. Assertion (A): $NaCl$ is less soluble in heavy water than in ordinary water.

Reason (R) : Dielectric constant of ordinary water is more than that of heavy water.

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9. Assertion : H_2O_2 has higher boiling point than water

Reason : It has stronger dipole interactions than that shown by water.

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10. Assertion (A) Decomposition of H_2O_2 is a disproportionation reaction.

Reason (R) H_2O_2 molecule simultaneously undergoes oxidation and reduction.

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11. 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.

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12. Assertion. H_2O_2 can be used as an antichlor in bleaching .

Reason. It oxidises HCl to Cl_2.

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13. Assertion. The O-O bond length in H_2O_2 is shorter than that of O_2F_2

Reason. H_2O_2 is an ionic compound.

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14. Assertion. Nascent hydrogen can discharge the pink colour of $KMnO_4$ solution.

Reason. Nascent hydrogen is much more reactive than dihydrogen .

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15. Assertion. On adding Zinc pieces to aqueous $FeCl_3$ solution, colour changes from deep yellow to light green

Reason. Aqueous $FeCl_3$ is acidic and on adding zinc, nascent hydrogen is produced which reduces deep yellow $FeCl_3$ solution to light green $FeCl_2$ solution.

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