

CHEMISTRY

BOOKS - NCERT CHEMISTRY (HINGLISH)

HYDROGEN

Multiple Choice Questions

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

C. Its low negative electron enthalpy value

D. Its small size.

Answer: B

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

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

B. Its reactivity 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 sizes 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.

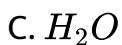
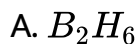
Among LiH, NaH, KH, RbH, CsH the correct order of increasing ionic character is



Answer: B

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



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

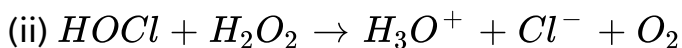
D. hydronium

Answer: C



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6. Consider the reactions



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

A. an oxidising agent in both (i) and (ii)

B. an oxidising agent in (i) and oxidising agent in(ii)

C. a reducing agent in (i) and oxidising agent in (ii)

D. a reducing agent in both (i) and (ii)

Answer: B



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

A. PbO_2

B. $BaO_2 \cdot 8H_2O + O_2$

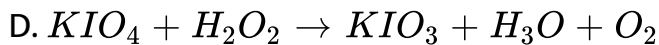
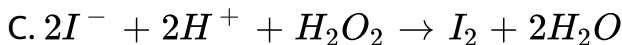
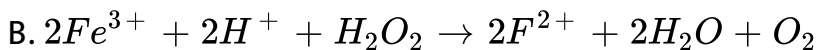
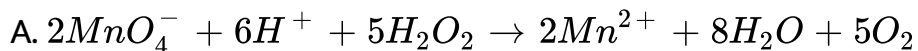
C. MnO_2

D. TiO_2

Answer: B

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

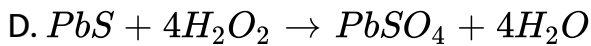
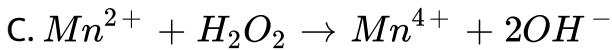
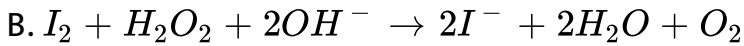
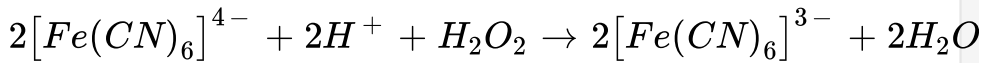


Answer: C

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

A.



Answer: B



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10. Hydrogen peroxide is ..

A. an oxidising agent

B. a reducing agent

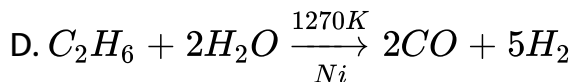
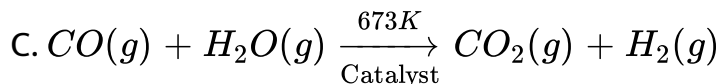
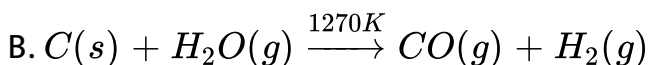
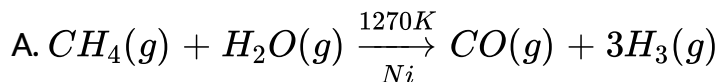
C. both an oxidising and a reducing agent

D. neither oxidising nor reducing agent

Answer: B

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



Answer: C

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12. When sodium peroxide is treated with the dilute sulphuric acid, we get

- 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

- A. water
- B. sulphuric acid

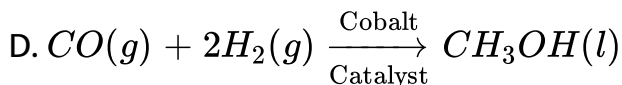
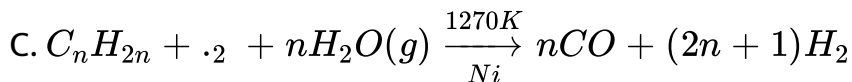
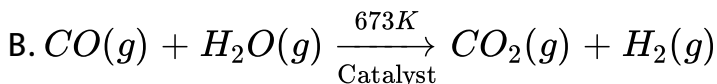
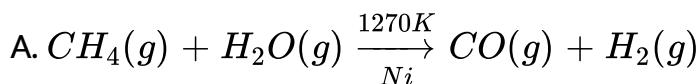
C. hydrochloric acid

D. fused sodium peroxide

Answer: B

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



Answer: D



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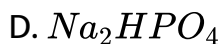
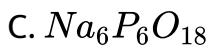
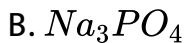
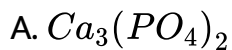
15. Which of the following ions will cause hardness in water sample?



Answer: A

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



Answer: C



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

A. Group 7,8,9

B. Group 13

C. Group 15,16,17

D. Group 14

Answer: A



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18. Only one element of d -block forms hydride.

A. group 6

B. group 7

C. group 8

D. group 9

Answer: A



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

A. It exist as diatomic molecule

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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20. Dihydrogen can be prepared on commercial scale by different methods. In its preparation by the action of steam on hydrocarbons, a mixture of CO and H_2 gas is formed. It is known as

- A. water gas
- B. syn gas
- C. producer gas
- D. industrial gas

Answer: A::B



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

Answer: A::C

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22. Which of the following statements about hydrogen are correct ?

- A. Hydrogen has three isotopes of which protium is the most common
- B. Hydrogen never acts as cation in ionic salts

C. Hydrogen ion, H^+ , exists freely in solution

D. Dihydrogen does not act as a reducing agent

Answer: A::B

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23. 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: B::C

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24. Hardness of water may be temporary 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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25. Which of the following statements is correct ?

- A. Elements of group 15 form electron deficient hydrides.
- B. All elements of group 14 form electron deficient hydrides
- C. Electron precise hydrides have tetrahedral geometries
- D. Electron rich hydrides can act as Lewis acids.

Answer: C::D



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26. Which of the following statements is correct?

- A. Hydrides of group 13 act as Lewis acids
- B. Hydrides of group 14 are electron
- 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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27. 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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Short Answer Type 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.

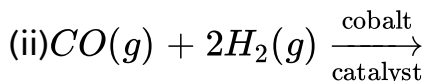
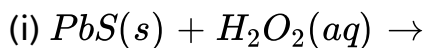
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4. If same mass of liquid water and a piece of ice is taken, then why is the density of ice less than that of liquefied water ?

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5. Complete the following equations



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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 its significance?

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8. Discuss briefly de-mineralisation of water by ion exchange resin.

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9. Molecular 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 agent 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

| | 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 the data explain in which of these liquids intermolecular forces are stronger?

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15. Dihydrogen reacts with dioxygen (O_2) to form water. Write the name and formula of the product when the isotope of hydrogen which has one proton and one neutron in its nucleus 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 dioxygen, it gives a compound whose solid state floats on its liquid state. This compound has an ability to act as an as well as a

base. What products will be formed when this compound undergoes autoionisation?

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18. Rohan heard that instructions were given to the laboratory attendant to store a particular chemical, i.e., keep it in the dark room, add some urea in it, and keep it away from 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 control treatment of domestic and industrial effluents.

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19. Give 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 principle of hydrogen economy is transportation and storage of energy 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 concentrated solution of hydrogen peroxide be obtained ?

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

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

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32. Phosphoric acid is preferred over sulphuric acid in preparing hydrogen peroxide from peroxides. Why?

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33. How will you account 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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Matching The Columns

1. Correlate the items listed in column I with those listed in column II. Find out as many correlation as you can.

| Column I | Column II |
|-----------------------|---|
| A. Synthesis gas | 1. $\text{Na}_2[\text{Na}_4(\text{PO}_3)_6]$ |
| B. Dihydrogen | 2. Oxidising agent |
| C. Heavy water | 3. Softening of water |
| D. Calgon | 4. Reducing agent |
| E. Hydrogen peroxide | 5. Stoichiometric compounds of s-block elements |
| F. Salt like hydrides | 6. Prolonged electrolysis of water |
| | 7. $\text{Zn} + \text{NaOH}$ |
| | 8. $\text{Zn} + \text{dil. H}_2\text{SO}_4$ |
| | 9. Synthesis of methanol |
| | 10. 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 |
|----------------------------------|---|
| A. H | 1. used in the name of perhydrol. |
| B. H ₂ | 2. can be reduced to dihydrogen by NaH. |
| C. H ₂ O | 3. can be used in hydroformylation of olefin. |
| D. H ₂ O ₂ | 4. 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 |
|---|---|
| A. Electrolysis of water produces | 1. atomic reactor |
| B. Lithium aluminium hydride is used as | 2. polar molecule |
| C. Hydrogen chloride is a | 3. recombines on metal surface to generate high temperature |
| D. Heavy water is used in | 4. reducing agent |
| E. Atomic hydrogen | 5. 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 |
|---|-----------------------------|
| A. Hydrogen peroxide is used as a | 1. zeolite |
| B. Used in Calgon method | 2. perhydrol |
| C. Permanent hardness of hard water is removed by | 3. sodium hexametaphosphate |
| | 4. propellant |



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Assertion And Reason

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

Reason (R) Washing soda reacts with soluble magnesium and calcium sulphate to form insoluble carbonates.

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

B.

C.

D.

Answer: A



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

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

A. Statements A and R both are correct and R is the correct expansion 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: A

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Long Answer Type Questions

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

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2. How can D_2O_2 prepared from water ? Mention the physical 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 drawing 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 peroxide will be present in 2 L of a 5 molar solution ?

(ii) Calculate the mass of oxygen 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 slowly on exposure to light . It is stabilised any mixing urea to store in the presence of 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 synthesis of other useful hydrides. Write the formula of this hydride. Write its reaction with Al_2Cl_6 .

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



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