

# 1 HYDROGEN

## I. Multiple choice questions: (Tick the correct option).

- Name the metal which does not react with dilute sulphuric acid.  
(a) Lead      (b) Tin      (c) Magnesium      (d) Iron
- In which list are the metals correctly arranged in the order of their increasing reactivity with water?  
(a) Magnesium, potassium, sodium, calcium, iron  
(b) Potassium, sodium, calcium, magnesium, iron  
(c) Magnesium, sodium, calcium, potassium, iron  
(d) Iron, magnesium, calcium, sodium, potassium
- The credit for the discovery of hydrogen goes to  
(a) Lavoisier      (b) Robert Boyle  
(c) Henry Cavendish      (d) Francis Bacon
- In the free state, hydrogen is present in  
(a) natural gas      (b) sun      (c) petroleum      (d) mineral salts
- Hydrogen burns in oxygen to form  
(a) hydrochloric acid      (b) water      (c) hydrogen sulphide      (d) ammonia
- The process of removing oxygen from their compounds is called  
(a) reduction      (b) combination      (c) synthesis      (d) oxidation
- Hydrogen frees metals from their  
(a) sulphates      (b) oxides      (c) nitrates      (d) none of the above
- When hydrogen gas is bubbled through a soap solution, soap bubbles filled with hydrogen begin to fly away. This experiment demonstrates that  
(a) hydrogen is denser than air      (b) hydrogen is less dense than air  
(c) hydrogen is the lightest gas  
(d) hydrogen in the bubble is attracted by the air above it.
- The lightest element known is  
(a) helium      (b) lithium      (c) hydrogen      (d) radium
- Petrol and paraffin wax are  
(a) hydrocarbons      (b) acids      (c) bases      (d) salts
- Hydrogen reacts with copper oxide to form  
(a) copper hydride and water      (b) copper and water  
(c) copper hydroxide and water      (d) copper hydroxide only

12. The substance which does not contain hydrogen in the combined state is  
(a) carbohydrates (b) proteins (c) fats (d) mineral salts
13. Which of the following pairs of elements will react to give a gas which dissolves in water to form an acid?  
(a) Hydrogen and oxygen (b) Hydrogen and chlorine  
(c) Hydrogen and nitrogen (d) None of the above
14. With which of the following elements will hydrogen react to give a gas that smells like rotten eggs?  
(a) Oxygen (b) Chlorine (c) Nitrogen (d) Sulphur
15. Which among the following metals reacts with water most vigorously?  
(a) Sodium (b) Magnesium (c) Zinc (d) Iron
16. Which of the following metals will not displace hydrogen from water?  
(a) Sodium (b) Potassium (c) Calcium (d) Copper
- Ans.** 1. (a) 2. (d) 3. (c) 4. (b) 5. (b) 6. (a) 7. (b) 8. (b) 9. (c) 10. (a)  
11. (b) 12. (d) 13. (b) 14. (d) 15. (a) 16. (d).

**II. Match the statements in Column A with those in Column B.**

1. <i>Column A</i>	<i>Column B</i>
(i) A metal used in converting vegetable oils to ghee.	(1) Lead
(ii) A flame used for cutting and welding purposes.	(2) Helium
(iii) A gas used in filling weather observation balloons.	(3) Sodium hydroxide
(iv) An alkali which reacts with aluminium to form hydrogen.	(4) Oxy-hydrogen flame
(v) A metal which does not react with dil. sulphuric acid.	(5) Nickel

**Ans.** (i) 5 (ii) 4 (iii) 2 (iv) 3 (v) 1

2. <i>Column A</i>	<i>Column B</i>
(i) A metal which reacts with cold water to form hydrogen.	(1) Reduction
(ii) A gas which is inflammable and a non-supporter of combustion.	(2) Hydrogenation

2. <i>Column A</i>	<i>Column B</i>
(iii) A process in which vanaspati ghee is prepared from vegetable oils.	(3) Oxidation
(iv) The removal of hydrogen or addition of oxygen.	(4) Sodium
(v) The addition of hydrogen or removal of oxygen.	(5) Hydrogen

Ans. (i) 4 (ii) 5 (iii) 2 (iv) 3 (v) 1

**III. A. Fill in the blanks with appropriate words.**

- An atom of hydrogen contains one proton and ..... electron/s.
- The reaction of iron with dilute hydrochloric acid produces ..... as the salt of iron along with hydrogen gas as the products of the reaction.
- Ammonia gas is highly soluble in water while hydrogen gas is ..... in water.
- Sulphur dioxide is an acidic gas while hydrogen is a ..... gas.
- ..... volumes of hydrogen react with one volume of nitrogen under suitable conditions to give ammonia gas.
- Water reacts with metals to give off ..... gas.
- Hydrogen was discovered by .....
- ..... gas is highly inflammable.
- Hydrogen acts as a ..... agent.
- Slow rusting involves the process of .....
- Hydrogen burns with a ..... flame and a ..... sound is heard.
- A metal placed ..... hydrogen in the activity series gives hydrogen with ..... acid or ..... acid but not with ..... acid.
- Hydrogen reacts with metal oxides to form ..... and .....
- Oxidation is the removal of ..... or addition of .....
- Oxidation and ..... occur simultaneously.
- Hydrogen is ..... than air.

Ans. 1. one 2. ferrous chloride 3. insoluble 4. neutral 5. Three 6. hydrogen 7. Henry Cavendish 8. Hydrogen 9. reducing 10. oxidation 11. pale blue flame, pop 12. above, dilute HCl, dilute H<sub>2</sub>SO<sub>4</sub>, dilute HNO<sub>3</sub> 13. metals, water 14. hydrogen, oxygen 15. reduction 16. lighter.

**B. Fill in the blanks with appropriate words from the given list.**

[List: Sun, animal, stars, dilute sulphuric acid, calcium, aluminium oxide, one, nine, combustion, plant.]

1. .... and .... have free hydrogen as the largest constituent.
2. Every ..... parts of water by weight, contain ..... part of hydrogen by weight.
3. Hydrogen is a vital constituent of ..... and ..... cells.
4. Hydrogen can be prepared in the laboratory by the reaction of zinc and .....
5. Steam is passed over aluminium to produce hydrogen and .....
6. .... reacts with cold water to produce hydrogen.
7. Hydrogen is combustible but not a supporter of .....

**Ans.** 1. Sun, stars 2. nine, one 3. animal, plant 4. dilute sulphuric acid  
5. aluminium oxide 6. Calcium 7. combustion.

**C. Choose the correct words from the brackets.**

1. Zinc (*powder/granules*) are used in the laboratory for the preparation of hydrogen using dilute hydrochloric acid.
2. Hydrogen is (*combustible/non-combustible*) and hence, burns at the mouth of a jar containing hydrogen gas, if a candle is brought near it.
3. A mixture of hydrogen and (*oxygen/ammonia*) on burning, produces a high temperature above 2500°C.
4. (*Pure hydrogen/hydrogen-air*) mixture burns with a characteristic 'pop' sound.
5. Hydrogen is collected by the downward displacement of (*air/water*).
6. Lead oxide is ..... by hydrogen to lead. (*oxidised/reduced*).
7. Magnesium reacts with steam to form ..... and ..... (*magnesium oxide/magnesium hydroxide/oxygen/hydrogen*).

**Ans.** 1. granules 2. combustible 3. oxygen 4. hydrogen-air 5. water 6. reduced  
7. magnesium oxide, hydrogen.

**IV. State whether the following statements are true or false. If false, write the correct statements.**

1. The reaction of sodium with dilute HCl is used as a laboratory method of preparation of hydrogen.

- Ans.** False: The reaction of zinc with dilute HCl is used as a laboratory method of preparation of hydrogen.
2. Hydrogen is lighter than air and hence collected by the downward displacement of air.
- Ans.** False: Hydrogen is lighter than air and hence collected by the downward displacement of water.
3. Hydrogen is lighter than air but heavier than oxygen.
- Ans.** False: Hydrogen is lighter than air and also lighter than oxygen.
4. Soap bubbles containing hydrogen gas rise upwards.
- Ans.** True
5. Hydrogen reacts with chlorine explosively in the presence of diffused sunlight and slowly in the presence of direct sunlight.
- Ans.** False: Hydrogen reacts with chlorine slowly in the presence of diffused sunlight and explosively in the presence of direct sunlight.
6. Hydrogen is a supporter of combustion.
- Ans.** False: Hydrogen is not a supporter of combustion.
7. Hydrogen is a colourless and odourless gas.
- Ans.** True
8. Helium is flammable, while hydrogen is non-flammable.
- Ans.** False: Helium is non-flammable while hydrogen is flammable.
9. Hydrogen can be obtained by displacement reactions between metals and acids.
- Ans.** True
10. Oxygen is combustible.
- Ans.** False: Hydrogen is combustible.
11. Hydrogen is a reducing agent because it takes away oxygen from other compounds.
- Ans.** True
12. Hydrogen, when oxidised, becomes water.
- Ans.** True
13. Sodium, potassium and calcium react only with steam to give hydrogen.
- Ans.** False: Sodium, potassium and calcium react with cold water to give hydrogen.
14. Hydrogen is soluble in water.
- Ans.** False: Hydrogen is insoluble in water.
15. The oxy-hydrogen flame has a temperature of 2800°C.
- Ans.** True

16. Hydrogen reacts with copper oxide to form copper and water.  
**Ans.** True
17. A mixture of hydrogen and helium is used for filling balloons.  
**Ans.** True
18. Calcium reacts with caustic soda to liberate hydrogen.  
**Ans.** False: Zinc reacts with caustic soda to liberate hydrogen.
19. Sodium reacts with hydrochloric acid explosively.  
**Ans.** True
20. Hydrogen is usually found in the free state.  
**Ans.** False: Hydrogen does not exist in the free state in the atmosphere.
21. The addition of oxygen to a substance is called reduction.  
**Ans.** False: The addition of hydrogen to a substance is called reduction.
22. The removal of oxygen from a substance is called reduction.  
**Ans.** True
23. Hydrogen cannot be used as a fuel.  
**Ans.** False: Hydrogen can be used as a fuel.
24. Hydrogen molecule is monovalent.  
**Ans.** False: Hydrogen molecule is divalent.
25. The reaction between hydrogen and nitrogen to form ammonia is reversible.  
**Ans.** True
26. Zinc can liberate hydrogen from water, acids and alkali solutions.  
**Ans.** True
27. Hydrogen burns with a pale blue flame to form water.  
**Ans.** True
28. Hydrogen gas is easily liquefiable.  
**Ans.** False: Hydrogen gas cannot be easily liquefied.
29. Zinc powder reacts with caustic soda on boiling to form sodium zincate and hydrogen gas.  
**Ans.** True
30. Steam reacts with red hot iron to form iron (II) oxide and hydrogen.  
**Ans.** False: Steam reacts with red hot iron to form triferric tetroxide and water.
31. Hydrogen is used in the manufacture of fertilisers such as potassium nitrate and calcium nitrate.  
**Ans.** False: Hydrogen is used in the manufacture of fertilisers such as ammonium sulphate and urea.

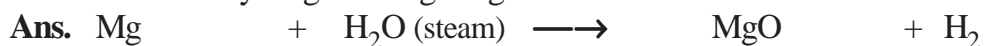
**V. Name the following.**

1. A metal which reacts reversibly with steam, giving hydrogen.
2. The salt formed when zinc reacts with concentrated sodium hydroxide solution.
3. The substance which alters the rate of the reaction in the conversion of nitrogen to ammonia.
4. A non-metal which reacts with hydrogen to give a foul smelling gas.
5. The catalyst used in the hydrogenation of oil.
6. A gas which burns in air to produce water.
7. The compound formed when hydrogen combines with nitrogen.
8. A hydride of a divalent metal.
9. The scientist who discovered hydrogen.
10. The product formed when a burning jet is introduced into a gas jar of hydrogen.
11. The product formed when hydrogen combines with chlorine in the presence of sunlight.
12. The product formed when hydrogen is passed over heated copper oxide.
13. The gas mixed with hydrogen in order to use for cutting and welding metals.
14. The alkali formed when calcium reacts with cold water.
15. The gaseous product obtained when zinc reacts with conc. caustic soda solution.
16. Two metals which give hydrogen with cold water.
17. Two metals which give hydrogen with very dilute and cold nitric acid.
18. A metal which forms a stable hydride.
19. The process in which oxygen is added or hydrogen is removed.
20. A metallic oxide which can be reduced into metal by hydrogen.

**Ans.** 1. Iron 2. Sodium zincate 3. Iron (finely divided) 4. Sulphur 5. Finely divided nickel 6. Hydrogen 7. Ammonia 8. Magnesium hydride 9. Henry Cavendish 10. Water 11. Hydrogen chloride gas 12. Copper and water 13. Oxygen 14. Calcium hydroxide 15. Hydrogen 16. Sodium, potassium 17. Magnesium, manganese 18. Calcium/sodium/potassium 19. Oxidation 20. Copper oxide/lead oxide.

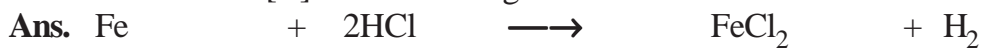
**VI. Write balanced chemical equations for the following reactions.**

1. Water to hydrogen using magnesium.

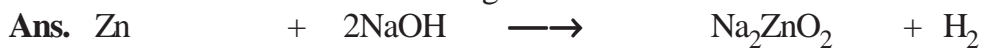




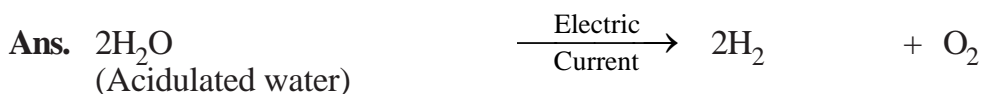
2. Iron to iron [II] chloride using an acid.



3. Zinc to sodium zincate using an alkali.



4. Water to two neutral gases as the only products.



5. Hydrogen to water using a neutral gas.



6. Hydrogen to hydrogen sulphide using a non-metal.



7. Lead [II] oxide to lead using hydrogen.



8. Iron [III] oxide to iron using hydrogen.



9. Two neutral gases one of which is hydrogen to a basic gas.



10. Sodium to an alkali using water.



11. Hydrogen combines with chlorine to form hydrogen chloride.



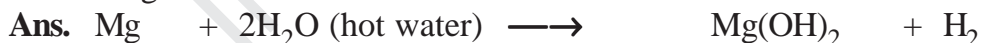
12. Hydrogen is passed over heated cupric oxide to produce metallic copper and water.



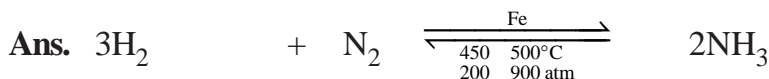
13. Potassium reacts with hydrogen to produce potassium hydride.



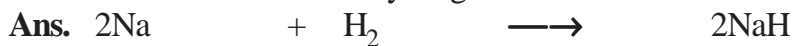
14. Magnesium reacts with hot water.



15. A mixture of hydrogen and nitrogen is passed over heated iron catalyst.



16. Sodium reacts with hydrogen.





**VII. Complete (and balance) the following equations.**

1. Mg + HCl  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
2. Al + H<sub>2</sub>O  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
3. H<sub>2</sub> + PbO  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
4. Zn + HCl  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
5. Fe + H<sub>2</sub>SO<sub>4</sub> (dilute)  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
6. CuO + \_\_\_\_\_  $\longrightarrow$  Cu + H<sub>2</sub>O
7. Fe + H<sub>2</sub>O  $\longrightarrow$  Fe<sub>3</sub>O<sub>4</sub> + \_\_\_\_\_  
(red hot) (steam)
8. Zn (red hot) + H<sub>2</sub>O (steam)  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_
9. H<sub>2</sub> + .....  $\longrightarrow$  HCl
10. H<sub>2</sub> + S  $\longrightarrow$  .....
11. Zn + .....  $\longrightarrow$  ZnCl<sub>2</sub> + H<sub>2</sub>
12. Al + NaOH + .....  $\longrightarrow$  ..... + .....
13. K + H<sub>2</sub>O  $\longrightarrow$  ..... + .....
14. Fe<sub>3</sub>O<sub>4</sub> + H<sub>2</sub>  $\longrightarrow$  \_\_\_\_\_

- Ans.**
1. Mg + 2HCl  $\longrightarrow$  MgCl<sub>2</sub> + H<sub>2</sub>
  2. 2Al + 3H<sub>2</sub>O  $\longrightarrow$  Al<sub>2</sub>O<sub>3</sub> + 3H<sub>2</sub>
  3. H<sub>2</sub> + PbO  $\longrightarrow$  Pb + H<sub>2</sub>O
  4. Zn + 2HCl  $\longrightarrow$  ZnCl<sub>2</sub> + H<sub>2</sub>
  5. Fe + H<sub>2</sub>SO<sub>4</sub> (dilute)  $\longrightarrow$  FeSO<sub>4</sub> + H<sub>2</sub>
  6. CuO + H<sub>2</sub>  $\longrightarrow$  Cu + H<sub>2</sub>O
  7. 3Fe + 4H<sub>2</sub>O  $\longrightarrow$  Fe<sub>3</sub>O<sub>4</sub> + 4H<sub>2</sub>
  8. Zn + H<sub>2</sub>O  $\longrightarrow$  ZnO + H<sub>2</sub>
  9. H<sub>2</sub> + Cl<sub>2</sub>  $\longrightarrow$  2HCl
  10. H<sub>2</sub> + S  $\longrightarrow$  H<sub>2</sub>S
  11. Zn + 2HCl  $\longrightarrow$  ZnCl<sub>2</sub> + H<sub>2</sub>
  12. 2Al + 2NaOH + 2H<sub>2</sub>O  $\longrightarrow$  2NaAlO<sub>2</sub> + 3H<sub>2</sub>
  13. 2K + 2H<sub>2</sub>O  $\longrightarrow$  2KOH + H<sub>2</sub>
  14. Fe<sub>3</sub>O<sub>4</sub> + 4H<sub>2</sub>  $\longrightarrow$  3Fe + 2H<sub>2</sub>O

**VIII. Give reasons for the following.**

1. Even though hydrogen is lighter than air, it is not collected by the downward displacement of air.

**Ans.** Hydrogen is not collected by the downward displacement of air since a mixture of hydrogen and air forms an explosive mixture.

2. Soap bubbles containing hydrogen rise upward but the same containing oxygen do not.

**Ans.** Soap bubbles containing hydrogen rise upward because hydrogen is lighter than air. Oxygen filled soap bubbles do not rise upward since oxygen gas is heavier than air.

3. Metallic zinc is obtained as a residue when hydrogen gas is passed over heated zinc oxide.

**Ans.** Zinc oxide is reduced by hydrogen gas to metallic zinc.

4. Hydrogen is used in the oxy-hydrogen flame for welding and cutting of strong metals but nitrogen is not used for the same.

**Ans.** Hydrogen is a combustible gas and oxygen is a supporter of combustion. Thus, oxy-hydrogen flame produces a temperature of about 2800°C at which the metal melts, enabling it to be cut and welded.

Nitrogen is a non-combustible gas and a mixture of nitrogen and hydrogen will not burn to produce a flame.

5. Zinc reacts with dilute sulphuric acid to give zinc sulphate and hydrogen but copper does not react with the same.

**Ans.** A metal which lies above hydrogen in the metal activity series can displace hydrogen from dilute acids but a metal which lies below hydrogen does not. Thus, zinc which lies above hydrogen in the metal activity series displaces hydrogen from dilute sulphuric acid but copper which lies below hydrogen does not react with the acid.

6. We see a flame on the surface of water, when sodium is made to react with it.

**Ans.** Sodium reacts violently with water and the hydrogen evolved immediately catches fire. Therefore, we see a flame on the surface of water when sodium is made to react with it.

7. Why can hydrogen be used as a fuel?

**Ans.** Hydrogen is used as a fuel because of its high heat of combustion. Moreover, hydrogen is a pollution free fuel.

8. Hydrogen is used in the extraction of metals.

**Ans.** Hydrogen is a good reducing agent and therefore, it is used to reduce metals from their oxides.

9. Hydrogen is used in airships.

**Ans.** Since hydrogen is the lightest gas and is combustible, it is used in airships as a fuel.

**10.** Why is hydrogen not prepared by the action of nitric acid on metals?

**Ans.** Nitric acid is a strong oxidising agent. It oxidises the hydrogen liberated during the reaction of metals with the acid, instantaneously to water. Therefore, hydrogen is not obtained when metals react with nitric acid.

**11.** Why is there a pop sound when hydrogen is burnt?

**Ans.** Hydrogen forms an explosive mixture with air. If the amount of air in the mixture is limited, the explosion is not dangerous and the gas burns with a pop sound.

**12.** Why has helium replaced hydrogen in weather observation balloons?

**Ans.** Hydrogen is highly inflammable and forms an explosive mixture with air. So, it has been replaced by helium in weather observation balloons.

**13.** The tip of the thistle funnel dips below the water level in the flask while preparing hydrogen gas.

**Ans.** The tip of the thistle funnel should dip below the water level in the flask while preparing hydrogen gas otherwise hydrogen will escape through it as soon as it is formed. Thus, it would not be possible to collect the gas in the gas jars.

**14.** Hydrogen-oxygen mixture is called a detonating mixture.

**Ans.** Hydrogen forms an explosive mixture with air (due to the presence of oxygen in air). When hydrogen is mixed with oxygen, the mixture explodes and causes serious damage and injury. Therefore, hydrogen-oxygen mixture is called a detonating mixture.

**IX. What is the product of the reaction when**

**1.** Hydrogen is passed over sodium?

**Ans.** Sodium hydride is formed.

**2.** Hydrogen is passed over heated lead oxide?

**Ans.** Lead oxide is reduced to metallic lead and water is formed as the other product.

**3.** Hydrogen combines with nitrogen in the presence of finely divided iron?

**Ans.** Ammonia is formed.

**4.** A mixture of carbon monoxide and hydrogen is passed over heated copper at 300°C under high pressure?

**Ans.** Methyl alcohol is formed.

5. Steam is passed over red hot iron?

**Ans.** Triferric tetroxide and hydrogen are formed. It is a reversible reaction.

6. Sodium metal is dropped into a beaker full of water?

**Ans.** Sodium reacts explosively to form sodium hydroxide and hydrogen. The reaction is so violent that the hydrogen formed catches fire instantly.

7. Zinc is heated with a concentrated solution of sodium hydroxide?

**Ans.** Sodium zincate is formed and hydrogen is liberated.

8. Magnesium metal is treated with dilute nitric acid?

**Ans.** Magnesium nitrate is formed and hydrogen is liberated.

#### X. Question-Answers.

1. What do you mean by hydrogenated oil?

**Ans.** Hydrogenated oil is solid vanaspati ghee prepared by the reaction of liquid vegetable fats like groundnut oil with hydrogen, using nickel as a catalyst.

2. How can you show that hydrogen is combustible but a non-supporter of combustion?

**Ans.** If a burning candle is placed in an inverted gas jar, filled with hydrogen, the candle gets extinguished but the gas starts burning with a pop sound.

3. How is hydrogen prepared in the laboratory?

**Ans.** Hydrogen is prepared in the laboratory by the action of dilute sulphuric acid or dilute hydrochloric acid on granulated zinc.



4. What are the precautions taken during the preparation of hydrogen gas in the laboratory?

**Ans.** (i) The first few bubbles of hydrogen gas should not be collected since they contain air mixed with the gas. Air mixed with hydrogen forms an explosive mixture.

(ii) A flame should not be brought near the apparatus since hydrogen is inflammable.

5. Explain why lead metal does not displace hydrogen from dilute sulphuric acid?

**Ans.** Lead reacts with dilute sulphuric acid and forms an insoluble coating of lead sulphate. Therefore, further reaction with the acid is prevented.

6. How can you prove that hydrogen burns in air to produce water?

**Ans.** Hydrogen, produced by the action of dilute sulphuric acid on zinc, is passed through anhydrous calcium chloride and then lighted at the end of a jet. Water droplets are produced which condense on the cold surface of a flask. The droplets are tested with anhydrous cobalt chloride which turns pink.

7. How can you prove that water contains two volumes of hydrogen and one volume of oxygen?

**Ans.** When acidulated water is electrolysed using platinum electrodes, water dissociates into hydrogen and oxygen. The ratio of hydrogen collected at the cathode is twice the volume of oxygen collected at the anode.

8. How will you show that hydrogen is lighter than oxygen?

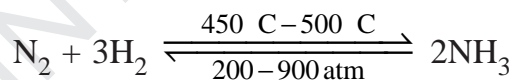
**Ans.** Freshly prepared hydrogen gas is bubbled by means of a small pipe into a trough containing soap solution. Soap bubbles filled with H<sub>2</sub> rise upward. Since hydrogen is lighter than air, soap bubbles filled with hydrogen rise upward.

9. Why is hydrogen considered a clean fuel?

**Ans.** Hydrogen burns in air to form water along with a large amount of heat. The product of the reaction, water, does not pollute the environment and thus hydrogen is considered as a clean fuel.

10. State the conditions under which Haber's process proceeds and the reactants and the products formed.

**Ans.** When a mixture of hydrogen and nitrogen in the ratio 3:1 are passed over finely divided iron at 450°C to 500°C, at a pressure of 200–900 atmosphere, ammonia is produced. This is Haber's process.



11. Write any two tests to identify hydrogen gas.

**Ans.** (i) Hydrogen burns in air with a pop sound.  
(ii) Pure hydrogen burns in air producing water.

12. Why is hydrogen called a reducing agent?

**Ans.** The process of removing oxygen from a compound is known as reduction. Hydrogen can remove oxygen from a number of metal oxides. Therefore, it is called a reducing agent.

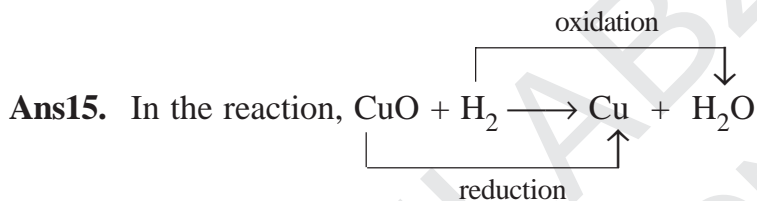
13. What are the physical properties of hydrogen?

- Ans.** (i) Hydrogen is a colourless, odourless and tasteless gas.  
 (ii) It is neutral towards litmus and non-poisonous.  
 (iii) It is lighter than air and slightly soluble in water.

14. Why is dilute  $\text{H}_2\text{SO}_4$  added to water during electrolysis?

- Ans.** Distilled water (used during electrolysis) is a non-conductor of electricity. When dilute  $\text{H}_2\text{SO}_4$  is added to water, it dissociates into ions. This makes it conducting and therefore, electrolysis can be carried out.

15. Explain oxidation and reduction reactions with the help of a chemical equation.



Oxygen is removed from copper oxide by hydrogen and thus, it is a reduction reaction. Oxygen is added to hydrogen and thus, it is an oxidation reaction.

\*\*\*\*