Exercise :6 A

1. Justify position of Hydrogen in the periodic table.

Solution:

Hydrogen has atomic number 1, and it exists in the first group and 1st period of the periodic table. Hence it is the first element of the periodic table.

2. Why does hydrogen show dual nature?

Solution:

Hydrogen resembles the alkali metals of Group IA and the halogens of Group VIIA hence it shows dual nature.

3. Compare hydrogen with alkali metals on the basis of :
i) ion formation (ii) Reducing- power
iii) Reaction with oxygen (iv) Oxide formation

Solution:

a) Hydrogen and Alkali metals can form a cation by the loss of an electron.

b) Both Hydrogen atoms and alkali metals are reducing agents.

c) Both alkali metals and Hyrogen burns in air to form oxides.

d) Hydrogen and Alkali metals can form oxides on reaction with Oxygen.

4 In what respect doses hydrogen differ from

i) Alkali metals ii)Halogens

Solution:

i) Oxides of alkali metals are basic, whereas oxides of Hydrogen is a neutral oxide.

ii) Hydrogen atom has only one shell, but halogens have two or more shells.

5. Give the general group study of hydrogen with reference
i) valence electrons (ii) burning iii) reducing power.

Solution:

i) Hydrogen has 1 valence electron in its orbit.

ii) Hydrogen burn with Oxygen to form oxides of Hydrogen with a pop sound.

$2H_2 + O_2 \rightarrow 2H_2O$

iii) Hydrogen acts as a reducing agent.
$CuO + H_2 \rightarrow Cu + H_2O$

6. Why was hydrogen called 'inflammable air'

Solution:

Hydrogen is highly combustible gas; hence, it is called as inflammable air.

7. State some sources of hydrogen.

Solution:

Hydrogen is found in earth's crust and in the atmosphere in a free state. It is found in organic compounds in combined state.

8. Compare hydrogen and halogens on the basis of :
i) Physical state ii) ion formation iii) valency (iv) reaction with oxygen

Solution:

a) Both Halogens and Hydrogen are gases
b) Both of them form anions as they are short of 1 electron to take stable confirmation.
c) Both Hydrogen and Halogens have the valency 1.
d) Hydrogen reacts with oxygen to form neutral oxides; Halogen reacts with oxygen to form acidic oxides.

9. Which metal is preferred for preparation of hydrogen
(i) from water ? (ii) from acid ?

Solution:

i) For the preparation of Hydrogen from water Reactive metals such as potassium, sodium and calcium are used.

ii) For the preparation of Hydrogen from acid Magnesium, aluminium, zinc and iron metals are used.

10. (i) Write the reaction of steam with red hot iron.
(ii) Why is this reaction considered a reversible reaction ?
(in) How can the reaction proceed continuously ?

Solution:

i) $3Fe + 4H2O \leftrightharpoons Fe3O4 + 4H2$

ii) This reaction is reversible because if hydrogen formed is not removed, then the iron oxide formed is reduced back to iron.

iii) This reaction is reversible. If the hydrogen formed is not removed the iron oxide formed is reduced back to iron. Thus, the reaction can proceed continuously.

11. Why Zinc and aluminium are considered to have unique nature. Give balanced equaons to support your answer.

Solution:

Zinc and aluminium are considered to have a unique nature for the following reasons

i) They can react with acids and alkali to form hydrogen and soluble salt.
$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$
$2Al + 6NaOH \rightarrow 2Na_2Al\ O_3 + 3H_2$
ii) They react with both bases and acids to give salt and water.
$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$
$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

12. Write balanced equations for the following
(i) iron reacts with dil HCl
(ii) Zinc reacts with caustic soda solution
(iii) Lead reacts with potassium hydroxide,
(iv) Aluminium reacts with fused sodium hydroxide

Solution:

i) $Fe + 2\ HC\ l \rightarrow FeCl_2 + H_2$
ii) $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$
iii) $Pb + 2KOH \rightarrow K_2PbO_2 + H_2$
iv) $2Al + 6NaOH \rightarrow 2Na_2Al\ O_3 + 3H_2$

13. Write balanced equations and give your observations when the following metals react:
(i) Sodium with cold water
(ii) Calcium with cold water
(iii) Magnesium with boiling water
(iv) Magnesium with steam.

Solution:

i) When Sodium reacts with cold water, Hydrogen gas is evolved with generation of heat.

$2Na + 2H2O \rightarrow 2NaOH + H2$

ii) Calcium sinks in water and the reaction is less vigorous.
$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

iii) Magnesium reacts with boiling water to produce magnesium hydroxide base liberating hydrogen gas.

$Mg + 2H2O \rightarrow Mg(OH)2 + H2O$

iv) Magnesium burns in steam to produce white magnesium oxide and hydrogen gas.

14. (i) Under what conditions iron reacts with water. (ii) Give the balanced equation of the reaction. (iii) What is noticed if the Products are not allowed to escape ?

Solution:

i) Iron doesnot reacts with water directly. Red hot iron reacts with steam to produce triferric tetra-oxide and hydrogen gas.

ii) $3Fe + 4H_2O \leftrightharpoons Fe3O_4 + 4H_2$

iii) If the product Hydrogen is not removed then the iron oxide formed is reduced back to iron.

15. From the knowledge of activity series, name a metal which shows the following properties
(i) It reacts readily with cold water
(ii) It displaces hydrogen from hot water
(iii) It displaces hydrogen from dilute HCl
(iv) It forms a base which is insoluble in water.

Solution:

i) Sodium
ii) Magnesium
iii) Zinc
iv) Calcium

16. Complete the following word equations
(a) Sodium hydroxide + zinc -4 hydrogen ....
b) Calcium + water —9 calcium hydroxide + ...

Solution:

a) Sodium hydroxide + zinc → hydrogen + sodium zincate
b) Calcium + water → calcium hydroxide + hydrogen