STUDY OF THE FIRST ELEMENT – HYDROGEN
WORKSHEET - 1

1. What do you understand by the term ''hydrogenation of vegetable oils''? Briefly explain how hydrogenation is carried out?

2. A, B, C, D, E and F are metals which can react as under:

(a) Metal A reacts violently with cold water to form a colorless solution and hydrogen gas.

(b) Metal B does not react even with steam or dilute sulphuric acid.

(c) Metal C does not react with steam, but silently reacts with dilute sulphuric acid.

(d) Metal D reacts vigorously with cold water to form turbid solution and hydrogen gas.

(e) Metal E rapidly reacts with steam to form hydrogen.

(f) Metal F reacts with steam to form hydrogen, but the reaction is reversible. By carefully studying the above reactions, arrange the metals in the metal activity series, starting with the least reactive metal.

3. You are given a metal X which lies between sodium and calcium in the metal activity series. State in word equations what reaction takes place between :

(a) X and oxygen

(b) X and water

(c) X and hydrochloric acid?

4. Metal sodium decomposes water at ordinary temperature. The metal magnesium decomposes boiling water very slowly, but much quicker when in powdered form. Explain briefly why is this so?

5. When a piece of calcium metal is dropped into a beaker of cold water a vigorous reaction takes place and the metal gradually disappears and a white suspension is formed.

(i) Write down an equation for the reaction.

(ii) Why does the solution become cloudy?

(iii) On filtering a clear solution is obtained. What is the name of the clear solution?

(iv) What happens when carbon dioxide is passed through the clear solution?

6. (a) Arrange the following metals in the order in which they appear in the activity series.

Copper, calcium, aluminium, iron, magnesium, lead, sodium and zinc.

Put down the most reactive metal first and the least reactive metal last.

(b) P, Q, R are the coded letters for three metals in the activity series given in (a) above. The metal P reacts violently with cold water and its hydroxide is not decomposed by heat. Metal Q has no reaction with water, but its hydroxide decomposes on slight warming giving a powder. Metal R reacts vigorously with cold dilute hydrochloric acid, but hardly at all with cold water. If steam is passed over white hot solid R, another white solid A is formed and a colorless gas B is set free.

(i) Which metals in the list are P, Q, R?

(ii) If A and B are codes for solid A and gas B, identify them.

(iii) State what would be your observations and write chemical equations when nitrates of P and Q are heated strongly.

(iv) Amongst the hydroxides of P and Q, state which is soluble and which is insoluble?

7. From the metals sodium, copper, magnesium, iron and zinc select the metal in each case :

(a) Which does not dissolve in dilute hydrochloric acid?

(b) Which can form 2+ and 3+ ions?

(c) Whose hydroxide is soluble in acids and alkalis?

(d) Which does not react readily with cold water, but reacts with steam when burning?

8. (a) P, Q and R are metals.

Q liberates hydrogen from cold water, whereas P and R do not.

R displaces P from an aqueous solution of one of its salts. Place P, Q and R in the order of decreasing activity.

(b) If QCI is the formula of a chloride:

(i) What is the formula of its sulphate?

(ii) What is the effect of heat on the hydroxide of Q?

9. Using the terms ‘‘Violent’’, ‘‘Slow’’ and ‘‘No reaction’’, describe how does (i) water (ii) dilute hydrochloric acid react with (1) magnesium (2) copper (3) sodium. Write chemical equations for the reactions and hence arrange the above metals in the order of the activity series.

10. An important step in the manufacture of hydrogen takes place when a mixture of hydrogen and carbon monoxide with steam is passed over iron (III) oxide heated to 500°C.

$$H_2 + CO + H_2O \text{ (steam)} \rightleftharpoons 2H_2 + CO_2$$

The products of the reaction are then passed into water under high pressure.

(a) State briefly how a suitable mixture of hydrogen and carbon monoxide can be obtained? Give an equation for the reaction.

(b) What is the purpose of iron (III) oxide in this process?

(c) Why is it not necessary to heat iron (III) oxide further, once the reaction starts?

(d) What do double arrows indicate?

(e) How can hydrogen be obtained from the mixture of products?

11. (a) A metal in the powdered form reacts very slowly with boiling water, but decomposes steam. Name the metal and write balanced equation for the reaction.

(b) Metals A and B, liberate hydrogen from dilute hydrochloric acid, but C does not. Metal B is displaced from a solution of one of its salt by metal A, but not by metal C. Arrange the metals in the order of the activity series, with the most active metal first.

12. (a) When steam is passed over red hot iron, magnetic oxide of iron and hydrogen are obtained. The reaction between red hot iron and steam is called a ‘‘reversible reaction’’. What is meant by this statement?

(b) When hydrogen burns in air, water is formed. Give two chemical tests to prove that water is formed.

(c) How can you obtain hydrogen from sodium hydroxide (not by electrolysis)?

13. There are two jars of hydrogen. One burns quietly, whereas other explodes with a pop sound. Explain the observation.

14. Thin strips of metals A, B and C are known to be magnesium, copper and iron respectively.

(a) Write down what would observe in each case, when the metals are treated as follows:

(i) When each metal is heated in air.

(ii) When each metal is treated with dil. HCl and warmed if necessary.

(iii) When each metal is added to aqueous solution of zinc sulphate.

(b) Arrange the metals A, B and C in the decreasing order of activity series.

15. From the knowledge of the activity series name a metal :

(a) Which readily reacts with cold water giving hydrogen gas?

(b) Which displaces hydrogen from dil. Sulphuric acid?

(c) Whose hydroxide is a strong base?

(d) Which displaces iron from iron (III) oxide?

16. Though hydrogen is lighter than air, it is not collected by the downward displacement of air. Why?