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CONTENTS

1. Chemical Reactions and Equations	1
2. Acids, Bases and Salts	24
3. Metals and Non-metals	42
4. Carbon and its Compounds	66
5. Life Processes	95
6. Control and Coordination	125
7. How Do Organisms Reproduce?	147
8. Heredity	171
9. Light – Reflection and Refraction	186
10. The Human Eye and the Colourful World	218
11. Electricity	234
12. Magnetic Effects of Electric Current	263
13. Our Environment	278

SCIENCE CLASS-X

CHAPTER

1

CHEMICAL REACTIONS AND EQUATIONS

Summary

- (1) **Chemical Reaction**—When a substance reacts with itself or any other substance to form a substance with one or more new chemical properties, then this is called a chemical reaction. The substances which participate in chemical reaction are called reactants and the new substances obtained after chemical reaction are called products.

- (2) (A) **Word-Equation**—

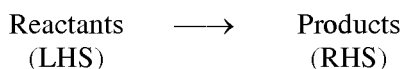
Writing the description of a chemical reaction in words is called word-equation. It is the simplest way to write a chemical reaction, like

- (i) When a magnesium ribbon is burnt in oxygen, it gets converted to magnesium oxide.

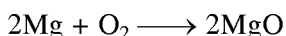


(Reactants) (Product)

A word equation shows change of reactants to products through an arrow placed between them. The reactants are written on the left-hand side (LHS) with a plus sign (+) between them. Similarly, products are written on the right-hand side (RHS) with a plus sign (+) between them. The arrowhead points towards the products, and shows the direction of the reaction.

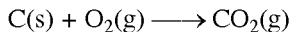
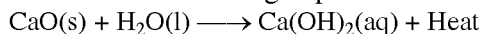


- (B) **Chemical Equation**—Representation of a chemical reaction by the use of symbols and chemical formulae of reactants and products is called chemical reaction. For example—

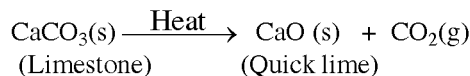


- (3) **Balanced Chemical Equation**—Number of all the atoms remains equal in the reactants and products of a balanced chemical equation. The chemical reaction must always be balanced which is done by hit or trial method.
- (4) A complete chemical equation represents the reactants, products and their physical states symbolically. Sometimes, the reaction conditions, such as temperature, pressure, catalyst, etc. for the reaction are indicated above and/or below the arrow in the equation.
- (5) The gaseous, liquid, aqueous and solid states of reactants and products are represented by notations (g), (l), (aq) and (s), respectively.
- (6) **Following observations may occur during a Chemical Reaction**—
- (a) Change in state (b) Change in colour
- (c) Evolution of a gas
- (d) Change in temperature.
- (7) **Types of Chemical Reactions**—Generally chemical reactions are of following type—

- (i) **Combination reaction**—In a combination reaction two or more reactants combine to form a new single product. For example—



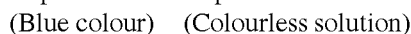
- (ii) **Decomposition reaction**—The reaction in which a single reactant decomposes to give two or more products is called decomposition reaction. For example—



Decomposition reactions require energy either in the form of heat, light or electricity for breaking down the reactants.

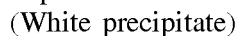
- (iii) **Displacement reaction**—The reaction in which a more reactive element displaces a less reactive element from its compound is called displacement reaction.

Example—



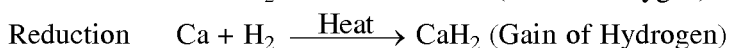
- (iv) **Double displacement reaction**—The reaction in which there is an exchange of ions between the reactants, it is called double displacement reaction.

Example—



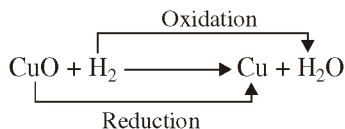
- (v) **Oxidation and Reduction**—In a reaction gain of oxygen or loss of hydrogen is called oxidation. The process of reduction is opposite to oxidation in which loss of oxygen or gain of hydrogen occurs.

Example—



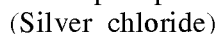
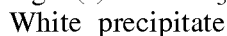
- (vi) **Redox reaction**—The chemical reactions in which oxidation and reduction reactions occurs simultaneously are called redox reactions.

Example—



- (vii) **Precipitation reaction**—The reactions in which a insoluble product (precipitate) is formed are called precipitation reactions.

Example—



- (8) **On the basis of heat**, reactions are classified in two parts.

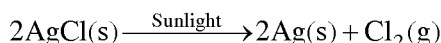
- (a) **Exothermic reaction**—Reactions in which heat is given out along with the products are called exothermic reactions. This makes the reaction mixture warm.

Example— $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) + \text{Energy}$

In exothermic reactions, after the products, energy word is written with a plus sign. Most of the combination reactions are of exothermic nature.

- (b) **Endothermic reaction—**Reactions in which energy is absorbed are known as endothermic reactions. This decreases the temperature of the reaction mixture.

Example—



In endothermic reactions, the word sunlight or heat or electric energy is written after the product with a minus sign or above the arrow.

- (9) **Corrosion—**When a metal comes in contact with acid, base or moisture then it will corrode. This process is called corrosion.

Example : (i) Rusting of iron (brown layer), (ii) Black casting on silver, (iii) Green coating on copper.

Methods to prevent corrosion :

- (i) By applying a thin layer of paint, varnish on the surface of metal.
 - (ii) By applying grease or oil on the parts of machines.
 - (iii) By using metals that do not corrode, like stainless steel or aluminium.
 - (iv) By galvanisation
 - (v) By chrome plating
 - (vi) By anodising or making alloys.
- (10) **Rancidity—**When fats and oils are left for a long time in the presence of oxygen then taste and odour of these have changed due to oxidation. This is called rancidity.

Methods to prevent rancidity :

- (i) By adding antioxidants to foods containing fats and oil.
- (ii) By keeping foods in airtight containers.
- (iii) Packaging foods in nitrogen gas.
- (iv) Keeping food in refrigerator.

In-text Questions

Page 6

Q. 1. Why should a magnesium ribbon be cleaned before burning in air?

Ans. Magnesium ribbon is cleaned with sand paper before burning in air because combustion of it is not easy due to layer of metal oxides on metal and impurities present on it. The surface of it becomes rough due to cleaning with sand paper so rate of reaction increases and pure magnesium is obtained.

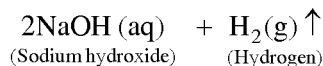
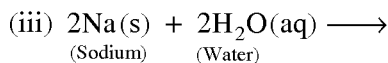
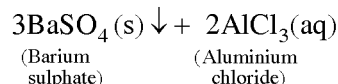
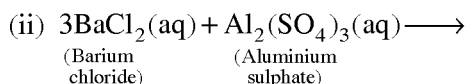
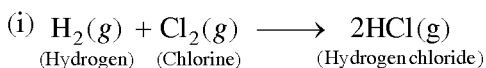
Q. 2. Write the balanced equation for the following chemical reactions—

(i) Hydrogen + Chlorine \rightarrow Hydrogen chloride

(ii) Barium chloride + Aluminium sulphate \rightarrow Barium sulphate + Aluminium chloride

(iii) Sodium + Water \rightarrow Sodium hydroxide + Hydrogen.

Ans.



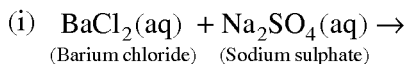
Q. 3. Write a balanced chemical equation with state symbols for the following reactions—

- (i) Solutions of barium chloride and

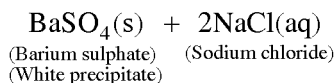
sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

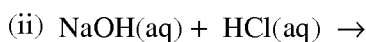
Ans.



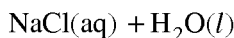
(Barium chloride) (Sodium sulphate)



(Barium sulphate) (Sodium chloride)
(White precipitate)



(Sodium hydroxide) (Hydrochloric acid)



(Sodium chloride) (Water)

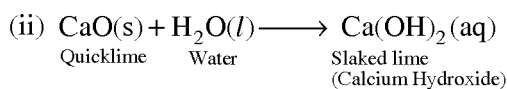
Page 10

Q. 1. A solution of substance 'X' is used for whitewashing.

(i) Name the substance 'X' and write its formula.

(ii) Write the reaction of the substance 'X' named in (i) above, with water.

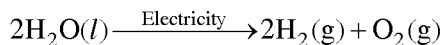
Ans. (i) The substance 'X' used for whitewashing is quicklime (calcium oxide), the chemical formulae of this is CaO.



Quicklime Water Slaked lime
(Calcium Hydroxide)

Q. 2. Why is the amount of gas collected in one of the test tubes in Activity 1.7 (See in text book) double of the amount collected in the other? Name this gas.

Ans. In activity 1.7 the reaction of electrolysis of water occurs as follows :



On completion of reaction hydrogen and oxygen are obtained at cathode and anode in the ratio of 2 : 1 by volume.

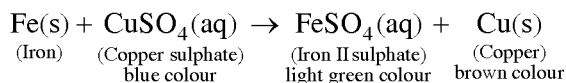
According to law of mass action, when two molecules of water (H₂O) are decomposed then amount of Hydrogen produced in double than amount of oxygen. So in the above

activity amount of gas (Hydrogen) collected in one of the test tubes is double of the amount collected in the other.

Page 13

Q. 1. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

Ans. When an iron nail is dipped in blue coloured copper sulphate solution then the reaction given below takes place. In this reaction more reactive iron displaces less reactive copper from copper sulphate solution.

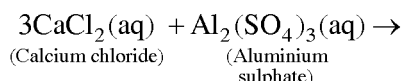


(Iron) (Copper sulphate) (Iron II sulphate) (Copper)
blue colour light green colour brown colour

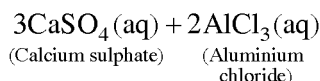
In this, the blue colour of copper of copper sulphate solution fades and Iron nails becomes brown.

Q. 2. Give an example of a double displacement reaction other than the one given in activity 1.10 (See in textbook).

Ans. Double displacement reaction—
The reaction in which there is an exchange of ions between the two different reactants are called double displacement reaction.

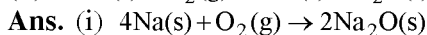
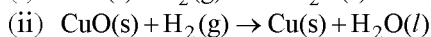
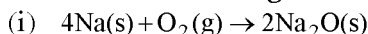


(Calcium chloride) (Aluminium sulphate)

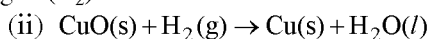


(Calcium sulphate) (Aluminium chloride)

Q. 3. Identify the substances that are oxidised and the substances that are reduced in the following reactions—



In this reaction sodium (Na) is oxidised and oxygen (O₂) is reduced.



In this reaction CuO is reduced and H₂ is oxidised.

Textual Questions

Q. 1. Which of the statements about the reaction below are incorrect?