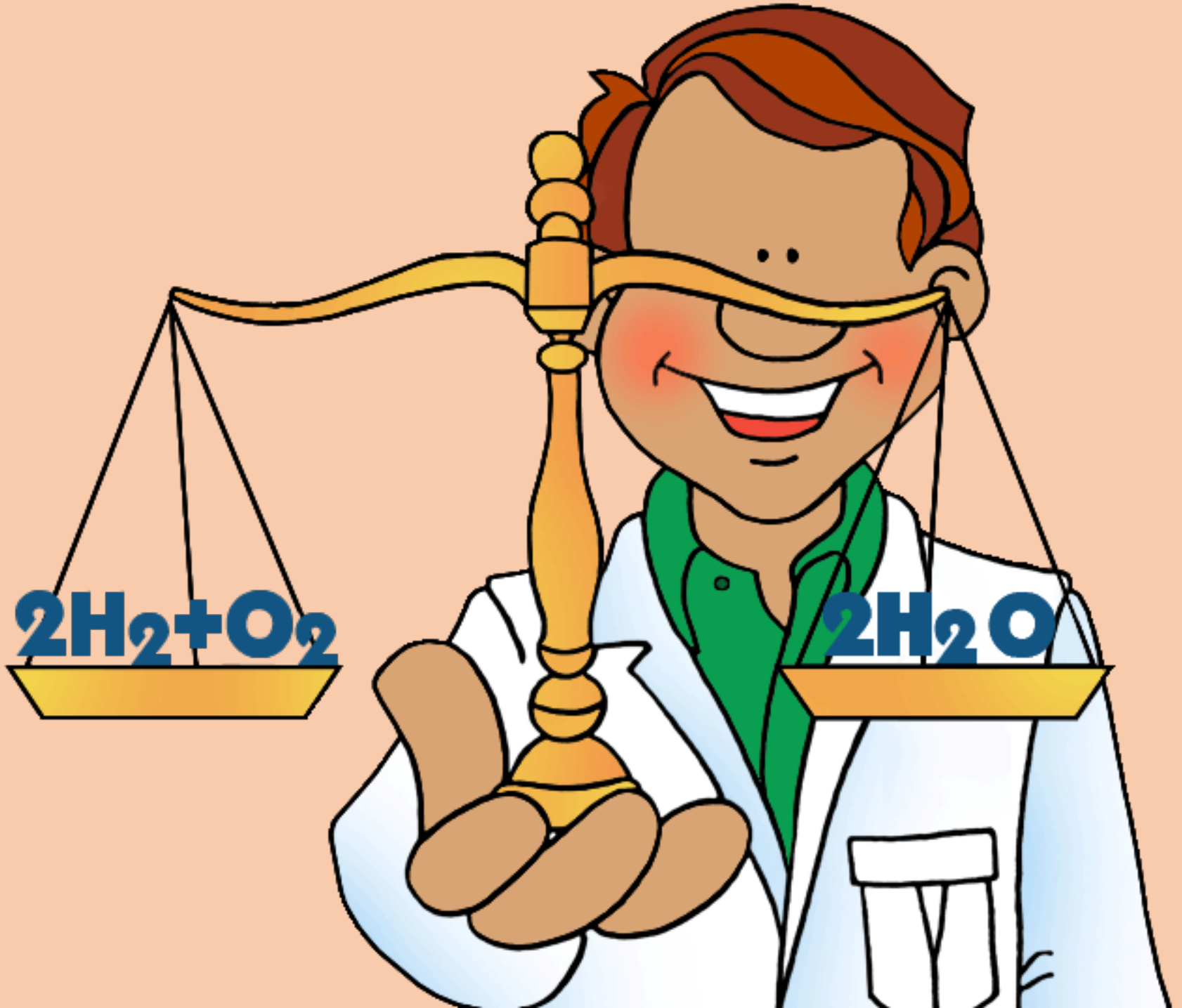
CLASS 10-
SCIENCE

CHAPTER 1 -
CHEMICAL
REACTIONS AND
EQUATIONS

PART 1 -
WRITING AND
BALANCING
CHEMICAL
EQUATIONS



CHEMICAL REACTION

The transformation of chemical substance (reactant) into another chemical substance (product) by making or breaking of bonds between different atoms is called a chemical reaction.

Examples of chemical reactions in our daily life-

a) Cooking of food

b) Rusting of iron

c) Respiration process

d) Digestion of food in our body

e) Formation of curd from milk

f) Fermentation of grapes

MORE ABOUT CHEMICAL REACTION

We can say that a chemical reaction involves a chemical change. This is so because in a chemical reaction, the rearrangement of atoms take place between the reacting substances to form new substances having completely different properties. This involves breaking of old chemical bonds between the atoms of reacting substances and making of new chemical bonds between the rearranged atoms of new substances.

Reactants- The substances which take part in a chemical reaction are called reactants.

Products- The new substances formed as a result of a chemical reaction are called products.

Example- Burning of magnesium in air to form magnesium oxide.

$$2Mg\,(s) + O_2\,(g) \longrightarrow 2MgO\,(s)$$

Reactants Product

CHARACTERISTICS OF CHEMICAL REACTION

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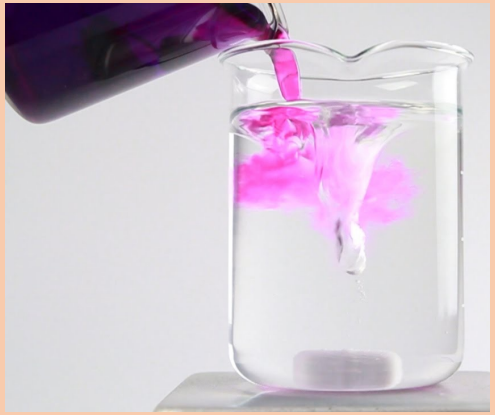
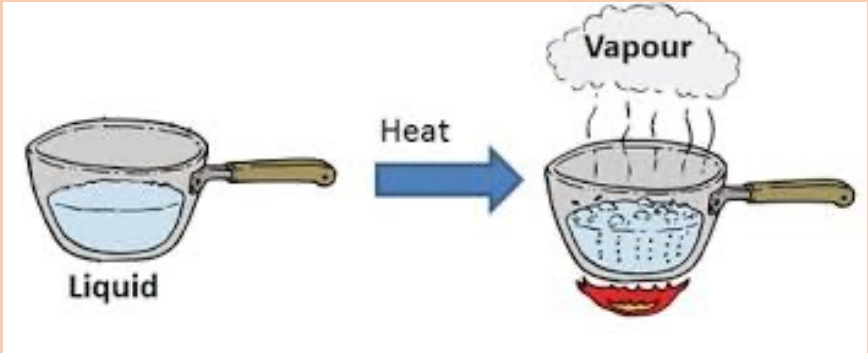
- CHANGE IN COLOUR
- EVOLUTION OF GAS
- FORMATION OF PRECIPITATE
- CHANGE IN TEMPERATURE
- CHANGE IN STATE





- **Chemical Equation-** A chemical equation is a symbolic representation of a chemical reaction where the reactants and the products are shown by the symbols or formulas.
- **Word Equation-** A word equation is a chemical reaction expressed in words rather than chemical formulas.

Examples-

Word equation- Zinc + Sulphuric acid ⟶ Zinc sulphate + Hydrogen

Chemical equation- $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

Reactants Products

Word equation- Hydrogen + Oxygen ⟶ Water

Chemical Equation- $2H_2 + O_2 \longrightarrow 2\,H_2O$

Reactants Product

WRITING AN EQUATION

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

Examples-

i) $2Mg + O_2 \longrightarrow 2MgO$

ii) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

- **Unbalanced/Skeletal Chemical Equation-** An unbalanced or skeletal equation is the chemical equation in which the total number of atoms of each element on the reactant side is not equal to the number of atoms of the same element on the product side.
- **Balanced Chemical Equation-** The chemical equation in which the number of atoms of each element in the reactant side is equal to that of the product side is called a balanced chemical equation.

Examples-

$CH_4 + O_2 \longrightarrow CO_2 + H_2O$ (Unbalanced)

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ (Balanced)

(Methane) (Oxygen) (Carbon dioxide) (Water)

$H_2 + O_2 \longrightarrow H_2O$ (Unbalanced)

$2H_2 + O_2 \longrightarrow 2H_2O$ (Balanced)

(Hydrogen) (Oxygen) (Water)

DIFFERENCE BETWEEN

UNBALANCED CHEMICAL EQUATION	BALANCED CHEMICAL EQUATION
i) Unbalanced chemical equation has an unequal number of atoms of one or more elements in the reactants and products.	i) Balanced chemical equation has an equal number of atoms of different elements in the reactants and products.
ii) It has unequal masses of various elements in the reactants and products.	ii) It has equal masses of various elements in the reactants and products.
iii) Eg: $H_2O \longrightarrow H_2 + O_2$	iii) Eg: $2H_2O \longrightarrow 2H_2 + O_2$

BALANCING OF CHEMICAL EQUATION

The process of making the number of different types of atoms equal on both the sides i.e. on the reactant side as well as on the product side of an equation is called balancing of equation.

Need to balance a chemical equation-

The chemical equation needs to be balanced so that it follows the "law of conservation of mass" introduced by Antoine Lavoisier.

According to the law of conservation of mass, "mass can either be created nor be destroyed in a chemical reaction". That is, the total mass of the elements present in the products of a chemical reaction has to be equal to the total mass of the elements present in the reactants. That is possible only when the total number of atoms on the reactant side is equal to the total number of atoms on the product side. Thus, a chemical reaction should always be balanced.

HOW TO BALANCE A CHEMICAL EQUATION

- Write down the chemical reaction in the form of word equation keeping reactants on the left hand side and products on the right hand side.
- Write symbols and formulas of all reactants and products in the word equation.
- Balance the equation by multiplying the symbols and formulas by smallest possible whole number.
- Write symbols of physical states of reactants and products along with their chemical formula. The gaseous, liquid, aqueous and solid states are represented by the notations (g), (l), (aq) and (s) respectively.
- Sometimes the reaction conditions such as temperature, pressure, catalyst etc. are indicated above or below the arrow in the equation.

Example 1- Methane burns in oxygen to form carbon dioxide and water.

- Methane + Oxygen ⟶ Carbon-dioxide + Water
- $CH_4 + O_2 \longrightarrow CO_2 + H_2O$
- Carbon atoms are already balanced on both the sides.
- There are four hydrogen atoms on reactant side and two on product side. So we will put a coefficient of two in front of H_2O.

  $CH_4 + O_2 \longrightarrow CO_2 + 2H_2O$

- Now there are two oxygen atoms on reactant side and four on product side. So we will put a coefficient of two in front of O_2.

  $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

  $CH_4\,(g) + 2O_2\,(g) \longrightarrow CO_2\,(g) + 2H_2O\,(g)$ (Water is in the form of Steam, hence shown as g)

The equation is now balanced.

Example 2- Sodium metal reacts with water to form sodium hydroxide and hydrogen

- Sodium + Water ⟶ Sodium hydroxide + Hydrogen
- $Na + H_2O \longrightarrow NaOH + H_2$
- There are two hydrogen atoms on reactant side and three on product side. So put a coefficient of two in front of H_2O.

$$Na + 2H_2O \longrightarrow NaOH + H_2$$

- Put a coefficient of two in front of NaOH on the product side to make four hydrogen atoms on both the sides.

$$Na + 2H_2O \longrightarrow 2NaOH + H_2$$

- Oxygen atoms are equal on both the sides i.e. two in number.
- There is one sodium atom on reactant side and two on product side. So put a coefficient of two in front of Na which makes two sodium atoms on both the sides.

$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

$$2Na\,(s) + 2H_2O\,(l) \longrightarrow 2NaOH\,(aq) + H_2\,(g)$$

The equation is now balanced.

THANK YOU