**CLASS** :- IX

**SUBJECT** :- SCIENCE

# CHAPTER - 3

# ATOMS AND MOLECULES

## No. of Modules : 3

# Module -1/3

- Laws of Chemical Combinations.

# 1) Laws of chemical combination :-There are two laws of chemical combinations:

**Law of conservation of mass :- states that 'Mass can neither be created nor destroyed in a chemical reaction'.**

**This means that during a chemical reaction the sum of the masses of the reactants and products remain unchanged.**

## Activity :-

**Take some sodium sulphate solution (colourless solution) in a conical flask and some barium chloride solution (colourless solution ) in an ignition tube. Hang the ignition tube in the flask by a thread and pot a cork on the flask. Find the mass of the flask on a balance.**

**Then tilt the flask. A chemical reaction takes place.**

**Sodium Sulphate + Barium Chloride → Sodium Chloride + Barium sulphate**

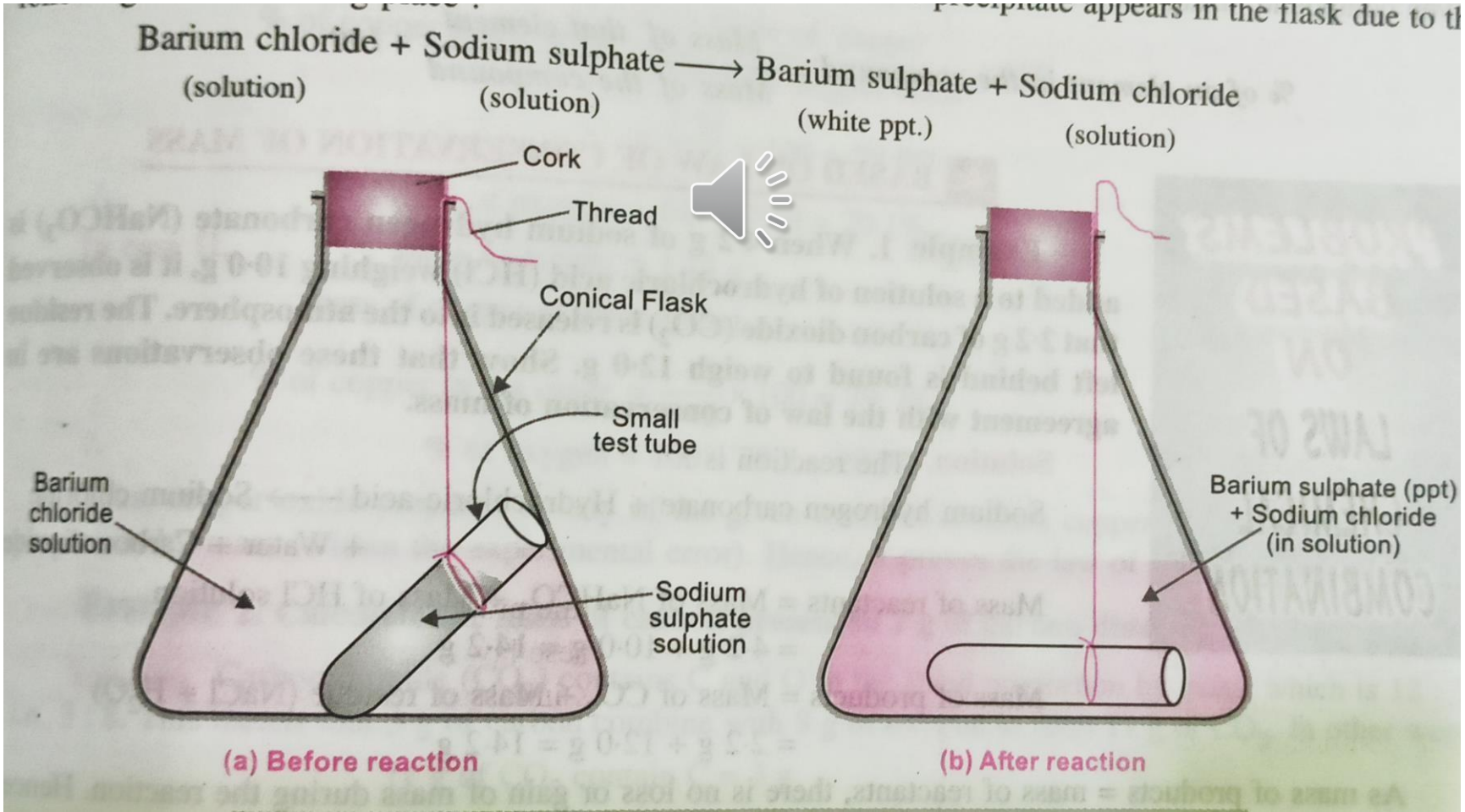
**(colourless soln) (colourless soln) (Colourless soln) ( White precipitate)**

**. Then find the mass of the flask again. It will be seen that the sum of the masses of the reactants and products remain unchanged.**

precipitate appears in the flask due to th

Barium chloride + Sodium sulphate ⟶ Barium sulphate + Sodium chloride

(solution) (solution) (white ppt.) (solution)



# Illustration based on Law of conservation of mass

Calcium Carbonate ($CaCO_3$) on heating decomposes to form Calcium oxide (CaO) quick lime, and Carbon dioxide($CO_2$). It is found that if 100 g of calcium carbonate is heated ,it give 56 g of Calcium oxide (CaO) quick lime and 44 g Carbon dioxide.Thus, for the reaction ,

Calcium carbonate $\rightarrow$ Calcium oxide + Carbon dioxide

100g 56g + 44g

mass of reactants = mass of product = 100g

Thus, total mass of reactants = total mass of products

This shows that no mass is created or destroyed in this chemical reaction.

**ii) Law of constant proportions :- In a chemical substance, the elements are always present in a definite proportions by mass.**

**Eg :- Water ( $H_2O$) always contains two elements, hydrogen and oxygen combined together in the ratio of 2:16 or 1:8 by mass. i.e 18 g of pure water will always contain 2 g of hydrogen and 16 g of oxygen irrespective of the source.**

**Pure Ammonia (NH3) will always contain Nitrogen and Hydrogen combined together in the ratio of 14:3 by mass irrespective of its source from which it is obtained.**

**This implies that any pure sample of a compound, no matter the source, will always consists of the same elements that are present in the same ratio by mass.**

# Illustration of law of constant proportions:

Carbon dioxide can be prepared by any one of the following methods:

- a) By burning charcoal in air ( $C + O_2 \rightarrow CO_2$ )
- b) By heating Limestone ( $CaCO_3 \rightarrow CaO + CO_2$ )
- c) By adding dilute hydrogen chloride on any carbonate.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + HCl + CO_2$$

d) By heating Sodium bicarbonate ( $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$)

It is found that in each case , Carbon dioxide is found to be made up of the same elements, i.e., Carbon and Oxygen combined in the same fixed ratio, i.e., 12 : 32 or 3 : 8 by mass.

Thus the Law of Constant Proportions is proved.

It also helps us to calculate the percentage of any element in the given compound, using the expression:

$$\% \text{ of an element in the compound} = \frac{\text{Mass of that element}}{\text{Mass of the compound}} \times 100$$

To be continued in module 2