Conservation of Mass

➢ Definition:

The law of the **conservation of mass** states that no matter is created or destroyed in a chemical reaction. It can only be transformed from one form to another. As a result, the total mass of the products in a chemical reaction is equal to the total mass of the reactants. For this reason, it is important to balance chemical reactions.

➢ **Example: Re**action between methane (CH_4) and oxygen (O_2) to produce carbon dioxide (CO_2) and water (H_2O).

➢ Explanation:

a. In this reaction, the number of atoms of each element must be balanced on both sides of the equation, ensuring that the Law of Conservation of Mass is obeyed.

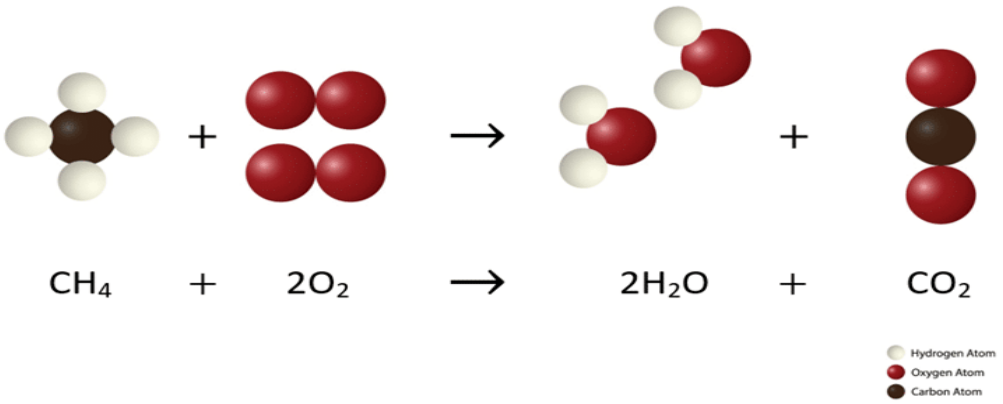
b. If we break down the number of atoms, we can see that the reactants on the left consist of:

- 1 carbon atom
- 4 hydrogen atoms
- 4 oxygen atoms

c. The products on the right consist of:

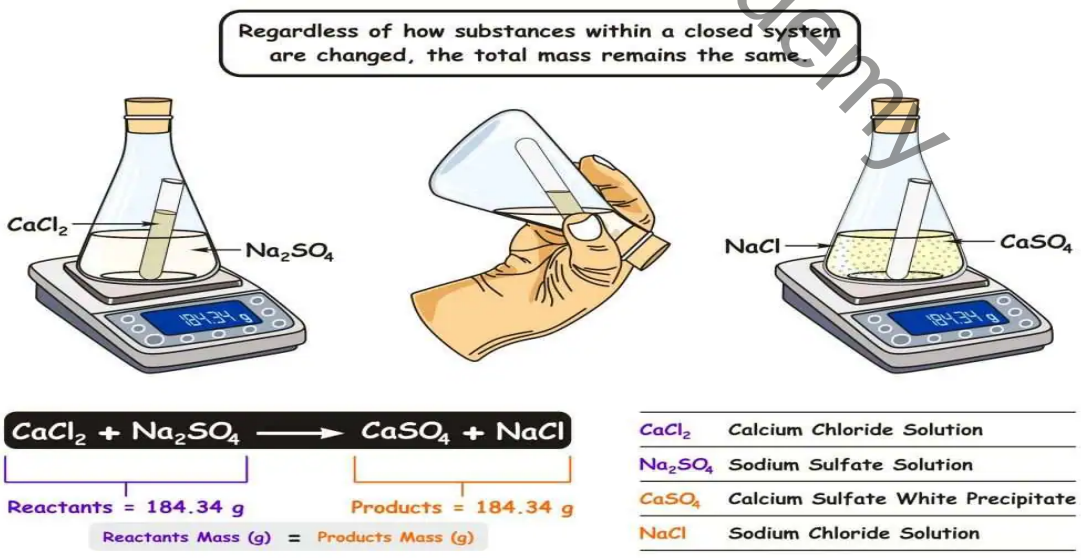
- 1 carbon atom
- 4 hydrogen atoms
- 4 oxygen atoms

d. We can see that there is the same number of each type of atom on both sides. The only thing that changes in a chemical reaction is the arrangement of the atoms. This rearrangement forms new substances with different physical and chemical properties.



Reactions in Closed Systems

- A **closed system** is a system where no substances can enter or leave. This is important in chemical reactions because it ensures that the total mass of the substances involved remains constant.
- A simple **example** of a closed system is a sealed container, such as a flask with a stopper.
- In close system, reactions taking place in open beakers can sometimes also behave as closed systems.
- One example is a **precipitation reaction**, in which two solutions react to form an insoluble salt (precipitate). In this type of reaction, the substances do not leave the beaker, meaning that the total mass of the substances in the beaker does not change during the reaction.



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- The law of conservation of mass can be observed in the reaction between calcium chloride (CaCl2) and sodium sulfate (Na2SO4), which produces calcium sulfate (CaSO4) and sodium chloride (NaCl).

- In this reaction, the mass of the products and reactants is equal to 184.34 g.

Reactions in Open Systems

- When chemical reactions occur in an open system, it means that substances can escape, such as gases. This can result in a decrease in the total mass of the substances in the container.

- An example of this is an open flask, where gases can escape freely

- **For example**

$$Zn\,(s) + 2HCl\,(aq) \rightarrow ZnCl2\,(aq) + H2\,(g)$$

- In this reaction, zinc reacts with dilute hydrochloric acid to produce zinc chloride and hydrogen gas. As the hydrogen gas is able to escape from the flask, the total mass of the substances in the container will decrease.

- if the total mass of the substances in the container increases during the reaction, it could indicate that a reactant from the air, such as a gas, is involved.