

Elements

An element is the simplest form of matter that cannot be split into simpler substances or built from simpler substances by any ordinary chemical or physical method. There are 114 elements known to us, out of which 92 are naturally occurring while the rest have been prepared artificially.

Elements are further classified into metals, non-metals and metalloids.

Compounds

A compound is a pure substance made up of two or more elements combined in a definite proportion by mass, which could be split by suitable chemical methods.

Characteristics of compound

- Compounds always contain a definite proportion of the same elements by mass.
- The properties of compounds are totally different from the elements from which they are formed.
- Compounds are homogeneous.
- Compounds are broadly classified into inorganic and organic compounds. Inorganic compounds are those, which are obtained from non-living sources such as minerals. For example, common salt, marble and limestone. Organic compounds are those, which occur in living sources such as plants and animals. They all contain carbon. Common organic compounds are oils, wax, fats etc.

Mixtures

A mixture is a combination of two or more elements or compounds in any proportion so that the components do not lose their identity. Air is an example of a mixture. Mixtures are of two types, homogeneous and heterogeneous.

Homogeneous mixtures have the same composition throughout the sample. The components of such mixtures cannot be seen under a powerful microscope. They are also called solutions. Examples of homogeneous mixtures are air, seawater, gasoline, brass etc.

Heterogeneous mixtures consist of two or more parts (phases), which have different compositions. These mixtures have visible boundaries of separation between the different constituents and can be seen with the naked eye e.g., sand and salt, chalk powder in water etc.

LAWS OF CHEMICAL COMBINATIONS

Law of Conservation of Mass (Given by Antoine Lavoisier in 1789).

It states that matter (mass) can neither be created nor destroyed.

Law of Definite Proportions or Law of Constant Composition:

This law was proposed by Louis Proust in 1799, which states that:

'A chemical compound always consists of the same elements combined together in the same ratio, irrespective of the method of preparation or the source from where it is taken'.

Law of Multiple Proportions Proposed by Dalton in 1803, this law states that:

Homogeneous mixture	Heterogeneous mixture
1. Homogeneous mixtures have the same composition throughout the sample. 2. The components of such mixtures cannot be seen under a powerful microscope.	1. Heterogeneous mixtures consist of two or more parts (phases), which have different compositions. 2. These mixtures have visible boundaries of separation between the different constituents and can be seen with the naked eye

2. Copper oxide obtained by heating copper carbonate or copper nitrate contains copper and oxygen in the same ratio by mass. Which law is illustrated by this observation? State the law.

Ans. Law of Definite Proportions This law states that: A chemical compound always consists of the same elements combined together in the same ratio, irrespective of the method of preparation or the source from where it is taken.

3. Write the empirical formula of the following:

(a) N_2O_4 (b) $C_6H_{12}O_6$ (c) H_2O (d) H_2O_2

Ans. (a) NO_2 (b) CH_2O (c) H_2O (d) HO

4. Briefly explain the difference between precision and accuracy.

Ans. Precision refers to the closeness of various measurements for the same quantity. However, accuracy is the agreement of a particular value to the true value of the result.

5. Define the law of multiple proportions. Explain it with one example.

Ans. When two elements combine to form two or more compounds, then the different masses of one element, which combine with a fixed mass of the other, bear a simple ratio to one another. For example- carbon combines with oxygen to form two compounds CO and CO_2 .

Compound	CO	CO_2
Mass of C	12	12
Mass of O	16	32

Masses of oxygen which combine with a fixed mass of carbon (12g) bear a simple ratio of 16:32 or 1:2.

6. Chlorine has two isotopes of atomic mass units 34.97 and 36.97. The relative abundance of the isotopes is 0.755 and 0.245 respectively. Find the average atomic mass of chlorine.

Ans. Average atomic mass = $34.97 \times 0.755 + 36.97 \times 0.245 = 35.46 \text{ u}$

7. Calculate the percentage composition of water.

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

Molar mass of water = 18.02 g

Mass % of hydrogen = $\frac{2 \times 1.008 \times 100}{18.02}$

= 11.18

Mass % of oxygen = $\frac{16.00 \times 100}{18.02} = 88.79$