

Chapter - 3 Atom and molecules

Laws of Chemical Combination

The chemical reaction between two or more substances giving rise to products are governed by certain laws. These laws are called 'Laws of Chemical Combination'.

1. Law of Conservation of Mass
2. Law of Constant Proportion

Law of Conservation of Mass

- According to this law, "Mass can neither be created nor destroyed."

Or

"During a chemical reaction total mass of reactants will be equal to total mass of products."

Law of Constant Proportion or law of definite proportions

According to this law, "in a chemical substance or compound, the elements are always present in definite proportions or ratios by mass.

In a compound such as water, the ratio of mass of hydrogen to the mass of oxygen is always 1:8, whatever the source of water. Thus, if 9g of water is decomposed, 1g of hydrogen and 8g of oxygen are always obtained.

Similarly, carbon dioxide (CO₂) always contains carbon and oxygen in the ratio of 3:8. If a sample of carbon dioxide (CO₂) contains 36g of carbon then it is compulsory that the sample has 96 g oxygen.

Atom

Atom are the smallest particles of an element which may or may not have independent existence but take part in a chemical reaction. These are the building blocks of all matter.

e.g., Atoms of hydrogen, oxygen, nitrogen etc., are not capable of independent existence whereas atoms of helium, neon etc., are capable of existing independently. Atoms are very small and their radius is measured in **nanometers**.

$$\frac{1}{10^9} m = 1nm$$

$$1m = 10^9 \text{ nm}$$

Hydrogen atom is the smallest atom and its radius is 0.1 nm.

Symbols for some elements

Element	Symbol	Element	Symbol
Aluminium	Al	Iodine	I
Argon	Ar	Iron	Fe
Barium	Ba	Lead	Pb
Calcium	Ca	Nitrogen	N
Carbon	C	Oxygen	O
Chlorine	Cl	Potassium	K
Cobalt	Co	Silicon	Si
Copper	Cu	Silver	Ag
Fluorine	F	Sulphur	S
Gold	Au	Zinc	Zn
Hydrogen	H		

Atomic Mass

- The mass of an atom of an element is called its atomic mass.

Atomic Mass Unit

The atomic mass unit is defined as the quantity of mass equal to 1/12 of mass of an atom of carbon-12.

$$1 \text{ amu or } u = \frac{1}{12} \times \text{Mass of an atom of C-12}$$

$$1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$$

Element	Atomic Mass (u)
Hydrogen	1
Carbon	12
Nitrogen	14
Oxygen	16
Sodium	23
Magnesium	24
Sulphur	32
Chlorine	35.5
Calcium	40

Molecule

A molecule is a group of two or more atoms that are chemically bonded together. Atoms of the same element or of different elements can join together to form molecules.

Molecules are of two types

Molecules of Elements

They contain same type of atoms of an element. Molecules of many elements are made up of only one atom of that element.

Molecules of compounds

Atom of different element joins together in definite proportions to form molecules of compounds.

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