# 1. Some Basics Concept of Chemistry

- Chemistry is the branch of science which deals with the study of various substances around us.

**Branches of Chemistry**

- Physical Chemistry
- Inorganic Chemistry
- Organic Chemistry
- Analytical Chemistry
- Biochemistry

**Importance and scope of chemistry**

- Engineering
- Drugs
- Food
- Energy
- Materials

- **Characteristics of matter particles**
  - Atoms are the smallest possible units of the matter which combine to form molecule.
  - There are spaces between matter particles.
  - Matter particles move continuously – movement increases with rising temperature.
  - Matter particles attract each other – attraction force is highest in solids > liquids > gases.

Pure substance can be classified as **elements** or **compounds**.

**Element:** The basic form of matter that cannot be broken down into simpler substances by chemical reactions'.

Elements can be further classified as metals, non-metals, metalloids and noble gases.

**Compound:** Compounds are formed when two or more elements combine chemically in a fixed proportion.

- The ancient people use hand-span, foot-span, finger width, palm length, the distance of a step, etc. as units of measurements. These are known as non-standard methods of measurement.

**Bigger Units:**

- For length, the bigger units use are:

  (i) Astronomical unit (A.U.): It is the mean distance between Earth and Sun. 1 A.U. = $1.496 \times \times 10^{11}$ m
  (ii) Light year (ly): It is the distance travelled by light in vacuum, in one year. 1 ly =$9.46 \times \times 10^{12}$ km
  (iii)Parsec: 1 Parsec = 3.26 ly

- For mass, the bigger units use are:

  (i) quintal: 1 quintal = 100 kg
  (ii) metric tonne: 1 metric tonne = 1000 kg = 10 quintal

- For time:

  (i) lunar month: 1 lunar month =29.5 days
  (ii) Leap year
  (iii) Decade
  (iv) Century
  (v) Millennium

**Laws of chemical combination:**

**Five laws**

- Law of conservation of mass → Matter can neither be created nor destroyed.
- Law of definite proportions → A compound always contains exactly the same proportions of elements by weight.
- Law of multiple proportions → If two elements can combine to form more than one compound, then the masses of one element that combine with a fixed mass of the other element are in small whole number ratios.
- Gay Lussac's law of gaseous volumes → When gases combine or are produced in a chemical reaction, they do so in a simple ratio by volume, provided all gases are at same temperature and pressure.
- Avogadro law → At the same temperature and pressure, equal volumes of all gases contain equal number of molecules.

**Dalton's atomic theory:**

- Matter consists of indivisible atoms.
- Atoms of a given element have identical properties including identical mass while those of different elements have different masses.
- Atoms of different elements combine in a fixed ratio to form a compound.
- Atoms are neither created nor destroyed in a chemical reaction.

**Atomic Mass**

One atomic mass unit is defined as a mass exactly equal to one-twelfth the mass of one carbon-12 atom.

**Molecular Mass**

Molecular mass is the sum of atomic masses of the elements present in a molecule.

**Formula Mass**

Formula mass is the mass of an ionic compound.

1 mole of any substance can be defined as:

- Amount of a substance that contains as many particles (atoms, molecules or ions) as there are atoms in 12 g of the $^{12}C$ isotope
- Avogadro number or Avogadro constant ($N_A$); equal to $6.022 \times 10^{23}$ particles

**Percentage Composition**

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

**Empirical formula and molecular formula:**

| Empirical formula | Molecular formula |
|---|---|
| Represents the simplest whole number ratio of various atoms present in a compound | Represents the exact number of different types of atoms present in a molecule of a compound |

**Limiting reagent (Limiting reactant):** Limiting reagent is the reactant present in the lesser amount, which gets consumed after sometime. After that, no reaction takes place further, whatever is the amount of the other reactant present.

**Expression for concentration of a solution:**

- $\text{Mass per cent (w/w \%)} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100\%$
- $\text{Mole fraction of A} = \frac{\text{No. of moles of A}}{\text{No. of moles of solution}} = \frac{n_A}{n_A + n_B}$

[Here, A and B are the components of the solution]

- $\text{Molarity (M)} = \frac{\text{No. of moles of solute}}{\text{Volume of solution in litres}}$
- $\text{Molality (m)} = \frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}}$