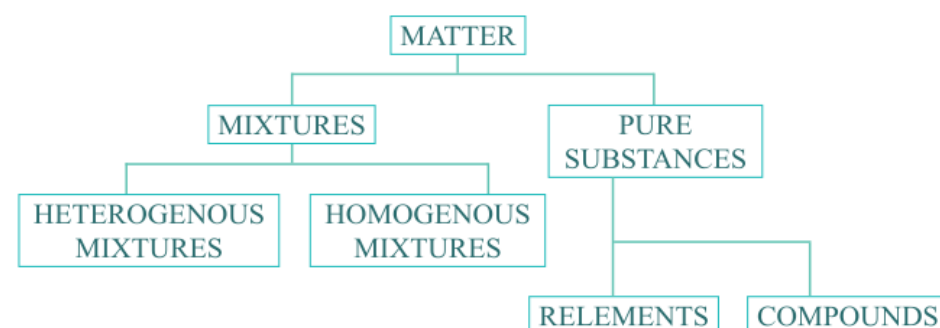


## Classification of matter

- Matter can exist in three physical states viz solid, liquid and gas



- A mixture contains particles of two or more pure substances in any ratio.
- Movement of air follow pressure gradient.**
- In **Homogeneous mixture**, components completely mix with each other.
- In **Heterogeneous mixture**, composition is not uniform.
- Constituent particles of **pure substance** have fixed composition.
- Compound** is formed when two or more atoms of different elements combine together in definite ratio.

## Properties of matter and their measurement

- Properties are of two types viz. physical and chemical properties
- Physical properties** can be measured or observed without changing the identity or the composition of the substance.
- Chemical properties** requires a chemical change to occur.
- Colour, odour, melting point, density etc are some physical properties.
- Composition, combustibility, reactivity with acids and bases are examples of chemical properties.
- Quantitative measurement of physical properties represented by a number followed by units.
- SI system has seven base units.
- Base physical quantities and their units.

|                                     |                                  |
|-------------------------------------|----------------------------------|
| <b>Length (m)</b>                   | <b>Mass (kg)</b>                 |
| <b>Time (s)</b>                     | <b>Electric current (A)</b>      |
| <b>Thermodynamic Temperature(K)</b> | <b>Amount of substance (mol)</b> |
|                                     | <b>Luminous intensity (cd)</b>   |

## SOME PREFIX USED IN SI SYSTEMS ARE

|                    |                   |                    |                    |                    |                |
|--------------------|-------------------|--------------------|--------------------|--------------------|----------------|
| $10^{-12}$ (pico), | $10^{-9}$ (nano), | $10^{-6}$ (micro), | $10^{-3}$ (milli), | $10^{-2}$ (centi), | $10^3$ (kilo), |
| $10^6$ (mega)      | $10^9$ (giga)     |                    |                    |                    |                |

## SOME COMMON UNITS

- 1 L = 1000 mL = 1000 cm<sup>3</sup> = 1 dm<sup>3</sup>, °F = 9/5 (°C) + 32, K = °C + 273.15

## Laws of chemical combination

- Law of conservation of mass** conclude that in all physical and chemical changes, there is no net change in mass during the change.
- Law of definite proportions/composition** stated that a given compound always contains exactly the same proportion of elements by weight.
- Law of multiple proportions** stated that, if two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of other element are in the ratio of small whole number.
- Gay Lussac's law of gaseous volume** : 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's law** proposed that equal volumes of all gases at same temperature and pressure should contain equal number of molecules.
- Dalton's Atomic Theory** proposed to following points
  - Matter consists of indivisible atoms.
  - All atoms of a given element have identical properties, including identical mass, atoms of different elements differ in mass
  - Compounds are formed when atoms of different elements combine in a fixed ratio
  - Chemical reactions involve **reorganisation** of atoms. These are neither created nor destroyed in a chemical reaction.

## Mole concept and molar masses

- Mole (Symbol, mol) is seventh base quantity for amount of a substance.
- One mole contains exactly  **$6.02214076 \times 10^{23}$**  elementary entities. This number is the fixed numerical value of the **Avogadro's constant** ( $N_A$ ).
- The mass of one mole of a substance in grams is called its **molar mass**.
- Mass% of an element** = Mass of that element in the compound  $\times 100$  / Molar mass of the compound.

- Empirical formula** represents the simplest whole number ratio of various atoms present in a compound, whereas, the molecular formula shows exact number of different types of atoms present in a molecule of a compound.

## Stoichiometry and stoichiometric calculations

- Stoichiometry deals with calculation of masses (sometime volume) of the reactants and products involved in a chemical reaction.
- Reactant, which gets consumed first, limits the amount of product formed is called limiting reagent.
- A majority of reactions are carried out in solutions. The concentration of a solution can be expressed in following ways.
- Mass percent = Mass of solute  $\times 100$  / (Mass of solution)
- Mole fraction of solute = No. of moles of solute / No. of moles of solution
- Molarity (M) = No. of moles of solute / Volume of solution in litres
  - For dilution of solutions,  $M_1 V_1 = M_2 V_2$
- Molality (m) = No. of moles of solute / Mass of solvent in kg.

## Atomic and molecular mass

- One atomic mass unit (amu)** is defined as a mass exactly equal to one-twelfth of the mass of one C-12 atom, **1 amu =  $1.66056 \times 10^{-24}$  g.**
- At present amu has been replaced by **unified mass (u)**
- Average atomic mass** can be computed when we take into account the existence of isotopes and their relative abundance.
- Molecular mass** is the sum of atomic masses of the elements present in a molecule.
- Formula mass** is used instead of molecular mass for ionic solids as in solid state they do not exist as a single entity.

## Uncertainty in measurement

- Scientific notation** is exponential notation in which any number represented in  $N \times 10^n$ , where n is exponent having positive or negative values and N is number between 1.000 ... and 9.999 .....
- Significant figures** are meaningful digits which are known with certainty plus one which is estimated or uncertain.
- Rules for determining the number of significant figures.**
- All non zero digits are significant.
- Zeros preceding to first non-zero digit are non significant.
- Zeros between two non-zero digits are significant.
- Zeros at the end or right of a number are significant provided they are on the right side of decimal point.
- Counting numbers have infinite significant figures.
- In a number written in scientific notation, all digits are significant.

- Precision** refers to the closeness of various measurements for the same quantity.
- Accuracy** is the agreement of a particular value to the true value of the result.
- In **addition and subtraction** of significant figures the result cannot have more digits to the right of the decimal point than either of the original numbers.
- In multiplication and division of significant figures the result must be reported with no more significant figures as are there in the measurement with the fewer significant figures.
- Important points for rounding off the numbers.**
  - If the rightmost digit to be removed is more than 5, the preceding number is increased by one.
  - If the rightmost digit is less than 5, the preceding number is not changed.
  - If the rightmost digit is 5 then preceding number increased by 1 only if it is an odd number.
- Im Method used to interconversion of unit is known as **dimensional analysis, unit factor method**.

## Some Basic Concepts Of Chemistry

Educating For Transmission Of Civilization