

Mole Concept

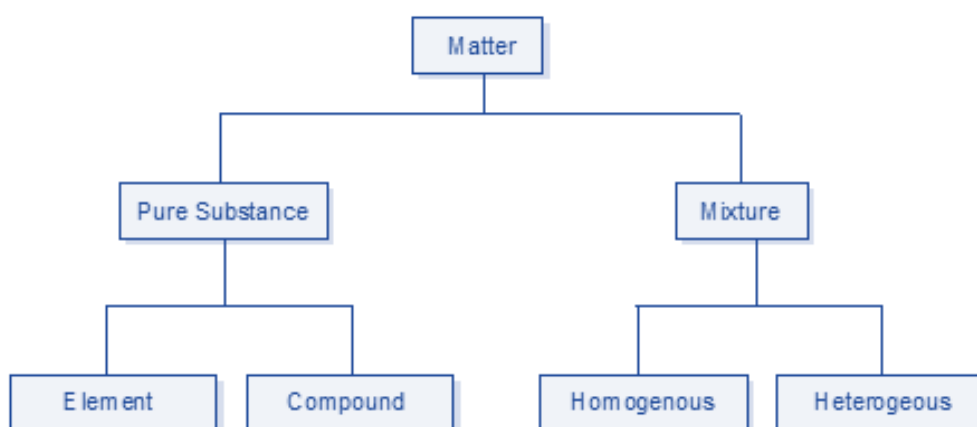
Matter:

Anything that exhibits inertia is called matter.

The quantity of matter is its mass.

Classification of Matter:-

Based on chemical composition of various substances..



Measurement of Temperature

Three scales of temperature

- Kelvin scale (K)
- Degree Celsius scale ($^{\circ}\text{C}$)
- Degree Fahrenheit scale ($^{\circ}\text{F}$)

Relations between the scales:

- $^{\circ}\text{F} = 9/5(^{\circ}\text{C}) + 32$
- $\text{K} = ^{\circ}\text{C} + 273$

0 K temperatures is called absolute zero.

Dalton's Atomic Theory:

- Every matter consists of indivisible atoms.
- Atoms can neither be created nor destroyed.
- Atoms of a given element are identical in properties
- Atoms of different elements differ in properties.
- Atoms of different elements combine in a fixed ratio to form molecule of a compound.

Laws of Chemical Combination:

Law of conservation of mass:

“For any chemical change total mass of active reactants are always equal to the mass of the product formed”

Law of constant proportions:

“A chemical compound always contains same elements in definite proportion by mass and it does not depend on the source of compound”.

Law of multiple proportions:

“When two elements combine to form two or more than two different compounds then the different masses of one element B which combine with fixed mass of the other element bear a simple ratio to one another”

Law of reciprocal proportion:

“If two elements B and C react with the same mass of a third element (A), the ratio in which they do so will be the same or simple multiple if B and C reacts with each other”.

Gay Lussac's law of combining volumes:

“At given temperature and pressure the volumes of all gaseous reactants and products bear a simple whole number ratio to each other”.

Atomic and Molecular Masses:

Atomic Mass:

- Mass of an atom.
- Reported in atomic mass unit “amu” or unified mass “u”
- One atomic mass unit i.e. amu, is the mass exactly equal to one-twelfth the mass of one carbon-12 atom.

Molecular Mass:

- Mass of a molecule of covalent compound.
- It is equal to the sum of atomic masses of all the elements present in the molecule.

Formula Unit Mass

- Mass of a molecule of an ionic compound
- It is also equal to the sum of atomic masses of all the elements present in the molecule

Mole Concept:

Mole:

- Unit of amount of substance.
- One mole amount of substance that contains as many particles or entities as there are atoms in exactly 12 g of the ^{12}C isotope.

Molar mass:

- Mass of one mole of a substance in gram
- Molar mass in gram is numerically equal to atomic/molecular/formula mass in amu or u.

?Percentage composition:

Mass percentage of an element in a compound = $\left(\frac{\text{Mass of that element in the compound}}{\text{Molecular mass of the compound}} \right) \times 100$

Percentage yield:

- It is the ratio of actual yield of the reaction to the theoretical yield multiplied by 100.
- $\% \text{ yield} = \left(\frac{\text{Actual yield}}{\text{Theoretical yield}} \right) \times 100$

Empirical formula and molecular formula:**Molecular Formula:-**

Represents the actual number of each individual atom in any molecule is known as molecular formula.

Empirical Formula:-

Expresses the smallest whole number ratio of the constituent atom within the molecule.

Molecular formula = (Empirical formula)_n

Molecular weight = n × Empirical weight

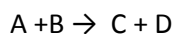
also,

Molecular weight = 2 × Vapour density

Limiting Reagent:

The reactant which is totally consumed during the course of reaction and when it is consumed reaction stops.

For a balanced reaction reaction:



B would be a limiting reagent if $n_A / n_B > n_B / n_A$

Similarly, A is a limiting reagent if $n_A / n_B < n_B / n_A$

Concentration of the solutions:**Mass by Mass Percentage:-**

Amount of solute in gram present per 100 gm of the solution.

Mass percentage of solute = $\left[\frac{\text{Mass of solute}}{\text{Mass of solution}} \right] \times 100$

Mass by Volume Percentage:-

Amount solute in gram present per 100 mL of the solution.

Volume by Volume Percentage:-

Volume of solute per 100 mL of the solution

Volume by volume percentage of solute = $\left[\frac{\text{Volume of solute}}{\text{volume of solution}} \right] \times 100$

Parts per million (ppm) :-

The amount of solute in gram per million (10⁶) gram of the solution.

ppm = $\left[\frac{\text{mass of solute}}{\text{mass of solution}} \right] \times 10^6$

Mole fraction:-

Ratio of the moles of one component of the solution to the total number of moles of solution

Total mole fraction of all the components of a solution is equal to 1.

For binary solutions having two components A and B

Mole fraction of A

$$X_A = (n_A)/(n_A+n_B)]$$

Mole fraction of B

$$X_B = (n_B)/(n_A+n_B)]$$

$$\text{or } X_B = 1 - X_A$$

Molarity(M):-

Number of moles of solute per 1000 mL of the solution.

$$M = (\text{Number of moles of solute})/(\text{Volume of solution in L})$$

Molality(m):-

number of moles of solute per 1000 gram of the solvent.

$$m = (\text{Number of moles of solute})/(\text{Weight of solvent in kg})$$