Chemistry Study Materials for Class 9
(NCERT Based notes of Chapter -03)

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Atoms and Molecules

MOLECULAR MASS

Atomic mass: The atomic mass of an element is the mass of one atom of that element in atomic mass units or (u).

Atomic mass unit (amu): $1/12^{th}$ of the mass of an atom of carbon-12 is called atomic mass unit. It is a unit of mass used to express atomic masses and molecular masses.

Molar mass: The molar mass of an element is equal to the numerical value of the atomic mass. However, in case of molar mass, the units change from 'u' to 'g'. The molar mass of an atom is also known as gram atomic mass.

For example, the atomic mass of carbon =12 atomic mass units. So, the gram atomic mass of carbon = 12 grams.

Molecular mass of the molecule: The sum of the atomic masses of all the atoms in a molecule of a substance is called the molecular mass of the molecule.

Molecular mass - calculation: Generally we use relative atomic masses of atoms for calculating the molecular mass of 1 mole of any molecular or ionic substances.

Example: Molecular mass of H_2SO_4

Atomic mass of Hydrogen = 1

Atomic mass of sulphur = 32

Atomic mass of oxygen = 16

Molecular mass of H_2SO4 = 2(Atomic mass of Hydrogen) + 1 (Atomic mass of sulphur) + 4 (Atomic mass of oxygen)

= 2×1 + 32 + 4× 16 = 98 u.

Calculation of molecular mass of hydrogen chloride: =

Atomic mass of hydrogen + Atomic mass of chlorine = 1 + 35.5 = 36.5 u.

FORMULA UNIT MASS

The formula unit mass of a substance is the sum of the atomic masses of all atoms in a formula unit of a compound. The term 'formula unit' is used for those substances which are made up of ions.

Formula unit mass of NaCl = 1x Atomic mass of Na +1 x Atomic mass of Cl

= 1 x 23 +1 x 35.5

= 58.5 atomic mass units.

Formula unit mass of ZnO = 1 x Atomic mass of Zn + 1 x Atomic mass O

= 1 x 65 + 1 x 16 = 81 u.

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Q1. Calculate the molecular masses of H_2, O_2, Cl_2, CO_2, CH_4, C_2H_6, C_2H_4, NH_3, CH_3OH.

Answer: Molecular mass of O_2 = 2 × Atomic mass of O = 2 × 16 = 32 u

Molecular mass of Cl_2 = 2 × Atomic mass of Cl = 2 × 35.5 = 71 u

Molecular mass of CO_2 = Atomic mass of C + 2 × Atomic mass of O

= 12 + 2 × 16 = 44 u

Molecular mass of CH_4 = Atomic mass of C + 4 × Atomic mass of H

= 12 + 4 × 1 = 16 u

Molecular mass of C_2H_6 = 2 × Atomic mass of C + 6 × Atomic mass of H

= 2 × 12 + 6 × 1 = 30 u

Molecular mass of C_2H_4 = 2 × Atomic mass of C + 4 × Atomic mass of H

= 2 × 12 + 4 × 1 = 28 u

Molecular mass of NH_3 = Atomic mass of N + 3 × Atomic mass of H

= 14 + 3 × 1 = 17 u

Molecular mass of CH_3OH = Atomic mass of C + 4 × Atomic mass of H + Atomic mass of O

= 12 + 4 × 1 + 16 = 32 u

Q2. Calculate the formula unit masses of ZnO, Na_2O, K_2CO_3, given atomic masses of Zn= 65 u, Na = 23 u, K = 39 u, C = 12 u, and O = 16 u.

Answer:

Formula unit mass of ZnO = Atomic mass of Zn + Atomic mass of O

= 65 + 16 = 81 u

Formula unit mass of Na_2O = 2 × Atomic mass of Na + Atomic mass of O

= 2 × 23 + 16 = 62 u

Formula unit mass of K_2CO_3 = 2 × Atomic mass of K + Atomic mass of C + 3 × Atomic mass of O

= 2 × 39 + 12 + 3 × 16 = 138 u

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