



KARACHI EDU COACHING CENTER

CLASS IX CHEMISTRY — CHAPTER 1

Fundamentals of Chemistry

Target Board: Sindh Textbook Board (STBB)

Exam Mastery & Lecture Deck

What is Chemistry & States of Matter

Chemistry: Branch of science studying **composition, structure, properties, and reactions** of matter with energy transformations.



SOLID

Fixed shape & fixed volume.



LIQUID

Fixed volume, indefinite shape.



GAS

No fixed shape or volume.



PLASMA

Ionized gas at extreme energy.

Key Contributions in Chemistry

Jabir Ibne-Hayan

Father of Alchemy (721–803 A.D.)

Prepared HNO_3 , HCl , and White Lead. Developed filtration and crystallization.

Al-Razi & Al-Beruni

Classification & Physics (862–1048 A.D.)

Al-Razi prepared ethyl alcohol. Al-Beruni determined exact metallic densities.

Robert Boyle

Systematic Natural Science (1627–1691 A.D.)

Formulated Boyle's Gas Law and defined elements as pure substances.

Core Branches of Chemistry

Physical Chemistry

Laws governing combination and reaction mechanisms.

Organic Chemistry

Study of hydrocarbons and their covalent derivatives.

Inorganic Chemistry

All elements & non-organic compounds from minerals.

Biochemistry

Chemical reactions inside living organism cells.

Analytical Chemistry

Qualitative & quantitative sample analysis.

Industrial Chemistry

Large-scale manufacture of fertilizers, glass, cement.

Substance vs. Mixture

PURE SUBSTANCE

Fixed composition & uniform properties.

1. Element

Same type of atoms (e.g., Na, Fe, O₂).

2. Compound

Chemically combined ratio (e.g., H₂O, NaCl).

MIXTURE

Impure matter combined physically.

1. Homogeneous

Uniform composition (e.g., Salt solution, Air).

2. Heterogeneous

Non-uniform phases (e.g., Soil, Water + Oil).

Atomic Number, Mass Number & a.m.u.

Z

Atomic Number

Total number of protons in nucleus.

A

Mass Number

Sum of Protons + Neutrons ($A = Z + N$).

a.m.u.

Atomic Mass Unit

1/12th mass of Carbon-12 atom.

Empirical vs. Molecular Formula

Property	Empirical Formula (E.F.)	Molecular Formula (M.F.)
Definition	Simplest whole-number ratio of atoms.	Actual number of atoms in a molecule.
Relationship	Base ratio	M.F. = n × (Empirical Formula)
Benzene Example	CH	C ₆ H ₆
Glucose Example	CH ₂ O	C ₆ H ₁₂ O ₆

Molecular Mass vs. Formula Mass

Covalent Compounds

Molecular Mass

Sum of atomic masses of all atoms in a molecule.

Example: H₂O

$$(2 \times 1.008) + (1 \times 16) = \mathbf{18.016 \text{ a.m.u.}}$$

Ionic Compounds

Formula Mass

Sum of atomic masses in a formula unit.

Example: NaCl

$$(1 \times 23) + (1 \times 35.5) = \mathbf{58.5 \text{ a.m.u.}}$$

Ions, Molecular Ions & Free Radicals

IONS

Charged species formed by gain/loss of electrons.

Cation (+): Na^+

Anion (-): Cl^-

MOLECULAR IONS

Molecules losing or gaining electrons.

Examples: CH_4^+ , CO^+ , N_2^+

FREE RADICALS

Atoms with unpaired electrons; highly reactive.

Examples: $\text{Cl}\cdot$, $\text{H}_3\text{C}\cdot$

4 Steps to Balance Equations

STEP 01

Write Skeleton

Write correct formulas for reactants & products.

STEP 02

Count Atoms

Count atoms of each element on both sides.

STEP 03

Adjust Coefficients

Add coefficients (never change subscripts!).

STEP 04

Verify Conservation

Ensure mass is conserved across reactants & products.

Stoichiometric Master Formulas

1. Mole & Mass

$$n = \text{Mass} / \text{Molar Mass}$$

Where n is quantity in moles (mol).

2. Avogadro's Number

$$N_A = 6.022 \times 10^{23}$$

Particles per mole (atoms, molecules, ions).

3. Gas Volume at STP

$$V = n \times 22.4 \text{ dm}^3$$

Standard Temperature (0°C) & Pressure (1 atm).



KARACHI EDU EXAM CHECKLIST

Chapter 1 Revision Mastered!

✓ **Definitions:** Branches, Matter, Ions, Radical

✓ **Numericals:** Moles, Mass, N_A &
a.m.u.

Questions or Discussion? Let's solve textbook exercises!
