

CHAPTER 3

Atoms and Molecules

CBSE · Science · Class 9

WHAT THIS CHAPTER DOES

Boards prep that builds confidence, not anxiety.

TODAY'S MISSION

Today's Mission

WHY THIS MATTERS

Matter is built from ATOMS. Atoms combine to form MOLECULES. To count atoms we use the MOLE — 6.022×10^{23} particles.

TOPIC

A

Part A — Laws of Chemical Combination

TOPIC

The Two Laws of Chemical Combination

POINT 1

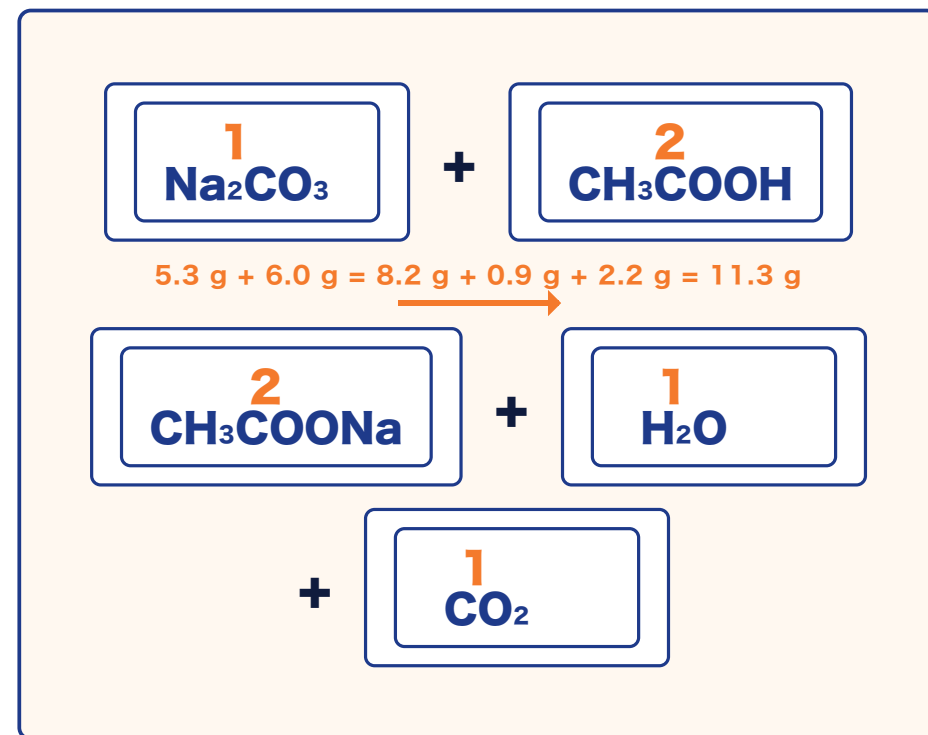
POINT 2

POINT 3

WORKED EXAMPLE

Worked Example 1 — Verifying Conservation of Mass

- 1 Write the balanced equation: $\text{Na}_2\text{CO}_3 + 2 \text{CH}_3\text{COOH} \rightarrow 2 \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$
- 2 Mass of reactants = mass of Na_2CO_3 + mass of CH_3COOH = 5.3 + 6.0 = 11.3 g.
- 3 Mass of products = mass of CO_2 + mass of H_2O + mass of CH_3COONa = 2.2 + 0.9 + 8.2 = 11.3 g.
- 4 Mass of reactants (11.3 g) = mass of products (11.3 g).
- 5 Hence the Law of Conservation of Mass is obeyed in this reaction.



TOPIC

B

Part B — Dalton's Atomic Theory

TOPIC

Dalton's Five Postulates

POINT 1

POINT 2

POINT 3

TOPIC

Dalton — Quick Recall Checklist

TOPIC

C

Part C — Atomic Mass, Molecular Mass and Formula Unit Mass

TOPIC

Atomic Mass, Molecular Mass, Formula Unit Mass

POINT 1

POINT 2

POINT 3

TOPIC

Practice Drill — Molecular / Formula Unit Mass of 10 Compounds

WORKED EXAMPLE

Worked Example 2 — Molecular Mass of H_2SO_4

1 Identify atoms in one molecule of H_2SO_4 : 2 atoms of H, 1 atom of S, 4 atoms of O.

2 Mass contribution from H = $2 \times 1 = 2$ u.

3 Mass contribution from S = $1 \times 32 = 32$ u.

4 Mass contribution from O = $4 \times 16 = 64$ u.

5 Total molecular mass = $2 + 32 + 64 = 98$ u.

TOPIC

D

Part D — The Mole Concept

TOPIC

Mole, Avogadro's Number and Molar Mass

POINT 1

POINT 2

POINT 3

TRY IT · SOLVE BEFORE YOU PEEK

Quick Test — 60 Seconds

Work it out before you flip the answer.

SOLUTION

WORKED EXAMPLE

Worked Example 3 — Counting Molecules in 9 g of Water

- 1 Molar mass of H_2O = $2(1) + 16 = 18 \text{ g/mol}$.
- 2 Number of moles $n = \text{mass} / \text{molar mass} = 9 / 18 = 0.5 \text{ mol}$.
- 3 Number of molecules $N = n \times N_A = 0.5 \times 6.022 \times 10^{23} = 3.011 \times 10^{23} \text{ molecules}$.
- 4 Each H_2O molecule has 3 atoms (2 H + 1 O), so number of atoms = $3 \times 3.011 \times 10^{23} = 9.033 \times 10^{23} \text{ atoms}$.
- 5 Always state the unit: 'molecules' for compound count, 'atoms' for atom count.

TOPIC

E

Part E — Writing Chemical Formulae

TOPIC

Common Valencies — Memorise These

WORKED EXAMPLE

Worked Example 4 — Criss-Cross Method

- 1 (a) Aluminium oxide: Al has valency 3 (Al^{3+}), O has valency 2 (O^{2-}).
- 2 Write symbols side by side with valencies as superscripts: $\text{Al}^3 \text{O}^2$.
- 3 Criss-cross the valencies down as subscripts: Al_2O_3 .
- 4 Verify: $2 \text{ Al} \times (+3) = +6$; $3 \text{ O} \times (-2) = -6$. Net = 0. Correct.
- 5 (b) Calcium nitrate: Ca has valency 2 (Ca^{2+}), NO_3 has valency 1 (NO_3^-).
- 6 Criss-cross: $\text{Ca}_1(\text{NO}_3)_2$. Drop the 1 $\rightarrow \text{Ca}(\text{NO}_3)_2$. Brackets around NO_3 because subscript > 1 .
- 7 Verify: $1 \text{ Ca} \times (+2) = +2$; $2 \text{ NO}_3 \times (-1) = -2$. Net = 0. Correct.

TOPIC

Formula-Writing Checklist

TOPPER TEMPLATE · MARK-BY-MARK

Topper's 5-Mark Model — Mole Numerical with Conversion

PYQ PATTERNS

Top 5 PYQ Patterns — Last 6 Years

MARKS DISTRIBUTION

Sub-topic Marks Heatmap

PYQ PATTERNS

Top PYQ patterns to drill

#1	Mole calculation	given mass, find number of moles, atoms or molecules (3 marks) — 88%
#2	Molecular / formula unit mass calculation of a given compound (2 marks)	80%
#3	Law of Conservation of Mass	state + verify with numerical example (3 marks) — 72%
#4	Write chemical formulae using valencies (4-5 compounds asked) (2 marks)	65%
#5	Postulates and limitations of Dalton's atomic theory (3 marks)	55%

RECAP · MEMORISE THESE

Chapter Summary — The 8 Must-Remembers

1 Law of Conservation of Mass (Lavoisier): mass of reactants = mass of products.

2 Law of Constant Proportions (Proust): a compound has a fixed elemental mass ratio.

3 Dalton's atomic theory has 5 postulates; 2 are revised (atoms divisible; isotopes exist).

4 ATOMIC MASS — mass of one atom in u; 1 u = 1/12 mass of ^{12}C .

5 MOLECULAR mass for covalent ($\text{H}_2\text{O} = 18$); FORMULA UNIT mass for ionic ($\text{NaCl} = 58.5$).

6 1 MOLE = 6.022×10^{23} particles = Avogadro's number = molar mass of substance in grams.

WHAT'S NEXT

Chapter 4 — Structure of the Atom



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