

Class 10 · Science · Chemistry

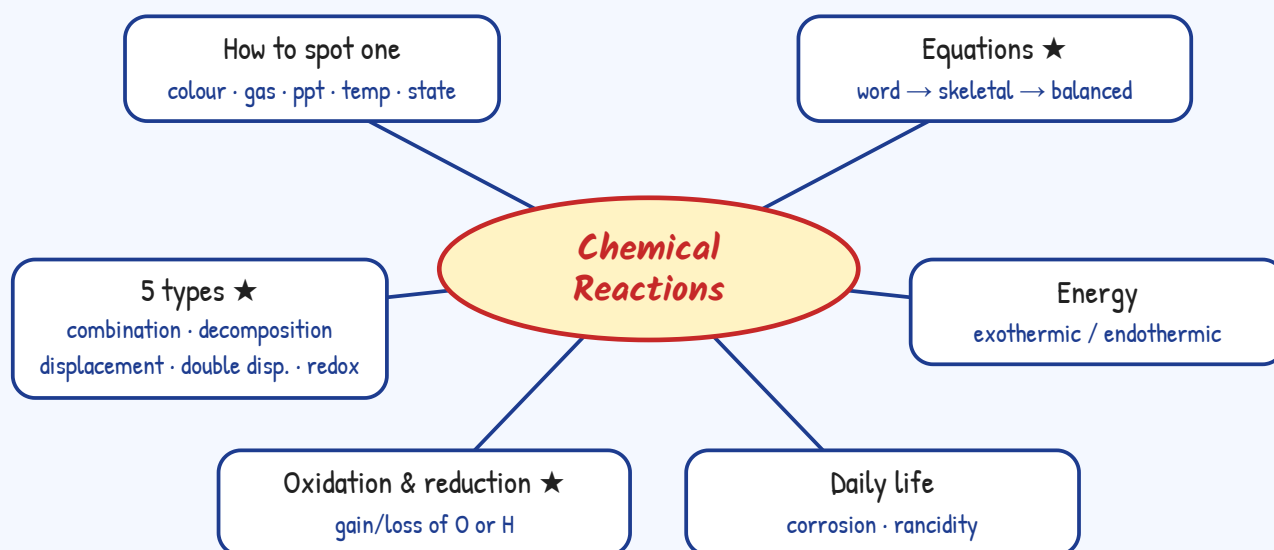
Chapter 1

Chemical Reactions & Equations



NCERT Science, Reprint 2026-27 · CBSE board 2027

Chapter map (★ = asked again and again)



What is inside

1. Concept notes with labelled diagrams (p. 2-8)
2. Don't-confuse tables & colour chart (p. 9)
3. NCERT in-text + exercise answers (p. 10-12)
4. Previous year questions, solved (p. 13-14)
5. 4 case-based questions, solved (p. 15)
6. 20 MCQs · 10 Assertion-Reason · 5 Give reasons (p. 16-17)
7. My mistakes page (p. 18)
8. One-page summary for the last night (p. 19)

Colour code used

red = key term green = definition

orange = condition on the arrow

purple = sub-heading black = equation

★ = high-frequency board topic

! = mark the examiner gives for that point

★ **Exam tip:** This chapter usually carries about 5-8 marks: MCQs + one 2/3-mark question. Equations are where students lose marks, so learn every boxed equation.

1.1 Chemical reaction

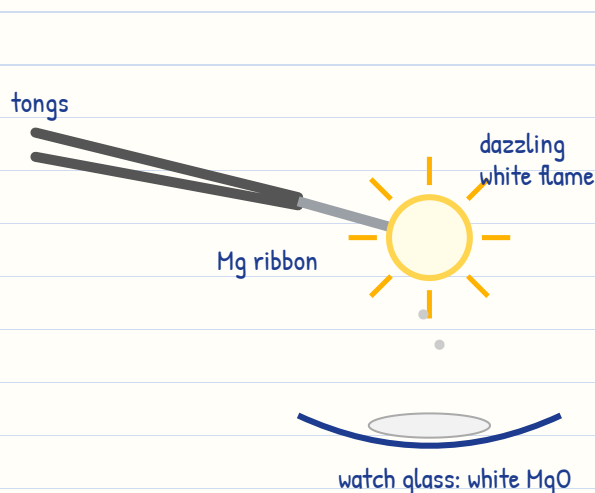
Definition 🔧 A process in which one or more substances (**reactants**) change into new substances (**products**) with different properties. Atoms are only *rearranged*; no atom is made or destroyed.

Everyday examples: milk turning sour (curd) · iron rusting · food being digested · grapes fermenting · cooking · respiration.

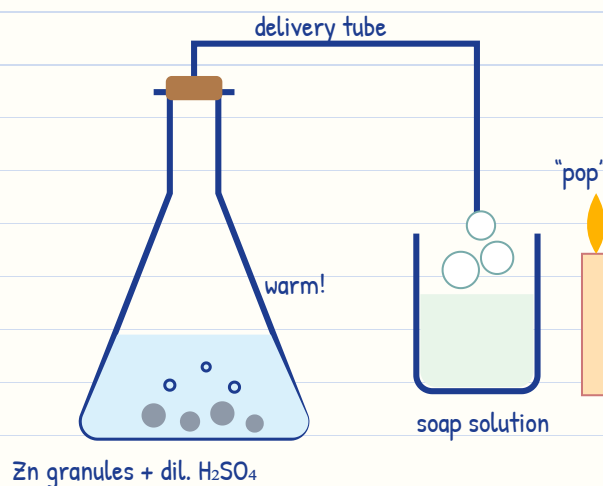
Physical change (melting of ice, dissolving sugar, crystallisation) → no new substance, so not a reaction.

★ How do we know a reaction has happened? (observations)

Sign	NCERT example
Change in state	Mg ribbon (solid) burns → white powder; solid + solution → gas (Zn + acid)
Change in colour	$\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow$ yellow ppt; blue CuSO_4 fades with iron nail
Gas given out	$\text{Zn} + \text{dil. H}_2\text{SO}_4 \rightarrow \text{H}_2$ bubbles (burns with a <i>pop</i>)
Change in temperature	flask with Zn + acid becomes warm; $\text{CaO} + \text{water} \rightarrow$ very hot
Precipitate forms	$\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow$ white BaSO_4



Activity 1.1 · burning of magnesium



Activity 1.3 · H_2 gas from zinc and dilute acid

Why clean the Mg ribbon with sandpaper? To remove the dull layer of magnesium oxide on it, so that magnesium can burn in oxygen directly.

Activity 1.2: Lead nitrate solution + potassium iodide solution → **yellow** precipitate of lead iodide (PbI_2).

Physical change vs chemical change

Point	Physical change	Chemical change
New substance?	No	Yes, with new properties
Reversible?	Usually easily reversed	Usually not reversed easily
Energy change	Small	Often large (heat, light)
Examples	melting ice, boiling water, dissolving salt, crystallisation, glass breaking	burning Mg, rusting, curdling of milk, digestion, fermentation of grapes, cooking

★ **Exam tip:** If the question asks “which is not a chemical reaction”, look for melting, evaporation, dissolving or crystallisation. CBSE 2020 asked exactly this.

1.2 Chemical equations ★

Word equation



Skeletal (unbalanced) equation



Balanced equation + states + conditions

Word equation: Magnesium + Oxygen → Magnesium oxide

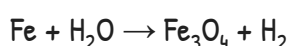
Skeletal equation: formulae used, atoms not yet equal: $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ (O: 2 on left, 1 on right)

Balanced equation: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Definition ✎ A **balanced chemical equation** has the same number of atoms of each element on the reactant side and on the product side.

Why balance? Because of the **law of conservation of mass**: mass can neither be created nor destroyed in a chemical reaction. So total mass of products = total mass of reactants.

Hit-and-trial balancing: the NCERT example (learn the steps)



Step	What I do	Equation now
1	Draw a box around each formula. Never change what is inside a box (no change in subscripts).	$[\text{Fe}] + [\text{H}_2\text{O}] \rightarrow [\text{Fe}_3\text{O}_4] + [\text{H}_2]$
2	Count atoms on each side: Fe 1 3, H 2 2, O 1 4	—
3	Start with the compound having most atoms (Fe_3O_4), balance O: put 4 before H_2O	$\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$
4	Now H: 8 on left, 2 on right → put 4 before H_2	$\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
5	Fe: 1 on left, 3 on right → put 3 before Fe	$3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
6	Re-count: Fe 3 3, H 8 8, O 4 4 ✓	balanced
7	Add states (iron reacts with <u>steam</u> , so H_2O is a gas)	$3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$

State symbols

(s) solid · (l) liquid · (g) gas · (aq) aqueous = dissolved in water

Example: $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$

↑ after a formula = gas given off; ↓ = precipitate (optional, but examiners like it).

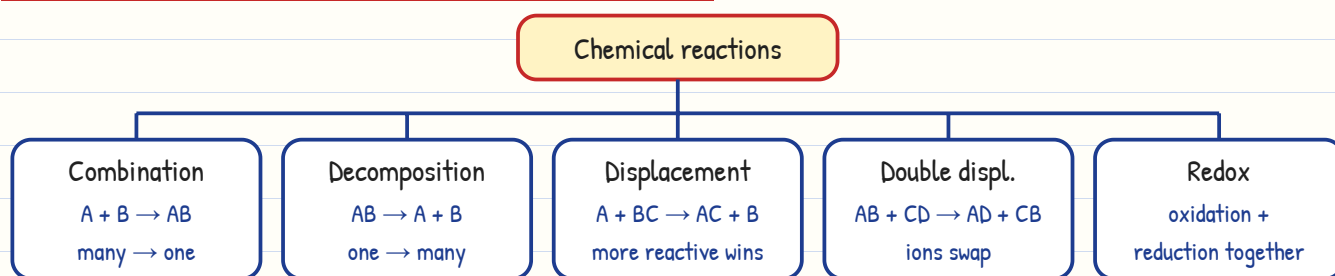
Conditions go on the arrow



(methanol) · (glucose) · heat, light, catalyst, pressure: all written over the arrow

★ **Exam tip:** Balance first, add states last. In the board answer, “balanced” means correct coefficients and correct formulas; states earn credit only where the question asks for them.

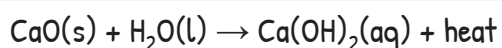
1.3 Types of chemical reactions ★



One reaction can belong to two groups. Example: $2Mg + O_2 \rightarrow 2MgO$ is combination and redox and exothermic.

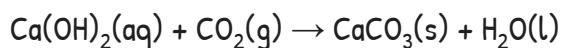
(A) Combination reaction

Definition 🔍 Two or more substances (elements or compounds) combine to form a single product.



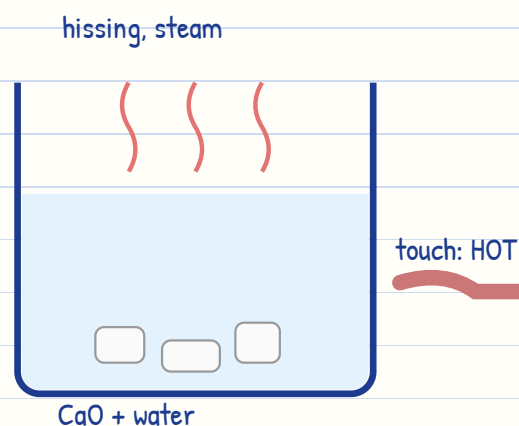
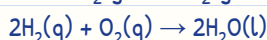
(quick lime) (slaked lime) Vigorous reaction, a hissing sound, beaker becomes very hot.

Whitewashing: $Ca(OH)_2$ solution on walls reacts slowly with CO_2 of air and forms a thin shiny layer of calcium carbonate in 2-3 days.



(Marble also has the formula $CaCO_3$.)

Other examples:



Activity 1.4 · quick lime + water

Energy in reactions

Definition 🔍 **Exothermic:** heat is given out along with products.

- burning of natural gas: $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$ + energy
- respiration: $C_6H_{12}O_6(aq) + 6O_2(aq) \rightarrow 6CO_2(aq) + 6H_2O(l)$ + energy
- decomposition of vegetable matter into compost
- CaO + water; Mg burning

Definition 🔍 **Endothermic:** energy (heat, light or electricity) is absorbed.

- most decomposition reactions ($CaCO_3$, $FeSO_4$, $AgCl$, water)
- photosynthesis
- $Ba(OH)_2 + 2NH_4Cl \rightarrow BaCl_2 + 2NH_3 + 2H_2O$: test tube feels cold

★ **Exam tip:** Respiration is exothermic because glucose is oxidised in our cells and the energy released keeps us alive. This is a favourite 2-mark "why" question.

(B) Decomposition reaction ★

Definition 🦋 A single reactant breaks down into two or more simpler products. It needs energy: heat, light or electricity. It is the opposite of combination.

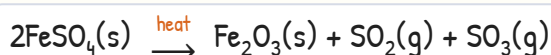
Heat → **thermal** decomposition

Electricity → **electrolytic** decomposition (electrolysis)

Light → **photolytic** decomposition

1. Thermal (by heat)

Activity 1.5 · ferrous sulphate crystals ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) are **light green**. On heating: water drops on the cooler part of the tube, green colour disappears, a **reddish-brown** solid is left, smell of burning sulphur.



ferrous sulphate → ferric oxide (reddish brown) + sulphur dioxide + sulphur trioxide

First the crystals lose water: $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} \rightarrow \text{FeSO}_4 + 7\text{H}_2\text{O}$



limestone → quick lime (used to make cement) + carbon dioxide

Activity 1.6 · lead nitrate (white powder) on heating gives **brown fumes** of nitrogen dioxide.



lead nitrate → lead oxide (yellow) + nitrogen dioxide (brown) + oxygen

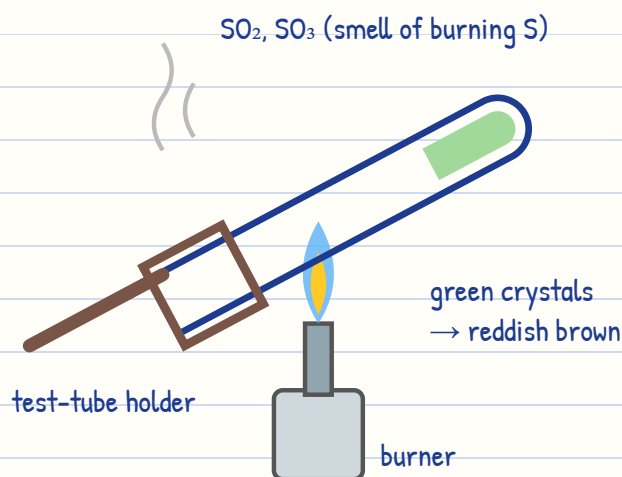


Fig 1.4 · heating ferrous sulphate (mouth away from you)

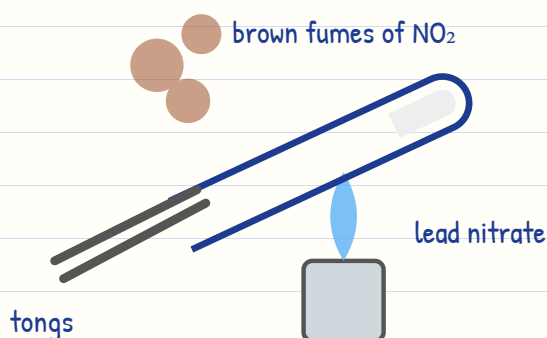


Fig 1.5 · heating lead nitrate

X Don't do this: Do not write "lead nitrate gives brown lead oxide". The brown fumes are NO_2 ; PbO is a yellowish solid.

Decomposition at a glance

Reactant	Energy	Products	What you see	Use / note
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	heat	$\text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$	green → reddish brown, smell	water lost first
CaCO_3	heat	$\text{CaO} + \text{CO}_2$	white solid stays white	quick lime for cement
$\text{Pb}(\text{NO}_3)_2$	heat	$\text{PbO} + \text{NO}_2 + \text{O}_2$	brown fumes	do it in a fume cupboard
H_2O	electricity	$\text{H}_2 + \text{O}_2$	bubbles, 2 : 1 volume	add a little acid
$\text{AgCl} / \text{AgBr}$	light	$\text{Ag} + \text{Cl}_2 / \text{Br}_2$	white / pale yellow → grey	B&W photography