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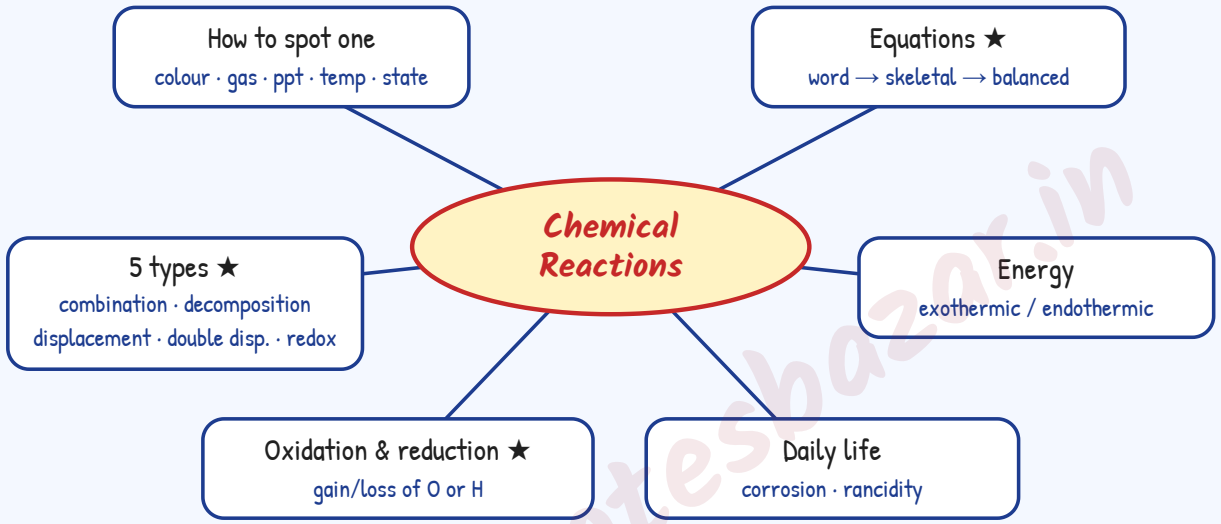
Class 10 · Science · Chemistry

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
2. Don't-confuse tables & colour chart
3. NCERT in-text + exercise answers
4. Previous year questions, solved
5. 4 case-based questions, solved
6. 20 MCQs · 10 Assertion-Reason · 5 Give reasons
7. My mistakes page
8. One-page summary for the last night

Colour code used

red = key term green = definition

orange = condition on the arrow

purple = sub-heading black = equation

★ = high-frequency board topic

1 = 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.

PYQ tags: a year is shown only when the question is in the actual CBSE paper (paper code shown) or two independent sources give the same year. Others are marked "Board-style".

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1.1 Chemical reaction

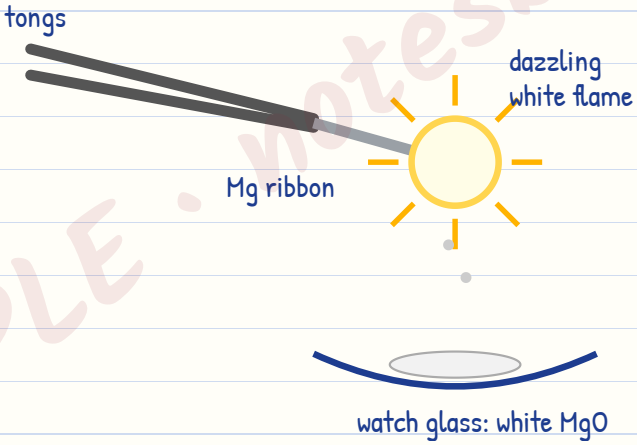
Definition ✎ A process in which one or more substances (**reactants**) change into new substances (**products**) with different properties. Atoms are only *rearranged*; no atom is made or destroyed.

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

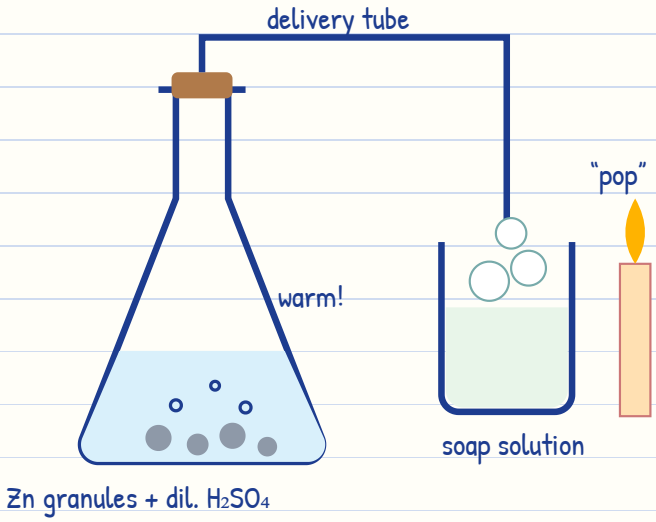
Physical change (melting of ice, dissolving sugar, crystallisation) → no new substance, so not a reaction.

★ 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**	$Pb(NO_3)_2$ + KI → yellow ppt; blue $CuSO_4$ fades with iron nail
Gas given out	Zn + dil. H_2SO_4 → H_2 bubbles (burns with a *pop*)
Change in **temperature**	flask with Zn + acid becomes warm; CaO + water → very hot
Precipitate forms	$BaCl_2$ + Na_2SO_4 → white $BaSO_4$



Activity 1.1 · burning of magnesium



Activity 1.3 · H_2 gas from zinc and dilute acid

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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: $Mg + O_2 \rightarrow MgO$ (O: 2 on left, 1 on right)

Balanced equation: $2Mg + O_2 \rightarrow 2MgO$

> **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)*

$Fe + H_2O \rightarrow Fe_3O_4 + H_2$

Step	What I do	Equation now
1	Draw a box around each formula. Never change what is inside a box (no change in subscripts).	$[Fe] + [H_2O] \rightarrow [Fe_3O_4] + [H_2]$
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	$Fe + 4H_2O \rightarrow Fe_3O_4 + H_2$
4	Now H: 8 on left, 2 on right → put 4 before H_2	$Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
5	Fe: 1 on left, 3 on right → put 3 before Fe	$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
6	Re-count: Fe 3|3, H 8|8, O 4|4 ✓	balanced
7	Add states (iron reacts with steam, so H_2O is a gas)	$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

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State symbols

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

Example: $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

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

Conditions go on the arrow

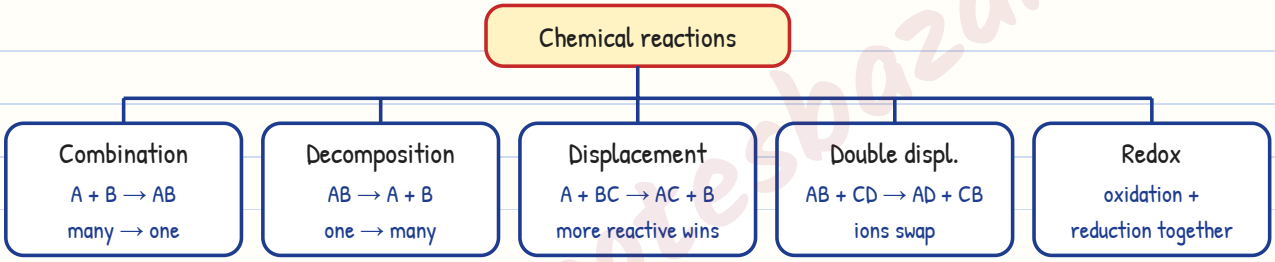
$$CO(g) + 2H_2(g) \xrightarrow{340\ atm} CH_3OH(l)$$

$$6CO_2 + 6H_2O \xrightarrow{sunlight,\ chlorophyll} C_6H_{12}O_6 + 6O_2$$

(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.

$$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) + heat$$

(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.

$$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$$

(Marble also has the formula $CaCO_3$.)

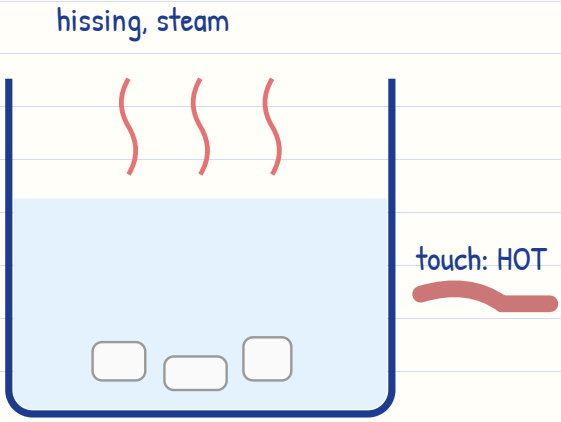
Other examples:

$C(s) + O_2(g) \rightarrow CO_2(g)$ burning of coal

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

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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 ($FeSO_4 \cdot 7H_2O$) 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.

$$2FeSO_4(s) \xrightarrow{heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$$

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

First the crystals lose water: $FeSO_4 \cdot 7H_2O \rightarrow FeSO_4 + 7H_2O$

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$$CaCO_3(s) \xrightarrow{heat} CaO(s) + CO_2(g)$$

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

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

$$2Pb(NO_3)_2(s) \xrightarrow{heat} 2PbO(s) + 4NO_2(g) + O_2(g)$$

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

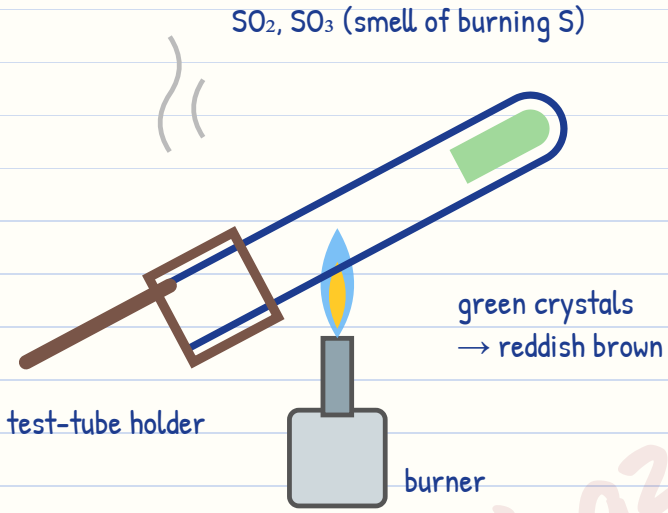


Fig 1.4 · heating ferrous sulphate (mouth away from you)

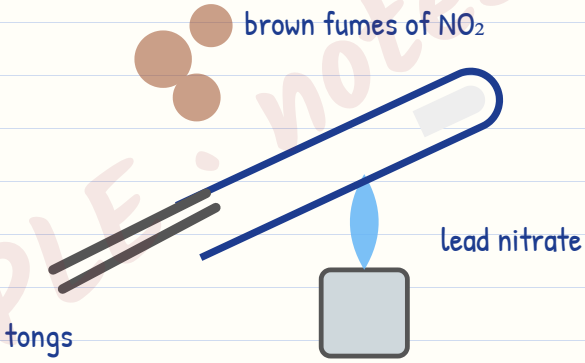


Fig 1.5 · heating lead nitrate

✗ 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
$FeSO_4 \cdot 7H_2O$	heat	$Fe_2O_3 + SO_2 + SO_3$	green → reddish brown, smell	water lost first
$CaCO_3$	heat	$CaO + CO_2$	white solid stays white	quick lime for cement
$Pb(NO_3)_2$	heat	$PbO + NO_2 + O_2$	brown fumes	do it in a fume cupboard
H_2O	electricity	$H_2 + O_2$	bubbles, 2 : 1 volume	add a little acid
AgCl / AgBr	light	$Ag + Cl_2$ / Br_2	white / pale yellow → grey	B&W photography

2. Electrolytic (by electricity) ★

Activity 1.7 · carbon electrodes in water + a few drops of dilute H_2SO_4, 6 V battery. Bubbles at both electrodes.

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$$2H_2O(l) \xrightarrow{\text{electric current}} 2H_2(g) + O_2(g)$$

Electrode	Gas	Volume	Test
Cathode (–)	H_2	double	burns with a pop
Anode (+)	O_2	half	candle burns brighter

Why double? Water is H_2O: 2 molecules of water give 2 molecules of H_2 and 1 of O_2. So volume ratio $H_2 : O_2$ = 2 : 1.

Why acid? Pure water is a poor conductor; a few drops of acid make it conduct electricity.

Mass ratio $H_2 : O_2 = 2\times2 : 32$ = 1 : 8 (not 2:1!)

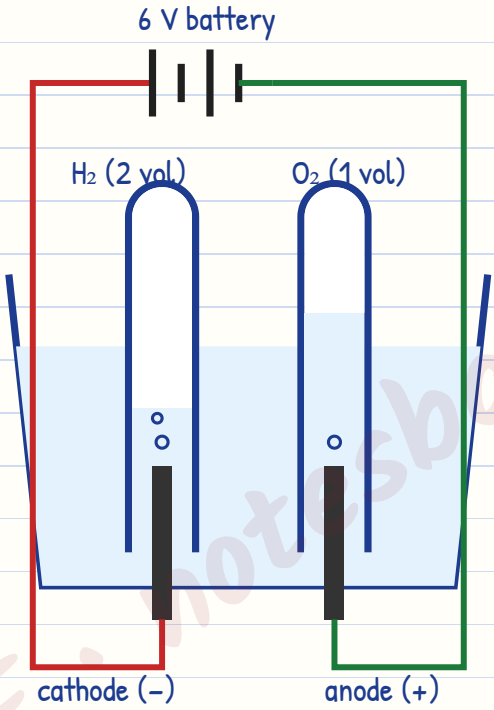


Fig 1.6 · electrolysis of water

3. Photolytic (by light)

Activity 1.8 · white silver chloride in sunlight turns grey (silver metal forms).

$$2AgCl(s) \xrightarrow{\text{sunlight}} 2Ag(s) + Cl_2(g)$$

$$2AgBr(s) \xrightarrow{\text{sunlight}} 2Ag(s) + Br_2(g)$$

Used in **black and white photography**. Silver salts are kept in dark-coloured bottles.

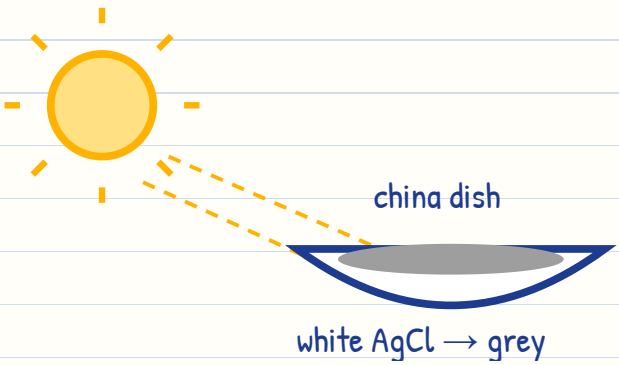


Fig 1.7 · silver chloride in sunlight

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(C) Displacement reaction ★

Definition ✎ A more reactive element displaces (pushes out) a less reactive element from its compound (salt solution).

Reactivity series (learn top to bottom): K > Na > Ca > Mg > Al > Zn > Fe > Pb > [H] > Cu > Hg > Ag > Au

"Please Stop Calling Me A Zebra, I Like Her Calling Me Smart Goat"

(Potassium, Sodium, Calcium, Magnesium, Aluminium, Zinc, Iron, Lead, Hydrogen, Copper, Mercury, Silver, Gold)

How to use the series in 3 seconds

Metal in solution: is the free metal above the metal in the salt?

- Zn in $CuSO_4$: Zn above Cu → reaction ($Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$)
- Cu in $AgNO_3$: Cu above Ag → reaction (solution turns blue, silver deposits)
- Cu in $FeSO_4$: Cu below Fe → no reaction
- Metals above H (Zn, Fe, Mg…) give H_2 with dilute HCl / H_2SO_4; Cu, Ag, Au do not.

★ **Exam tip:** An MCQ often gives four "metal + salt" pairs and asks which will react. Draw the series in the margin first, then tick the pairs.

Activity 1.9 · clean iron nails (rubbed with sandpaper) dipped in blue $CuSO_4$ solution for 20 min.

- nail gets a brown coating (copper)
- blue colour of solution fades and turns light green ($FeSO_4$)

$$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$$

blue → light green · iron is more reactive than copper

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

blue → colourless

$$Pb(s) + CuCl_2(aq) \rightarrow PbCl_2(aq) + Cu(s)$$

No reaction: $Cu + FeSO_4$ ✗ · $Cu + ZnSO_4$ ✗ · $Fe + ZnSO_4$ ✗ (less reactive cannot push out more reactive).

Refining of silver: $Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$

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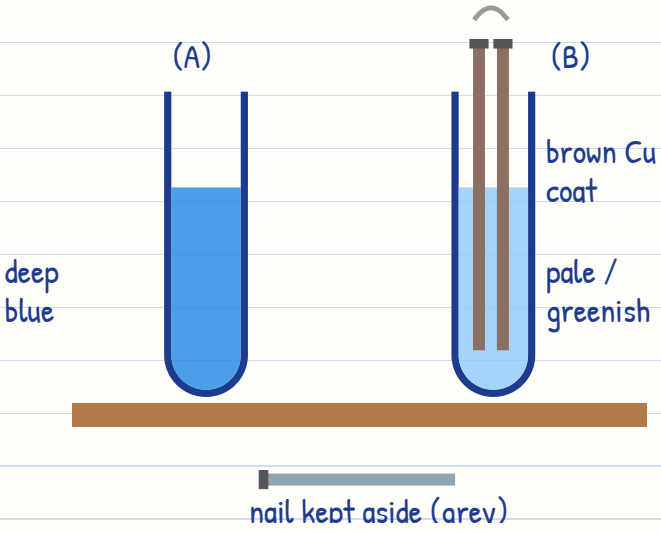


Fig 1.8 · iron nails in copper sulphate

(D) Double displacement reaction ★

Definition ✎ Two compounds react by exchanging their ions to form two new compounds.

Activity 1.10 · sodium sulphate solution + barium chloride solution → white insoluble substance (precipitate) of barium sulphate.

$$Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s)\downarrow + 2NaCl(aq)$$

Ba^{2+} and SO_4^{2-} join → $BaSO_4$ (white ppt); Na^+ and Cl^- stay in solution.

Definition ✎ **Precipitation reaction**: any reaction that produces an insoluble solid (precipitate).

$$Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow PbI_2(s)\downarrow + 2KNO_3(aq)$$

yellow ppt of lead iodide (Activity 1.2) — also double displacement

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s)\downarrow + NaNO_3(aq)$$

white ppt of silver chloride

Neutralisation is also double displacement: $NaOH + HCl \longrightarrow NaCl + H_2O$

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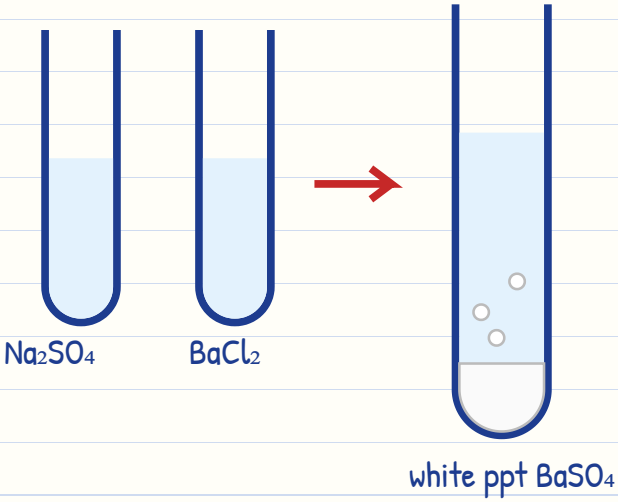


Fig 1.9 · formation of barium sulphate

★ **Exam tip:** Displacement = one element + compound. Double displacement = two compounds swapping ions. Look at the reactant side to decide.

(E) Oxidation and reduction (redox) ★

	Oxygen	Hydrogen
Oxidation	gain of O	loss of H
Reduction	loss of O	gain of H

Trick: in oxidation, oxygen comes IN and hydrogen goes OUT. Reduction is the reverse.

Definition ✎ A reaction in which one reactant is oxidised and the other is reduced is a **redox reaction**.

Oxidising agent = gives oxygen / takes hydrogen → itself gets reduced.
Reducing agent = takes oxygen / gives hydrogen → itself gets oxidised.

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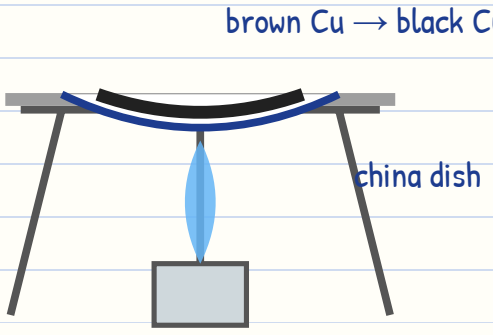
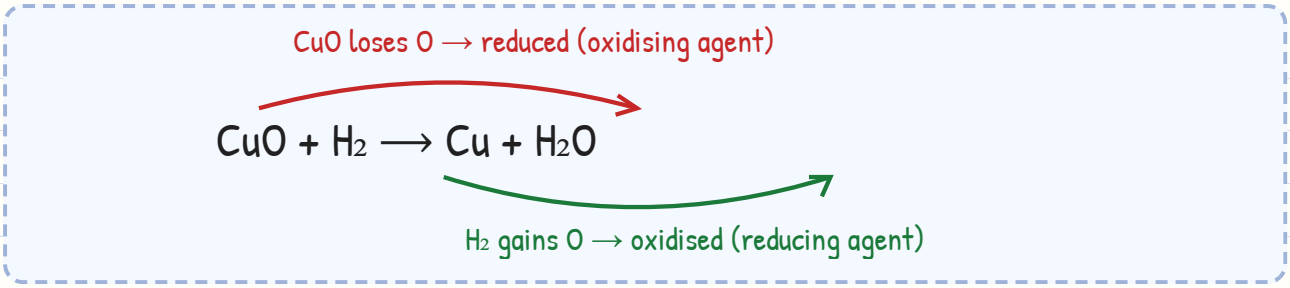


Fig 1.10 · oxidation of copper (Activity 1.11)

$2Cu + O_2 \xrightarrow{heat} 2CuO$ brown copper → black copper(II) oxide (Cu oxidised)

$CuO + H_2 \xrightarrow{heat} Cu + H_2O$ black → brown again



$ZnO + C \longrightarrow Zn + CO$

C is oxidised to CO; ZnO is reduced to Zn.

$MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

HCl is oxidised to Cl_2 (loses H); MnO_2 is reduced to $MnCl_2$ (loses O).

1.4 Oxidation in daily life

Corrosion

> **Definition** ✎ A metal is slowly eaten up when attacked by substances around it, such as moisture, air (oxygen) and acids.

- iron → reddish-brown rust (needs both air and water)
- silver → black coating (silver sulphide)
- copper → green coating (basic copper carbonate)
- damages car bodies, bridges, railings, ships
- **Prevention:** painting, oiling/greasing, galvanising (zinc coat), chrome plating, alloying (details in Ch 3)

Rancidity

> **Definition** ✎ Fats and oils get oxidised when food is kept for long; the food's smell and taste change (become unpleasant).

- add **antioxidants** to fatty food
- keep food in **air-tight** containers
- chips packets are **flushed with nitrogen** (an unreactive gas) so no oxygen is left
- keep in the refrigerator / away from light

Don't-confuse tables

Point	Combination	Decomposition
Reactants	two or more	only one
Products	only one	two or more
Energy	usually released (exothermic)	usually absorbed (endothermic)
Example	$CaO + H_2O \longrightarrow Ca(OH)_2$	$CaCO_3 \longrightarrow CaO + CO_2$

Point	Displacement	Double displacement
Reactants	element + compound	two compounds
What moves	one element replaces another	ions are exchanged

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Condition	displacing element must be more reactive	usually a ppt, water or gas forms
Example	$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$	$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$

Point	Exothermic	Endothermic
Energy	given out	taken in
Container feels	hot	cold
Example	respiration, burning, CaO + water	photosynthesis, $CaCO_3$ decomposition, $Ba(OH)_2 + NH_4Cl$

Point	Corrosion	Rancidity
What	metals	fats and oils in food
Caused by	air + moisture (+ acids)	oxidation by air
Prevent by	paint, oil, galvanising	antioxidants, air-tight packing, N_2

★ Colour, smell & sound chart (MCQ gold)

Substance / change	What you see
Mg burning	dazzling white flame → white powder MgO
PbI_2 (lead iodide)	yellow precipitate
$BaSO_4$ / AgCl	white precipitate
$FeSO_4 \cdot 7H_2O$	light green crystals → reddish-brown Fe_2O_3; smell of burning sulphur
$Pb(NO_3)_2$ heated	brown fumes of NO_2, yellowish PbO left
AgCl in sunlight	white → grey (Ag)
$CuSO_4$ solution	blue → light green with Fe; → colourless with Zn
Cu heated in air	reddish-brown → black (CuO)
CaO + water	hissing sound, lots of heat
H_2 gas	burns with a pop sound
Rust / silver tarnish / copper tarnish	reddish brown / black / green

NCERT in-text questions

Page 6

1. Why should a magnesium ribbon be cleaned before burning it in air?

> **Ans.** Magnesium reacts slowly with air and gets a layer of magnesium oxide on its surface. This layer stops the ribbon from burning properly, so it is rubbed with sandpaper to expose clean magnesium. 1

2. Write the balanced equation for the following chemical reactions.

(i) Hydrogen + Chlorine → Hydrogen chloride (ii) Barium chloride + Aluminium sulphate → Barium sulphate + Aluminium chloride (iii) Sodium + Water → Sodium hydroxide + Hydrogen

> **Ans.** (i) $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
>
> (ii) $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 3BaSO_4(s) + 2AlCl_3(aq)$
>
> (iii) $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

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3. Write a balanced chemical equation with state symbols for the following reactions.
(i) Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.
(ii) Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

> **Ans.** (i) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$
> (ii) $NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$

Page 10

1. A solution of a substance 'X' is used for whitewashing. (i) Name the substance 'X' and write its formula. (ii) Write the reaction of the substance 'X' named in (i) above with water.

> **Ans.** (i) X is calcium oxide (quick lime), CaO.
> (ii) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$ + heat. The slaked lime solution is used for whitewashing.

2. Why is the amount of gas collected in one of the test tubes in Activity 1.7 double of the amount collected in the other? Name this gas.

> **Ans.** In $2H_2O \longrightarrow 2H_2 + O_2$, two molecules of hydrogen form for every one molecule of oxygen, so the volume of hydrogen is double. The gas is **hydrogen**, collected at the cathode.

Page 13

1. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

> **Ans.** Iron is more reactive than copper, so it displaces copper from copper sulphate. Blue $CuSO_4$ changes to light green $FeSO_4$, so the blue colour fades: $Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$.

2. Give an example of a double displacement reaction other than the one given in Activity 1.10.

> **Ans.** $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$ (white ppt), or $Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$.

3. Identify the substances that are oxidised and the substances that are reduced in the following reactions.
(i) $4Na(s) + O_2(g) \longrightarrow 2Na_2O(s)$ (ii) $CuO(s) + H_2(g) \longrightarrow Cu(s) + H_2O(l)$

> **Ans.** (i) Na is oxidised (gains oxygen); O_2 is reduced.
> (ii) CuO is reduced (loses oxygen); H_2 is oxidised (gains oxygen).

Activity questions in the text

· Activity 1.1 reaction type? ⟶ combination (and exothermic). · Energy causing AgCl / AgBr decomposition? ⟶ light. · $Ba(OH)_2 + NH_4Cl \longrightarrow$ endothermic (tube feels cold). · Mg burning: oxidised or reduced? ⟶ oxidised (gains oxygen). · Activity 1.2 precipitate ⟶ yellow PbI_2; $Pb(NO_3)_2 + 2KI \longrightarrow PbI_2 + 2KNO_3$; yes, double displacement.

NCERT exercises

1. Which of the statements about the reaction below are incorrect? $2PbO(s) + C(s) \longrightarrow 2Pb(s) + CO_2(g)$
(a) Lead is getting reduced. (b) Carbon dioxide is getting oxidised. (c) Carbon is getting oxidised. (d) Lead oxide is getting reduced.
(i) (a) and (b) (ii) (a) and (c) (iii) (a), (b) and (c) (iv) all

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Ans. (i) (a) and (b). It is lead oxide that is reduced, not lead; CO_2 is a product, not something being oxidised.

2. $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$. The above reaction is an example of a (a) combination (b) double displacement (c) decomposition (d) displacement reaction.

Ans. (d) displacement: aluminium displaces iron from iron oxide (thermit reaction).

3. What happens when dilute hydrochloric acid is added to iron fillings? Tick the correct answer.

Ans. (a) Hydrogen gas and iron chloride are produced: $Fe + 2HCl \longrightarrow FeCl_2 + H_2$.

4. What is a balanced chemical equation? Why should chemical equations be balanced?

Ans. An equation with equal numbers of atoms of every element on both sides. It must be balanced to obey the law of conservation of mass: atoms are neither created nor destroyed, so mass of reactants = mass of products.

5. Translate the following statements into chemical equations and then balance them.

Ans. (a) $3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$

(b) $2H_2S(g) + 3O_2(g) \longrightarrow 2H_2O(l) + 2SO_2(g)$

(c) $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \longrightarrow 2AlCl_3(aq) + 3BaSO_4(s)$

(d) $2K(s) + 2H_2O(l) \longrightarrow 2KOH(aq) + H_2(g)$

6. Balance the following chemical equations.

Ans. (a) $2HNO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + 2H_2O$

(b) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(c) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$ (already balanced)

(d) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

7. Write the balanced chemical equations for the following reactions.

Ans. (a) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

(b) $Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

(c) $2Al + 3CuCl_2 \longrightarrow 2AlCl_3 + 3Cu$

(d) $BaCl_2 + K_2SO_4 \longrightarrow BaSO_4 + 2KCl$

8. Write the balanced chemical equation for the following and identify the type of reaction in each case.

Ans. (a) $2KBr(aq) + BaI_2(aq) \longrightarrow 2KI(aq) + BaBr_2(s)$ – double displacement (states as printed in NCERT)

(b) $ZnCO_3(s) \longrightarrow ZnO(s) + CO_2(g)$ – decomposition (thermal)

(c) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ – combination

(d) $Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$ – displacement

9. What does one mean by exothermic and endothermic reactions? Give examples.

Ans. Exothermic: heat is released, e.g. $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$ + heat; $CaO + H_2O \longrightarrow Ca(OH)_2$ + heat. Endothermic: energy is absorbed, e.g. $CaCO_3 \longrightarrow CaO + CO_2$ (on heating); $2AgCl \longrightarrow 2Ag + Cl_2$ (in sunlight).

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10. Why is respiration considered an exothermic reaction? Explain.

Ans. During respiration, glucose from digested food combines with oxygen in our cells and breaks into CO_2 and water, releasing energy: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy. Since energy is given out, it is exothermic.

11. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Ans. In combination, two or more substances join to give one product; in decomposition, one substance breaks into two or more. Combination: $CaO + CO_2 \rightarrow CaCO_3$. Decomposition: $CaCO_3 \rightarrow CaO + CO_2$ (on heating). The same reaction runs in opposite directions.

12. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

Ans. Heat: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Light: $2AgBr(s) \rightarrow 2Ag(s) + Br_2(g)$

Electricity: $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

13. What is the difference between displacement and double displacement reactions? Write equations for these reactions.

Ans. Displacement: a more reactive element replaces a less reactive one from its compound: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$. Double displacement: two compounds exchange ions: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$.

14. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

Ans. $Cu(s) + 2AgNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + 2Ag(s)$

15. What do you mean by a precipitation reaction? Explain by giving examples.

Ans. A reaction that forms an insoluble solid (precipitate) in solution. Examples: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow$ (white) + 2NaCl; $Pb(NO_3)_2 + 2KI \rightarrow PbI_2\downarrow$ (yellow) + $2KNO_3$.

16. Explain the following in terms of gain or loss of oxygen with two examples each. (a) Oxidation (b) Reduction

Ans. (a) Oxidation = gain of oxygen: $2Cu + O_2 \rightarrow 2CuO$; $C + O_2 \rightarrow CO_2$.

(b) Reduction = loss of oxygen: $CuO + H_2 \rightarrow Cu + H_2O$ (CuO reduced); $ZnO + C \rightarrow Zn + CO$ (ZnO reduced).

17. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and the black coloured compound formed.

Ans. X = copper (Cu); black compound = copper(II) oxide, CuO. $2Cu + O_2 \rightarrow 2CuO$.

18. Why do we apply paint on iron articles?

Ans. Paint keeps air and moisture away from the iron surface, so iron does not rust (corrosion is prevented).

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19. Oil and fat containing food items are flushed with nitrogen. Why?

Ans. Nitrogen is unreactive and pushes out oxygen, so the fats and oils are not oxidised and the food does not become rancid.

20. Explain the following terms with one example each. (a) Corrosion (b) Rancidity

Ans. (a) Corrosion: a metal is slowly eaten up by air, moisture or acids around it, e.g. rusting of iron (reddish-brown coat).
(b) Rancidity: oxidation of fats and oils in food, which changes its smell and taste, e.g. chips or butter left open for long smell bad.

Group activity (A–D): A: K_2SO_4 in water → temperature hardly changes / falls slightly · B: NH_4NO_3 in water → temperature falls (endothermic) · C: anhydrous $CuSO_4$ in water → temperature rises (exothermic) · D: iron fillings in $CuSO_4$ solution → temperature rises (exothermic displacement). A–C are dissolving processes; only D is a true chemical reaction.

Previous year questions ★

Answers are written the way the marking scheme gives marks; ½ / 1 show where each mark comes from.

CBSE 2020 In which of the following, the identity of initial substance remains unchanged? (a) Curdling of milk (b) Formation of crystals by process of crystallisation (c) Fermentation of grapes (d) Digestion of food 1

Ans. (b) — crystallisation is a physical change.

CBSE 2020 Assertion (A): Following is a balanced chemical equation for the action of steam on iron: $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$. Reason (R): The law of conservation of mass holds good for a chemical equation. 1

Ans. (a) Both true and R explains A — atoms are equal on both sides because mass is conserved.

CBSE 2020 When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of: (a) combination (b) displacement (c) decomposition (d) double displacement reaction 1

Ans. (d) $CuSO_4 + H_2S \rightarrow CuS\downarrow + H_2SO_4$: ions are exchanged.

CBSE 2020 In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution: (A) exchange of atoms takes place (B) exchange of ions takes place (C) a precipitate is produced (D) an insoluble salt is produced. The correct option is: (a) (B) and (D) (b) (A) and (C) (c) only (B) (d) (B), (C) and (D) 1

Ans. (d) (B), (C) and (D).

CBSE 2020 1 g of copper powder was taken in a China dish and heated. What change takes place on heating? When hydrogen gas is passed over this heated substance, a visible change is seen in it. Give the chemical equations of reactions, the name and the colour of the products formed in each case. 3

Ans. On heating, the brown surface becomes black ½: $2Cu + O_2 \rightarrow 2CuO$, copper(II) oxide, black 1
With H_2, black coating turns brown again ½: $CuO + H_2 \rightarrow Cu + H_2O$, copper (brown) and water 1

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CBSE 2020 A compound 'A' is used in the manufacture of cement. When dissolved in water, it evolves a large amount of heat and forms compound 'B'. (i) Identify A and B (ii) Write chemical equation for the reaction of A with water (iii) List two types of reaction in which this reaction may be classified 3

Ans. (i) A = calcium oxide (quick lime) CaO; B = calcium hydroxide (slaked lime) $Ca(OH)_2$ 1

(ii) $CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$ + heat 1

(iii) combination reaction; exothermic reaction ½+½

CBSE 2020 Mention with reason the colour changes observed when: (i) silver chloride is exposed to sunlight (ii) copper powder is strongly heated in the presence of oxygen (iii) a piece of zinc is dropped in copper sulphate solution 3

Ans. (i) white → grey: AgCl decomposes into silver (grey) and chlorine; $2AgCl \rightarrow 2Ag + Cl_2$ 1

(ii) brown → black: copper is oxidised to black CuO; $2Cu + O_2 \rightarrow 2CuO$ 1

(iii) blue solution → colourless and reddish-brown copper deposits on zinc: Zn displaces Cu; $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$ 1

CBSE 2020 Lead nitrate solution is added to a test tube containing potassium iodide solution. (a) Write the name and colour of the compound precipitated (b) Write the balanced chemical equation for the reaction involved (c) Name the type of this reaction justifying your answer 3

Ans. (a) Lead iodide, yellow 1 (b) $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$ 1

(c) Double displacement (also precipitation): Pb^{2+} and K^+ exchange partners and an insoluble ppt forms 1

CBSE 2020 What happens when food materials containing fats and oils are left for a long time? List two observable changes and suggest three ways by which this phenomenon can be prevented. 3

Ans. The fats/oils are oxidised and the food becomes rancid 1. Changes: unpleasant smell; changed (bad) taste ½+½. Prevention: add antioxidants; store in air-tight containers; flush packets with nitrogen / refrigerate 1

CBSE 2019 2 g of silver chloride is taken in a China dish and the China dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction. 3

Ans. White silver chloride turns grey 1. $2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$ in sunlight 1. Photolytic decomposition reaction (decomposition by light) 1

CBSE 2019 Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions. (a) Zinc reacts with silver nitrate to produce zinc nitrate and silver (b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide 2

Ans. (a) Displacement: $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$ 1

(b) Double displacement (precipitation): $2KI + Pb(NO_3)_2 \rightarrow 2KNO_3 + PbI_2$ 1

CBSE 2019 2 g of ferrous sulphate crystals are heated in a dry boiling tube. (a) List any two observations (b) Name the type of chemical reaction taking place (c) Write balanced chemical equation for the reaction and name the products formed 3

Ans. (a) green colour changes to reddish brown; smell of burning sulphur (any two, also water drops on the cooler part) ½+½

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(b) thermal decomposition ½

(c) $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$ 1; ferric oxide, sulphur dioxide, sulphur trioxide ½

Recent board questions

Tagged with year and paper code when found in the actual CBSE paper; others are seen in recent papers but not yet confirmed, so marked "Board-style".

CBSE 2025 · 31/1/1 Electrolysis of water is a decomposition reaction. The mass ratio ($M_H : M_O$) of hydrogen and oxygen gases liberated at the electrodes is: (a) 8:1 (b) 2:1 (c) 1:2 (d) 1:8 1

Ans. (d) 1:8 — volumes are 2:1, but O_2 is 16 times heavier: 2×2 g : 32 g = 1 : 8.

Board-style The values of a, b, c and d in $aPb(NO_3)_2 \rightarrow bPbO + cNO_2 + dO_2$ are respectively: (a) 1,1,2,1 (b) 1,1,1,2 (c) 2,2,1,4 (d) 2,2,4,1 1

Ans. (d) 2, 2, 4, 1 (O: 12 = 2 + 8 + 2 ✓)

Board-style Consider the cases: (A) $CaSO_4$ + Al (B) $CuSO_4$ + Ca (C) $FeSO_4$ + Cu (D) $ZnSO_4$ + Mg. New products will form in: (a) A and B (b) B and C (c) C and D (d) B and D 1

Ans. (d) — Ca is above Cu and Mg is above Zn; Al is below Ca and Cu is below Fe.

CBSE 2024 · 31/5/1 Which of the following is a redox reaction, but not a combination reaction? (a) $C + O_2 \rightarrow CO_2$ (b) $2H_2 + O_2 \rightarrow 2H_2O$ (c) $2Mg + O_2 \rightarrow 2MgO$ (d) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ 1

Ans. (d) — two products, so not combination; Fe_2O_3 reduced, CO oxidised.

Board-style Identify the reducing agent: (i) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ (ii) $H_2O + F_2 \rightarrow HF + HOF$ (iii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ (iv) $2H_2 + O_2 \rightarrow 2H_2O$ 2

Ans. (i) NH_3 (ii) H_2O (loses H) (iii) CO (iv) H_2 ½ each

Board-style What change is observed when copper powder is heated in a china dish? Name the phenomenon and write the balanced reaction. How is this different from the change observed when copper wares lose shine in moist air? 3

Ans. Brown surface turns black: $2Cu + O_2 \rightarrow 2CuO$; oxidation 2. In moist air copper slowly gets a green coat of basic copper carbonate — that is corrosion, slow and needs moisture and CO_2, while heating gives black CuO quickly 1.

From the actual CBSE papers 2023–2025 *(answers as per official marking scheme)*

CBSE 2025 · 31/1/1 Assertion (A): Decomposition reactions are generally endothermic reactions. Reason (R): Decomposition of organic matter into compost is an exothermic process. 1

Ans. (B) Both true, but R is not the correct explanation of A.

CBSE 2025 · 31/1/1 A student performs an experiment in the school laboratory (a figure of a reaction in a test tube was given). List two observations to justify that a chemical change has taken place. 2

Ans. Evolution of a gas 1; change / rise in temperature 1 (any two signs: gas, temperature, colour, precipitate, state).

CBSE 2023 · 31/4/1 When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is: (a) $KI + PbNO_3 \rightarrow PbI + KNO_3$ (b) $2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$ (c) $KI + Pb(NO_3)_2 \rightarrow PbI + KNO_3$ (d) $KI + PbNO_3 \rightarrow PbI_2 + KNO_3$ 1

Ans. (b)

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CBSE 2023 · 31/4/1 A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is: (a) X = Ca; Y = CaO; decomposition (b) X = Mg; Y = MgO; combination (c) X = Al; Y = Al_2O_3; thermal decomposition (d) X = Zn; Y = ZnO; endothermic 1

Ans. (b)

CBSE 2023 · 31/5/1 The balanced chemical equation showing reaction between quicklime and water is: (a) $2CaO + H_2O \rightarrow 2CaOH + H_2 + Heat$ (b) $CaO + H_2O \rightarrow Ca(OH)_2 + H_2 + Heat$ (c) $CaO + H_2O \rightarrow Ca(OH)_2 + Heat$ (d) $2CaO + 3H_2O \rightarrow 2Ca(OH)_3 + O_2 + Heat$ 1

Ans. (c)

CBSE 2023 · 31/5/1 Study the reaction: $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$. The reducing agent in this reaction is: (a) Na (b) H_2O (c) NaOH (d) H_2 1

Ans. (a) Na — it gives electrons/takes oxygen from water and is itself oxidised to NaOH.

CBSE 2023 · 31/4/1 (i) While electrolysing water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode. (ii) What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved. 3

Ans. (i) To make water a good conductor of electricity ½; cathode: hydrogen, anode: oxygen ½+½; volume at anode : volume at cathode = 1 : 2 ½

(ii) White silver chloride turns grey ½; photolytic decomposition reaction ½

CBSE 2023 · 31/5/1 (a) Define a double displacement reaction. (b) Write the chemical equation of a double displacement reaction which is also a (i) neutralisation reaction and (ii) precipitation reaction. Give justification for your answer. 3

Ans. (a) A reaction in which two compounds exchange their ions to form two new compounds 1

(b)(i) $NaOH + HCl \rightarrow NaCl + H_2O$ — acid + base give salt + water 1

(ii) $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$ — insoluble white $BaSO_4$ forms 1

CBSE 2024 · 31/5/1 Write a chemical equation for the reaction that occurs when the aqueous solutions of barium chloride and sodium sulphate react together. Write the symbols of the ions present in the compound precipitated in the reaction. 2

Ans. $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$ 1; ions in the precipitate: Ba^{2+} and SO_4^{2-} ½+½

Case-based questions (4 marks each)

Case 1 · The school lab electrolysis. Riya fills a plastic mug with water, adds a few drops of dilute sulphuric acid and passes current from a 6 V battery through two carbon electrodes. After 10 minutes the tube over electrode P has 20 mL of gas and the tube over electrode Q has 10 mL.

(i) Name the gas over P and over Q. (1) (ii) Which electrode is the cathode? Give a reason. (1) (iii) Write the balanced equation and the type of reaction. (2)

Ans. (i) P: hydrogen; Q: oxygen. (ii) P is the cathode (−): hydrogen is set free at the negative electrode, and it has double volume. (iii) $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$ by electricity; electrolytic

decomposition (endothermic: electrical energy is absorbed).

Case 2 · Grandma's kitchen. An opened packet of namkeen left for two weeks smells strange; the iron kadhai left wet overnight shows reddish-brown patches; a new chips packet feels "puffed up" with gas.

(i) Name the process that spoilt the namkeen. (1) (ii) Which gas fills the chips packet and why? (1) (iii) Name the change in the kadhai and two conditions it needs. Suggest one way to prevent it. (2)

Ans. (i) Rancidity: oxidation of the fats and oils. (ii) Nitrogen: it is unreactive and keeps oxygen out, so the oil does not get oxidised. (iii) Rusting (corrosion of iron); needs both oxygen (air) and moisture (water). Prevent by drying and oiling the kadhai.

Case 3 · The vanishing black. A shiny reddish-brown metal X is heated in a china dish. It turns black (compound Y). When hydrogen gas is passed over hot Y, it becomes reddish-brown again and droplets of a liquid Z appear.

(i) Identify X, Y and Z. (1) (ii) Write equations for both changes. (1) (iii) In the second change, name the substance oxidised, the substance reduced and the reducing agent. (2)

Ans. (i) X = copper, Y = copper(II) oxide (CuO), Z = water. (ii) $2Cu + O_2 \rightarrow 2CuO$ (heat); $CuO + H_2 \rightarrow Cu + H_2O$ (heat). (iii) H_2 is oxidised (gains O); CuO is reduced (loses O); reducing agent = H_2 (CuO is the oxidising agent).

Case 4 · Four test tubes. Aman sets up: A — zinc strip in $FeSO_4$ solution; B — copper strip in $ZnSO_4$ solution; C — iron nail in $CuSO_4$ solution; D — silver wire in $CuSO_4$ solution. He waits 30 minutes.

(i) In which tubes does a reaction take place? (1) (ii) Write the colour change in C with the equation. (1) (iii) Arrange Zn, Fe, Cu and Ag in decreasing reactivity and explain why B shows no change. (2)

Ans. (i) A and C. (ii) Blue → light green; brown Cu deposits on the nail: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$. (iii) Zn > Fe > Cu > Ag. Copper is less reactive than zinc, so it cannot displace zinc from $ZnSO_4$.

20 MCQs (1 mark each)

1. Which is a chemical change?
   (a) melting of ice (b) dissolving sugar (c) rusting of iron (d) evaporation of water

2. Number of oxygen atoms on the reactant side of $2Pb(NO_3)_2 \rightarrow \ldots$ is
   (a) 6 (b) 9 (c) 12 (d) 18

3. Gas set free at the cathode in electrolysis of acidified water:
   (a) O_2 (b) H_2 (c) Cl_2 (d) SO_2

4. White precipitate on mixing $BaCl_2$ and Na_2SO_4 solutions:
   (a) NaCl (b) $BaCl_2$ (c) $BaSO_4$ (d) Na_2SO_4

5. Colour of the precipitate of lead iodide:
   (a) white (b) yellow (c) green (d) black

6. Which pair will <u>not</u> react?
   (a) Zn + $CuSO_4$ (b) Fe + $CuSO_4$ (c) Cu + $FeSO_4$ (d) Mg + $ZnSO_4$

7. Chemical formula of quick lime:
   (a) $CaCO_3$ (b) $Ca(OH)_2$ (c) CaO (d) $CaCl_2$

8. In $CuO + H_2 \rightarrow Cu + H_2O$, the oxidising agent is
   (a) CuO (b) H_2 (c) Cu (d) H_2O

9. Which is endothermic?
   (a) respiration (b) burning of coal (c) CaO + water (d) decomposition of $CaCO_3$

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10. Residue left on heating ferrous sulphate is
(a) green $FeSO_4$ (b) reddish-brown Fe_2O_3 (c) black FeO (d) white SO_3

11. Chips packets are flushed with
(a) O_2 (b) H_2 (c) N_2 (d) CO_2 only for taste

12. The black coating on silver articles is
(a) Ag_2O (b) Ag_2S (c) AgCl (d) $AgNO_3$

13. The green coating on copper is
(a) CuO (b) $CuSO_4$ (c) basic copper carbonate (d) $CuCl_2$

14. $aFe + bO_2 \rightarrow cFe_2O_3$; a, b, c are
(a) 2,3,1 (b) 4,3,2 (c) 4,2,3 (d) 2,1,2

15. A reaction that is both double displacement and precipitation:
(a) $Zn + CuSO_4$ (b) $AgNO_3 + NaCl$ (c) $CaO + H_2O$
(d) $2H_2O \rightarrow 2H_2 + O_2$

16. $2H_2 + O_2 \rightarrow 2H_2O$ is a
(a) combination (b) decomposition (c) displacement (d) double displacement reaction

17. Mg ribbon is rubbed with sandpaper before burning to remove
(a) dust (b) a layer of MgO (c) moisture (d) grease

18. Volume ratio of $H_2 : O_2$ in electrolysis of water
(a) 1:1 (b) 1:2 (c) 2:1 (d) 8:1

19. "Heat" written above the arrow shows
(a) a product (b) a reactant (c) a condition (d) a catalyst only

20. In $ZnO + C \rightarrow Zn + CO$, the substance oxidised is
(a) ZnO (b) C (c) Zn (d) CO

Answer key

1 c	2 c	3 b	4 c	5 b	6 c	7 c	8 a	9 d	10 b
11 c	12 b	13 c	14 b	15 b	16 a	17 b	18 c	19 c	20 b

Why: 2 → 2 × (3 × 2) = 12 · 6 → Cu is below Fe · 8 → CuO gives O to H_2 · 14 → Fe 4 = 4, O 6 = 6 · 20 → C gains O.

Assertion–Reason (10)

(a) Both A and R true, R explains A · (b) Both true, R does not explain A · (c) A true, R false · (d) A false, R true

1. A: A chemical equation must be balanced. R: Mass can neither be created nor destroyed in a chemical reaction. → (a)
2. A: Copper displaces silver from silver nitrate solution. R: Copper is more reactive than silver. → (a)
3. A: An iron nail kept in zinc sulphate solution shows no change. R: Zinc is more reactive than iron. → (a)
4. A: Electrolysis of water is a decomposition reaction. R: A few drops of dilute sulphuric acid are added to water before electrolysis. → (b) acid only helps conduction
5. A: Burning of magnesium is an oxidation reaction. R: Magnesium gains oxygen to form MgO. → (a)
6. A: Respiration is an endothermic reaction. R: Glucose is broken down in our cells. → (d) respiration releases energy
7. A: Whitewashed walls become shiny after 2–3 days. R: Calcium hydroxide reacts with CO_2 in air to form a thin layer of calcium carbonate. → (a)
8. A: Silver bromide is used in black and white photography. R: Silver chloride turns grey in sunlight. → (b) R is true but is about AgCl
9. A: Precipitation reactions produce insoluble salts. R: In the reaction of $BaCl_2$ with Na_2SO_4, NaCl is the precipitate. → (c) $BaSO_4$ is the ppt
10. A: Fats and oils become rancid when kept open for long. R: Rancidity is the reduction of fats and oils. → (c) it is oxidation

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Give reasons (2 marks each)

1. A magnesium ribbon is cleaned before burning.

> **Ans.** It carries a layer of magnesium oxide that stops it burning; sandpaper removes it so Mg can combine with oxygen. 2

2. Silver chloride is stored in dark-coloured bottles.

> **Ans.** In light it decomposes: $2AgCl \rightarrow 2Ag + Cl_2$. Dark bottles cut off light and prevent this photolytic decomposition. 2

3. The blue colour of copper sulphate fades when an iron nail is kept in it.

> **Ans.** Iron is more reactive than copper and displaces it: $Fe + CuSO_4 \rightarrow FeSO_4$ (light green) + Cu. Fewer Cu^{2+} ions remain, so blue fades. 2

4. In electrolysis of water, the gas at one electrode is double the other.

> **Ans.** Water (H_2O) has 2 H for every O; $2H_2O \rightarrow 2H_2 + O_2$ gives 2 volumes of H_2 (cathode) per 1 volume of O_2 (anode). 2

5. Decomposition reactions are generally endothermic.

> **Ans.** Bonds in the single reactant must be broken, which needs energy in the form of heat, light or electricity — this energy is absorbed. 2

My mistakes page ✗ → ✓

Mistakes toppers have made in this chapter. Read them before every test, then add your own below.

#	✗ Wrong	✓ Right
1	$Mg + O \rightarrow MgO$	Oxygen is diatomic: $2Mg + O_2 \rightarrow 2MgO$
2	Balancing $Fe + O_2$ by writing FeO_2	Never change subscripts; change only the numbers in front
3	$KI + Pb(NO_3)_2 \rightarrow PbI + KNO_3$	Pb is +2: $2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$
4	$PbNO_3$ (brackets missing)	$Pb(NO_3)_2$ — the 2 applies to the whole NO_3 group
5	"Oxygen at cathode, hydrogen at anode"	H_2 at cathode (−), double volume; O_2 at anode (+)
6	Mass ratio $H_2 : O_2 = 2 : 1$	That is the volume ratio; mass ratio is 1 : 8
7	In $2PbO + C \rightarrow 2Pb + CO_2$, "lead is reduced"	Lead oxide is reduced; carbon is oxidised
8	Brown fumes = lead oxide	Brown fumes = NO_2
9	Calling $Fe + CuSO_4$ "double displacement"	One element + one compound → (single) displacement
10	$Zn + CuSO_4$: "solution turns green"	Turns colourless ($ZnSO_4$); green is for Fe
11	Respiration is endothermic because it happens inside the body	It releases energy → exothermic
12	Rusting needs only air	Needs air (oxygen) and water
13	Writing $H_2O(l)$ for "steam" on iron	Steam = $H_2O(g)$
14	Calcium hydroxide = quick lime	CaO = quick lime; $Ca(OH)_2$ = slaked lime; $CaCO_3$ = limestone/marble

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My own mistakes (fill after every test)

Date / test	What I wrote	What is correct

Last-night summary ★

Basics

- Reaction = new substance; signs: colour, gas, ppt, temperature, state
- Balance because of the **law of conservation of mass**
- Never change subscripts; states (s)(l)(g)(aq); conditions over the arrow

Types — one line + one equation

- **Combination**: $CaO + H_2O \rightarrow Ca(OH)_2$ + heat
- **Decomposition**
  - heat: $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$; $CaCO_3 \rightarrow CaO + CO_2$; $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$
  - electricity: $2H_2O \rightarrow 2H_2 + O_2$ (2:1 volume)
  - light: $2AgCl \rightarrow 2Ag + Cl_2$; $2AgBr \rightarrow 2Ag + Br_2$
- **Displacement**: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
- **Double displacement**: $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + 2NaCl$
- **Redox**: $CuO + H_2 \rightarrow Cu + H_2O$

Energy

- Exo: respiration, burning, CaO + water, compost
- Endo: most decompositions, photosynthesis, $Ba(OH)_2 + NH_4Cl$

Redox in one box

Oxidation = +O or −H
Reduction = −O or +H
Oxidising agent gets reduced; reducing agent gets oxidised

Reactivity series

K Na Ca Mg Al Zn Fe Pb [H] Cu Hg Ag Au — upper one displaces lower one

Colours to remember

- PbI_2 yellow · $BaSO_4$, AgCl white
- $FeSO_4$ green → Fe_2O_3 reddish brown

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- NO_2 brown fumes · AgCl → grey
- $CuSO_4$ blue → green (Fe) / colourless (Zn)
- Cu → CuO black
- rust reddish brown · Ag black · Cu green

Daily life

- **Corrosion**: prevent by paint, oil, galvanising
- **Rancidity**: prevent by antioxidants, air-tight packing, N_2 flushing, refrigeration

Common names

CaO quick lime · $Ca(OH)_2$ slaked lime · $CaCO_3$ limestone/marble · Fe_2O_3 ferric oxide · CH_3OH methanol

★ ***Exam tip:*** Before the exam, cover the right side of the colour chart and the boxed equations and try to write them from memory. If you can write all 15 boxed equations, you are ready for this chapter.

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