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CHAPTER NOTES

Chemical Reactions and Equations — Class 10 Science Notes | CBSE Chapter 1

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Chemical Reactions and Equations — Class 10 Science Notes | CBSE Chapter 1

Think about this: you strike a matchstick, and it bursts into flame. You leave your bicycle out in the rain, and it slowly turns reddish-brown with rust. You drop a fizzy tablet into water, and bubbles shoot up everywhere.

What do all these have in common? **They're all chemical reactions** — and they're happening around you every single day. In this chapter, you'll learn what chemical reactions really are, how scientists write them in a shorthand code (chemical equations), and the different types of reactions you need to know for your board exams.

Board exam tip: This chapter carries **5–8 marks** every year. The good news? It's one of the most scoring chapters once you understand the patterns.

What You'll Learn in This Chapter

- How to tell when a chemical reaction has happened
- How to write and balance chemical equations
- The 5 types of chemical reactions (with easy tricks to remember each)
- What oxidation and reduction mean in everyday life
- Why food goes stale and iron gets rusty — and how to prevent it

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Key Concepts

1. What is a Chemical Reaction?

Imagine you're cooking an egg. The runny, transparent egg white turns solid and white when heated. Can you turn it back into a raw egg? **Nope.** That's because a chemical reaction has happened — the substances have permanently changed into something new.

In chemistry terms: a **chemical reaction** is when one or more substances (called **reactants**) transform into completely new substances (called **products**).

How do you know a chemical reaction has happened?

Look for these 5 clues:

- 🎨 **Change in colour** — iron turns reddish-brown when it rusts
- 💨 **Gas is released** — vinegar + baking soda = fizzy CO_2 bubbles
- 🌡️ **Temperature changes** — burning paper releases heat

- ⚪ **A solid appears in a liquid** — this is called a *precipitate*
- 👃 **Change in smell** — milk turning sour

> **In short:** A chemical reaction = old substances → new substances. Look for colour change, gas, temperature change, precipitate, or smell change as clues.

2. Chemical Equations — The Shorthand Code

Scientists are lazy (in a good way). Instead of writing "magnesium reacts with oxygen to form magnesium oxide," they use a short code called a **chemical equation**.

Word equation:
Magnesium + Oxygen → Magnesium Oxide

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

The arrow (→) means "produces" or "gives." Reactants go on the **left**, products go on the **right**.

Symbols you'll see in equations

Symbol	Meaning
(s)	Solid
(l)	Liquid
(g)	Gas
(aq)	Dissolved in water (aqueous)
↑	Gas escapes
↓	Precipitate (solid) formed
Δ	Heat applied

> **In short:** Chemical equations are shortcuts — symbols and formulas instead of words. Reactants on the left, products on the right, arrow in the middle.

3. How to Balance a Chemical Equation

Here's a rule that nature never breaks: **atoms can't be created or destroyed**. This is called the *Law of Conservation of Mass*. So whatever atoms you start with, you must end with — no more, no less.

That's why we **balance** equations — to make sure the count of each type of atom is the same on both sides.

Step-by-step method (with example):

Unbalanced: $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

Step 1: Count atoms on each side.

Element	Left side	Right side
Fe	1	3 ✗
H	2	2 ✓
O	1	4 ✗

Step 2: Start with the element that appears in the fewest formulas. Balance Fe first → put **3** before Fe on the left.

$3Fe + H_2O \rightarrow Fe_3O_4 + H_2$

Step 3: Balance O → put **4** before H_2O.

$3Fe + 4H_2O \rightarrow Fe_3O_4 + H_2$

Step 4: Now H is off (8 on left, 2 on right) → put **4** before H_2.

$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

Final check: Fe: 3=3 ✓ | H: 8=8 ✓ | O: 4=4 ✓

Balanced: $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

Golden rule: Only add numbers *before* formulas (coefficients). Never change the formula itself — that changes the substance!

> **In short:** Balancing = making atom counts equal on both sides. Count atoms → add coefficients → recheck. Never change the chemical formula.

4. Types of Chemical Reactions

There are **5 types** you need to know. Here's an easy way to remember them all:

a) Combination Reaction — "Two become one"

Two or more substances join together to form a **single** new substance.

Pattern: A + B → AB

Real-life example: When quicklime (CaO) is added to water, it gets really hot and forms slaked lime. This is why construction workers feel heat when they mix cement!

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

b) Decomposition Reaction — "One breaks into many"

A single substance breaks apart into two or more simpler substances. It's the **opposite** of combination.

Pattern: AB → A + B

What causes it to break apart? Three things:

- **Heat** (thermal decomposition) — $2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$
- **Electricity** (electrolytic decomposition) — $2H_2O \xrightarrow{electricity} 2H_2 + O_2$
- **Sunlight** (photolytic decomposition) — $2AgBr \xrightarrow{sunlight} 2Ag + Br_2$

Fun fact: The silver bromide reaction is why old-school camera film works — light breaks the chemical and leaves silver behind, creating your photo!

c) Displacement Reaction — "The bully kicks someone out"

A more reactive element pushes out a less reactive element from its compound. Think of it like the class bully taking someone's seat.

Pattern: A + BC → AC + B (A is more reactive than B)

Real-life example: Drop an iron nail into blue copper sulphate solution. Wait an hour. The solution turns **green** and the nail gets coated in **reddish-brown copper**.

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

Iron is more reactive than copper, so it kicks copper out.

d) Double Displacement Reaction — "Partner swap"

Two compounds swap their partners (ions) to form two completely new compounds. Like a dance where pairs exchange partners.

Pattern: AB + CD → AD + CB

Example:

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

A white solid ($BaSO_4$) suddenly appears in the liquid — that's the precipitate. So this is also called a **precipitation reaction**.

e) Oxidation and Reduction (Redox Reactions)

This is less about "what reacts" and more about "what happens to the atoms."

- **Oxidation** = Gain of oxygen OR loss of hydrogen OR loss of electrons
- **Reduction** = Loss of oxygen OR gain of hydrogen OR gain of electrons

Memory trick: *OIL RIG* — Oxidation Is Loss, Reduction Is Gain (of electrons)

They always happen together. If one substance gets oxidised, another gets reduced — that's why it's called a **redox reaction**.

Example:
$CuO + H_2 \rightarrow Cu + H_2O$

- CuO **loses oxygen** → it's **reduced**
- H_2 **gains oxygen** → it's **oxidised**

> **In short:** 5 reaction types — Combination (A+B→AB), Decomposition (AB→A+B), Displacement (bully kicks out), Double Displacement (partner swap), Redox (oxygen/hydrogen/electron transfer). Use the memory tricks!

5. Oxidation in Daily Life — Corrosion and Rancidity

Corrosion — When metals slowly "rot"

Leave an iron gate in the rain and it slowly turns reddish-brown. That's **rusting** — a type of corrosion.

$4Fe + 3O_2 + xH_2O \rightarrow 2Fe_2O_3 \cdot xH_2O$ (rust)

It's not just iron — silver turns black (tarnishing), copper turns green (patina on old statues).

How to prevent corrosion:

- **Painting or oiling** — blocks air and moisture
- **Galvanising** — coating iron with a layer of zinc
- **Alloying** — mixing with other metals (stainless steel = iron + chromium + nickel)

Rancidity — When food goes "off"

Ever opened a packet of chips and it smelled weird and tasted terrible? The fats and oils in the food got oxidised. This is **rancidity**.

How to prevent rancidity:

- Store food in **airtight containers** (no oxygen = no oxidation)
- Add **antioxidants** (like BHA, BHT in packaged food)
- **Refrigerate** — cold slows down oxidation
- **Nitrogen flushing** — chip packets are filled with nitrogen gas instead of air

In short: Corrosion = slow oxidation of metals (rust, tarnish). Rancidity = oxidation of food fats (bad smell/taste). Both are preventable — block the oxygen!

Important Definitions

Term	What It Means (Plain English)
Chemical reaction	A process where substances change into completely new substances
Reactant	The starting substance (left side of the equation)
Product	The new substance formed (right side of the equation)
Chemical equation	A shorthand way to write a reaction using symbols and formulas
Balanced equation	An equation where atom counts are equal on both sides
Catalyst	A substance that speeds up a reaction without getting used up itself
Exothermic reaction	A reaction that releases heat (feels hot)
Endothermic reaction	A reaction that absorbs heat (feels cold)
Oxidation	Gain of oxygen / loss of hydrogen / loss of electrons
Reduction	Loss of oxygen / gain of hydrogen / gain of electrons
Redox reaction	A reaction where oxidation and reduction happen at the same time
Precipitate	A solid that appears when two liquids react together
Corrosion	Slow destruction of metal by air and moisture (e.g., rusting)
Rancidity	Food fats getting oxidised, causing bad smell and taste

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Solved Examples (Step-by-Step)

Example 1: Balance this equation

$H_2 + O_2 \rightarrow H_2O$

Let's work through it:

Step 1: Count atoms.
Left: H=2, O=2 | Right: H=2, O=1

Oxygen doesn't match.

Step 2: Put 2 before H_2O → $H_2 + O_2 \rightarrow 2H_2O$
Now: Left: H=2, O=2 | Right: H=4, O=2
Oxygen matches now, but hydrogen doesn't.

Step 3: Put 2 before H_2 → $2H_2 + O_2 \rightarrow 2H_2O$
Left: H=4, O=2 | Right: H=4, O=2 ✓ Balanced!

Answer: $2H_2 + O_2 \rightarrow 2H_2O$

Example 2: Identify the reaction type

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

Think: Zinc is alone on the left. It reacts with a compound and pushes hydrogen out. One element replacing another = **displacement reaction**.

(Zinc is more reactive than hydrogen in the reactivity series.)

Example 3: Identify oxidation and reduction

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

Look at what happened:

- HCl lost its hydrogen → **HCl is oxidised**
- MnO_2 lost its oxygen → **MnO_2 is reduced**

Since both happened in one reaction → this is a **redox reaction**.

Important Questions for Board Exams

1-Mark Questions

1. What is a chemical equation?
2. Define a combination reaction with one example.
3. What is a displacement reaction?
4. What type of reaction happens when silver chloride turns grey in sunlight?
5. Define rancidity.

2-Mark Questions

1. Explain the difference between exothermic and endothermic reactions with one example each.

2. Why is it necessary to balance a chemical equation?
3. What happens when iron nails are placed in copper sulphate solution? Write the equation.
4. What is corrosion? Give two ways to prevent it.
5. Why are chip packets flushed with nitrogen gas?

3-Mark Questions

1. Balance: $Fe_2O_3 + Al \rightarrow Al_2O_3 + Fe$. Name the reaction type.
2. Explain the thermite reaction. What type of reaction is it?
3. What is a double displacement reaction? Give one example with a balanced equation.
4. Distinguish between oxidation and reduction with examples.
5. List five observations that indicate a chemical reaction has taken place.

5-Mark Questions

1. Write and balance the equations for: (a) burning of magnesium ribbon (b) electrolysis of water (c) reaction of zinc with dilute H_2SO_4. Identify each reaction type.
2. Describe all five types of chemical reactions with one balanced equation for each.

Quick Revision — Read This Before Your Exam

Scan this in 2 minutes to refresh everything:

- Chemical reactions create **new substances** — look for colour change, gas, temperature change, precipitate, or smell change
- Chemical equations: reactants on left → products on right
- Balancing is based on the **Law of Conservation of Mass** — atoms in = atoms out
- **Combination:** A + B → AB (two become one)
- **Decomposition:** AB → A + B (one breaks into many) — caused by heat, electricity, or light
- **Displacement:** More reactive element kicks out less reactive one
- **Double Displacement:** Two compounds swap ions — often forms a precipitate
- **Redox:** Oxidation (gain O_2 / lose H_2 / lose e^-) + Reduction (opposite) happen together
- **Memory trick:** OIL RIG — Oxidation Is Loss, Reduction Is Gain (of electrons)
- **Corrosion** = slow oxidation of metals (prevent: paint, galvanise, alloy)
- **Rancidity** = oxidation of food fats (prevent: airtight, antioxidants, refrigerate, nitrogen flush)

Test Your Understanding

Let's check how well you understood this chapter. Pick your answer for each question, then check the answer to see if you're right!

Q1. Which of the following is NOT a sign that a chemical reaction has occurred?

a) Change in colour
b) Change in shape of the container
c) Evolution of a gas
d) Change in temperature

▶ **Click to see answer**

Q2. In the equation $2Mg + O_2 \rightarrow 2MgO$, the reactants are:

a) MgO
b) Mg and O_2
c) Mg and MgO
d) O_2 and MgO

▶ **Click to see answer**

Q3. The Law of Conservation of Mass states that:

a) Energy cannot be created or destroyed
b) Mass is always gained in a reaction
c) Atoms cannot be created or destroyed in a chemical reaction
d) Products always weigh more than reactants

▶ **Click to see answer**

Q4. $CaO + H_2O \rightarrow Ca(OH)_2$ is an example of:

a) Decomposition reaction
b) Displacement reaction
c) Combination reaction
d) Double displacement reaction

▶ **Click to see answer**

Q5. When silver bromide is exposed to sunlight, it decomposes. This is called:

a) Thermal decomposition
b) Electrolytic decomposition
c) Photolytic decomposition
d) Displacement reaction

▶ **Click to see answer**

Q6. In the reaction $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$, iron displaces copper because:

a) Iron is cheaper than copper
b) Iron is more reactive than copper
c) Iron is less reactive than copper
d) Copper is a gas

▶ **Click to see answer**

Q7. A white precipitate of $BaSO_4$ forms when Na_2SO_4 reacts with $BaCl_2$. This is a:

a) Combination reaction
b) Decomposition reaction
c) Displacement reaction
d) Double displacement reaction

▶ **Click to see answer**

Q8. In the reaction $CuO + H_2 \rightarrow Cu + H_2O$, which substance is oxidised?

a) CuO
b) H_2
c) Cu
d) H_2O

▶ **Click to see answer**

Q9. What is OIL RIG a memory trick for?

a) Types of chemical reactions
b) How to balance equations
c) Oxidation Is Loss, Reduction Is Gain (of electrons)
d) Order of reactivity of metals

▶ **Click to see answer**

Q10. Chip packets are filled with nitrogen gas to:

a) Make the packet look bigger
b) Add flavour to the chips
c) Prevent oxidation of fats (rancidity)
d) Keep the chips warm

▶ **Click to see answer**

Q11. The green coating that forms on copper over time is due to:

a) Rancidity
b) Rusting
c) Corrosion
d) Decomposition

▶ **Click to see answer**

Q12. Which method can prevent rusting of iron?

a) Keeping it in water
b) Galvanising (coating with zinc)
c) Exposing it to moist air
d) Adding salt water to it

▶ **Click to see answer**

How did you do? Scored 10+ out of 12? You've nailed this chapter! Below 10? Go back and re-read the sections you got wrong — you'll get there.

Next Chapter: Chapter 2 — Acids, Bases and Salts