NCEA
BY CLASS24

Chemical Reactions

Foundations & First Clues

Understanding the invisible world of changes and conservation.

Is it a Physical or Chemical Change?

Physical Change

Only the shape, size, or state changes. The substance stays the same. (e.g., Tearing paper, melting ice).

Chemical Reaction

Atoms rearrange to create a brand-new substance. Usually irreversible. (e.g., Baking, burning, rusting).

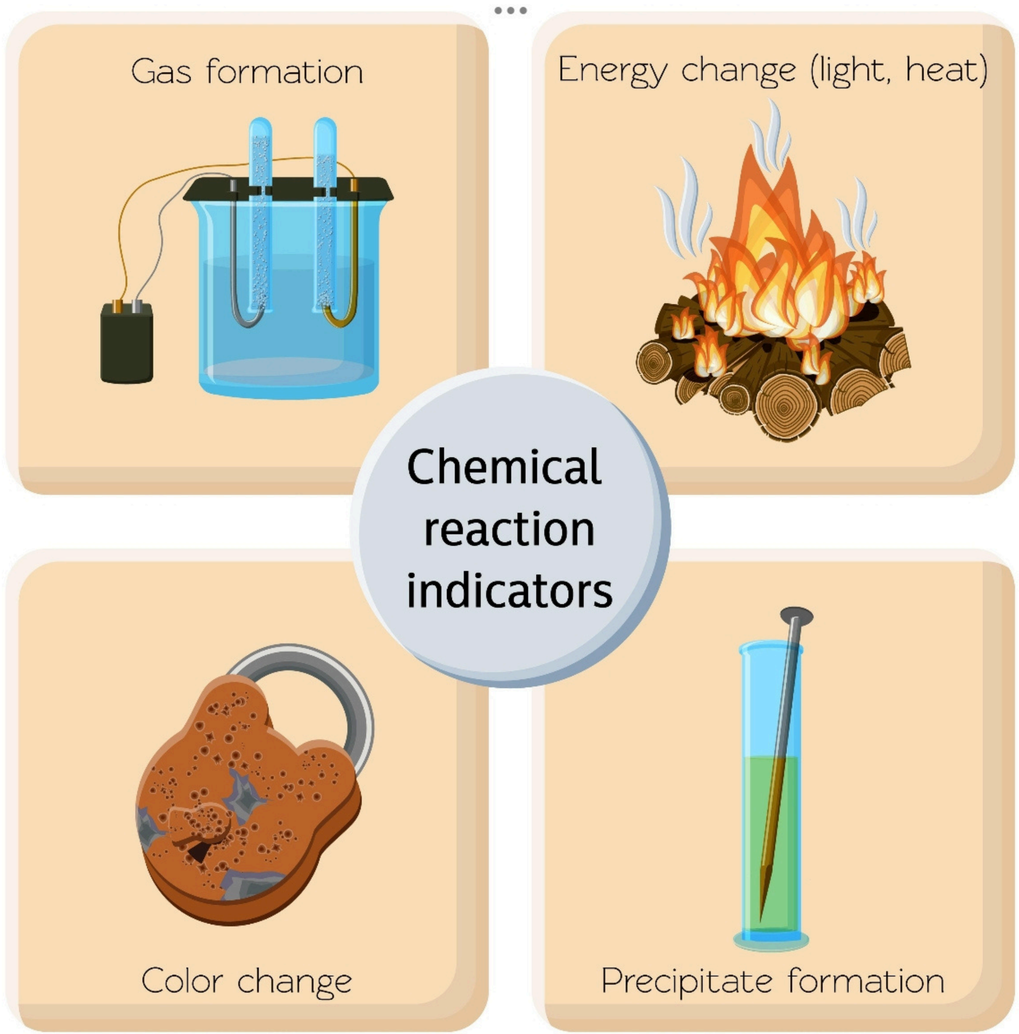
Reversibility

Physical changes are easy to undo. Chemical reactions are permanent "break-and-remake" events.

Detailed Comparison Table

Feature	Physical Change	Chemical Reaction
New Substance?	No, ingredients stay same	Yes, brand-new stuff formed
Molecular Level	Molecules just move closer/apart	Bonds break & new ones form
Energy	Minimal energy change	Significant Heat, Light, or Sound
Examples	Melting wax, breaking glass	Cooking an egg, fireworks

4 Clues: The Science Detective



- **Color Change:** Sliced apples turning brown or leaves changing color in Autumn.
- **Gas Formation:** Bubbles, fizzing, or smoke appearing suddenly.
- **Solid Forming:** A "precipitate" (chunky solid) appearing in a clear liquid.
- **Temp/Light Change:** Heat released (Hot) or absorbed (Cold).

Hot vs Cold: Energy in Action

Exothermic

Heat is RELEASED

Energy leaves the reaction. It feels **HOT** to the touch.

- Campfires & Fireworks
- Respiration in our cells

Endothermic

Energy is ABSORBED

Heat is taken in. The surroundings feel **COLD**.

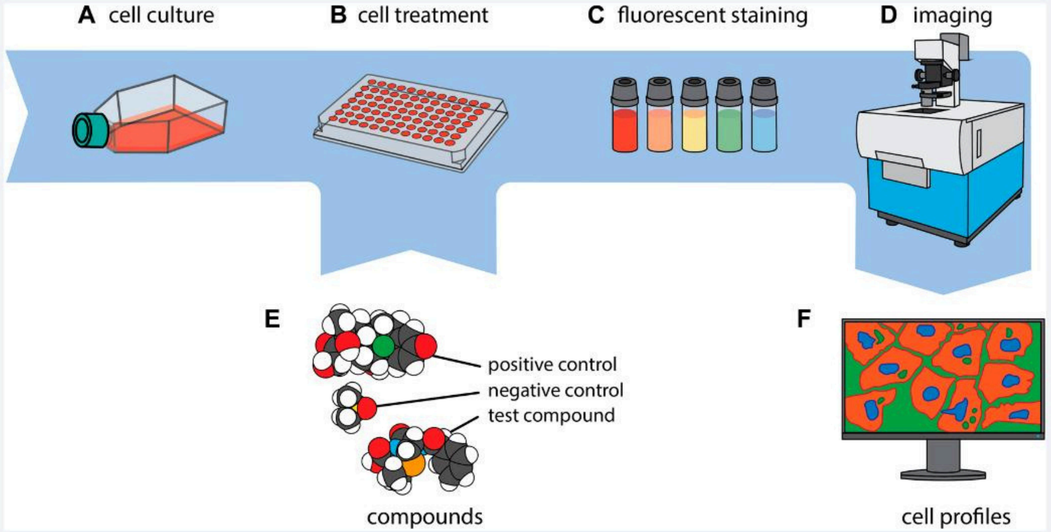
- First-aid Cold Packs
- Photosynthesis in plants

Law of Conservation of Mass

"What goes in, must come out." Atoms are never lost or created from thin air; they just swap partners.

Reactants → Products
100g Iron + 50g Oxygen = 150g Rust

Even if gas escapes, its weight is still part of the equation! Everything must be balanced.



Type 1 & 2: Marriage vs Breakup

1. Combination (Marriage)

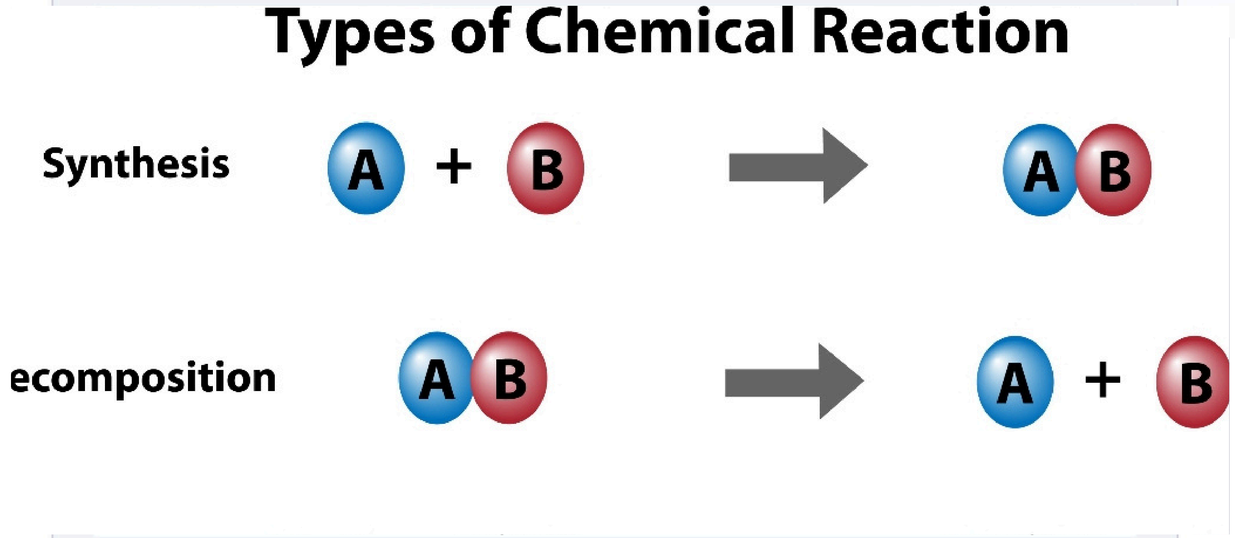
Two substances become one.

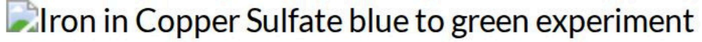
$$A + B \rightarrow AB$$

2. Decomposition (Breakup)

One complex substance breaks into two.

$$AB \rightarrow A + B$$



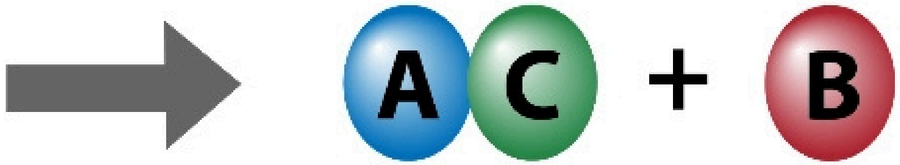


Type 3: Single Displacement

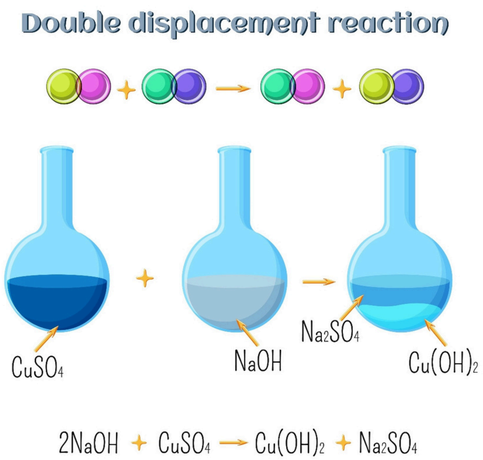
This is the **"Bully"** reaction. A stronger (more active) element kicks out a weaker one.

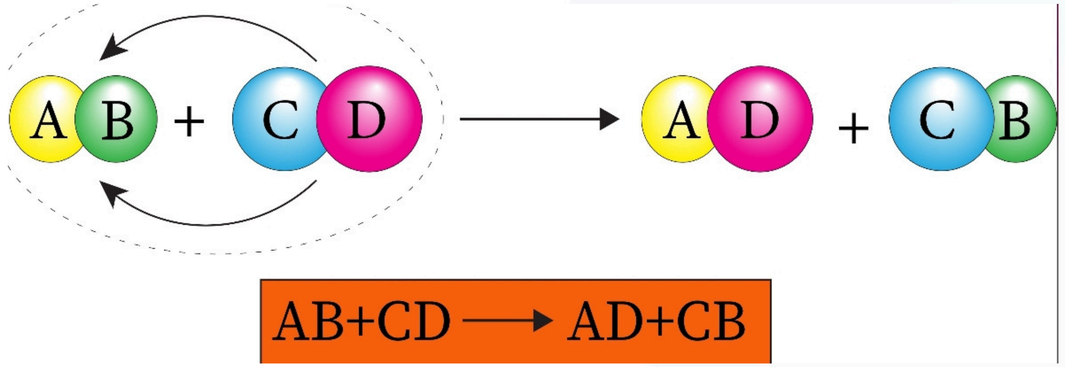
$$A + BC \rightarrow AC + B$$

Iron in Copper Sulfate: Iron is stronger than Copper. It kicks copper out, changing the solution from Blue to Green!



Type 4: Double Displacement





The "Partner Swap"

Two compounds trade partners to form two new compounds. Often creates a solid precipitate.

$$AB + CD \rightarrow AD + CB$$

Example: Lead Nitrate + Potassium Iodide → Lead Iodide (Bright Yellow Solid!)

Type 5: Redox Reactions

Oxidation & Reduction

One loses, one gains! Use the mnemonic:

OIL: Oxidation Is Loss (of electrons)

RIG: Reduction Is Gain (of electrons)

Rusting is a classic redox reaction where Iron "loses" electrons to Oxygen.