



AMBITION INSTITUTE

CLASS 10TH

CHAPTER 1

REACTIONS AND EQUATIONS

Every reaction
tells a story...
Let's discover
it together! 😊

Let's React, Balance and Understand
the Language of Chemistry! ☆

Observe
Think
Predict
Understand
Grow!

$$\text{A} + \text{B} \rightarrow \text{C} + \text{D}$$

Reactants Products



CHEMICAL REACTIONS



IN SHORT

- No. of atoms remain same.
- Reactants and Products both present.
- Physical state of elements, atoms, acids/alkalis, aqueous/ions are usually indicated.

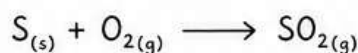
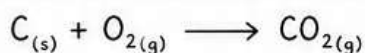
Note

Skeletal (skeleton) equations are usually unbalanced equations but there are few which need not to be balanced as they are already balanced e.g.

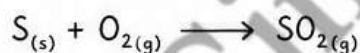
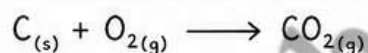
♥ Science Class - 10



SKELETON EQUATION



BALANCED EQUATION



➤ The process in which new substances with new properties are formed is called **Chemical Reaction**.



➤ The substances which take part in a chemical reaction are called **Reactants**.

➤ The substances which are formed in a chemical reaction are called **Products**.

EXAMPLES

- Digestion of food
- Respiration
- Rusting of iron
- Burning of Magnesium ribbon
- Formation of curd

CHEMICAL REACTION INVOLVES

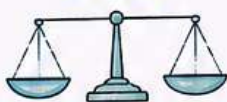
- Change in state
- Change in colour
- Change in temperature
- Evolution of gas

Tip!

Look for signs around you! That's how chemistry happens.

ADDITIONAL INFO (GOOD TO KNOW!)

Law of Conservation of Mass



Mass can neither be created nor destroyed in a chemical reaction.

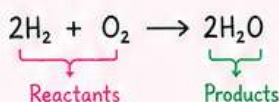
States of Matter

(s) Solid (l) Liquid
(g) Gas (aq) Aqueous

These are written in equations.

Balancing Equation

Make sure number of atoms of each element is same on both sides.



Why Important?

Helps us understand, predict and control chemical changes in daily life.

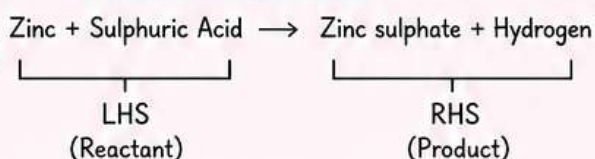




WAYS OF REPRESENTING A CHEMICAL REACTION

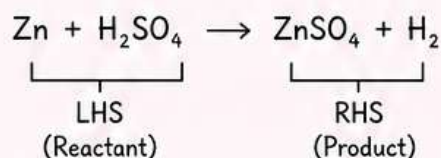


WORD EQUATION

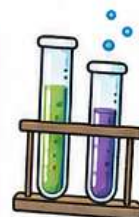


★ Uses names of substances.

CHEMICAL EQUATION



★ Uses chemical symbols and formulae.

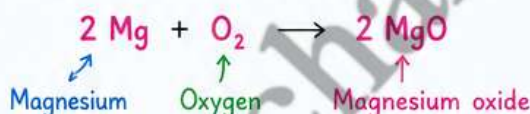


CHEMICAL EQUATION



- ★ A chemical reaction can be represented by chemical equation. It involves uses of symbol of elements or chemical formula of reactant and product with mention of physical state.
- ★ The necessary conditions such as temperature, pressure or any catalyst should be written on arrow between reactant and products.

e.g., Magnesium is burnt in air to form Magnesium oxide.



TIP!

Physical states are shown as:
(s) Solid
(l) Liquid
(g) Gas
(aq) Aqueous

BALANCING CHEMICAL EQUATION



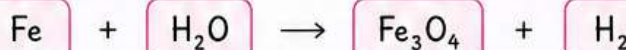
Mass of reactants
= Mass of products

- ✓ Law of conservation of Mass : Matter can neither be created nor be destroyed in a chemical reaction.
- ✓ So number of atoms of the elements involved in chemical reaction should remain same at reactant and product side.



STEPWISE BALANCING (Hit and Trial)

STEP 1 Write a chemical equation and draw boxes around each formula.



Do not change anything inside the box.



STEP 2 Count the number of atoms of each element on both the sides of chemical equation.

LHS (Reactant Side)	Element	RHS (Product Side)
1	Fe	3
2	H	2
1	O	4



Atoms are not same on both sides.
So we need to balance!

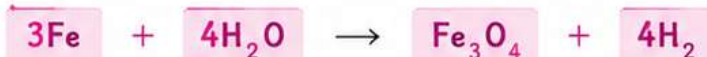
STEP 3 Equalise the number of atoms of element which has maximum number by putting in front of them.



We start with the element that appears the most!



STEP 4 Try to equalize all the atoms of elements on reactant and product side by adding coefficient in front of them.



✓ Now all the atoms of elements are equal on both sides.

Tip!

Add coefficients (don't change subscripts).

STEP 5 Write the physical states of reactants and products.



Physical States



(s)

Solid state



(l)

Liquid state



(g)

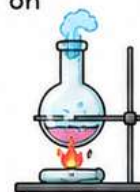
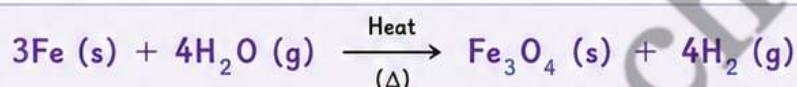
Gaseous state



(aq)

Aqueous state

STEP 6 Write necessary conditions of temperature, pressure or catalyst on arrow above or below.



Conditions may be :

- ✓ Heat / Temperature (Δ)
- ✓ Pressure (P)
- ✓ Catalyst (e.g. MnO_2)
- ✓ Light ($h\nu$)

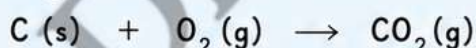
TYPES OF CHEMICAL REACTIONS

I. COMBINATION REACTION : The reaction in which two or more reactants combine to form a single product.

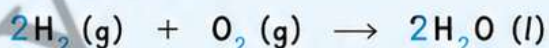
e.g.



(i) Burning of coal



(ii) Formation of water



(iii) $\text{CaO (s)} + \text{H}_2\text{O (l)} \rightarrow \text{Ca(OH)}_2 \text{ (aq)}$

Quick lime

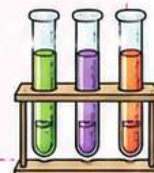
Slaked lime

General form
 $\text{A} + \text{B} \rightarrow \text{C}$



Key Points

- ✓ Two or more $\rightarrow$ one
- ✓ Simple and common type of reaction
- ✓ Usually release heat (exothermic)



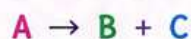
Exothermic Reactions : Reaction in which heat is released along with formation of products.

Example : Burning of coal, burning of magnesium, neutralization etc.

II. DECOMPOSITION REACTION

The reaction in which a compound splits into two or more simple substances is called decomposition reaction.

General form

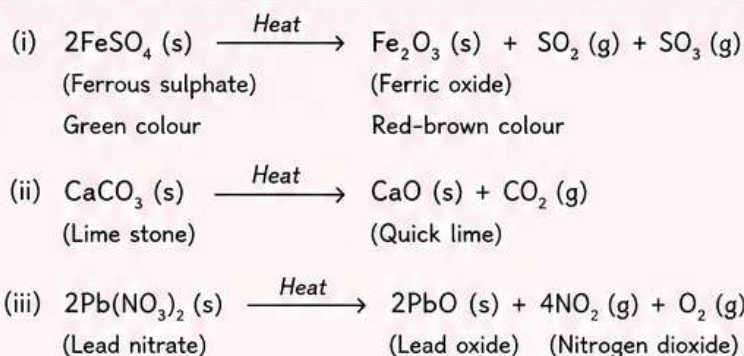


The decompositions are mostly endothermic in nature. Energy in the form of heat, light or electricity is generally absorbed in these reactions.



1. THERMAL DECOMPOSITION : When decomposition is carried out by heating.

Examples

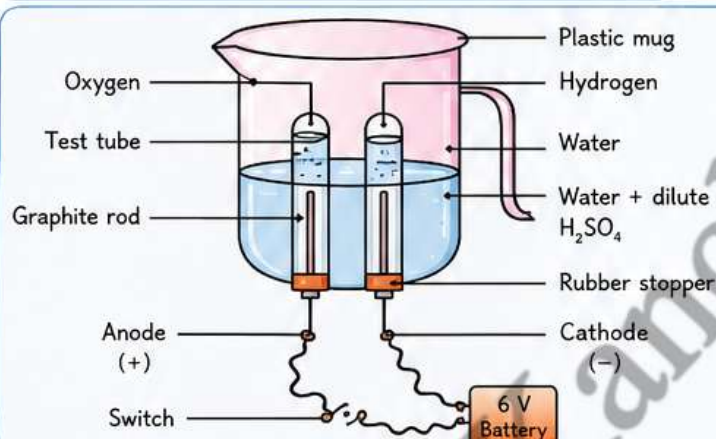


Key Points

- ✓ Heat is supplied.
- ✓ Generally requires high temperature.
- ✓ Mostly endothermic in nature.



2. ELECTROLYTIC DECOMPOSITION : When decomposition is carried out by passing electricity.



What happens?

- Water is decomposed into hydrogen and oxygen gas.
- Hydrogen collects at cathode (-).
- Oxygen collects at anode (+).

Key Points

- ✓ Electricity is passed through the electrolyte.
- ✓ Electrolyte used here: Water + dilute H_2SO_4
- ✓ Endothermic reaction.



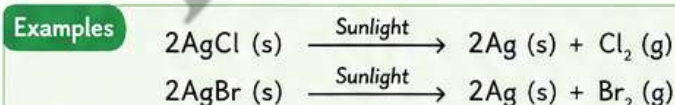
3. PHOTOLYTIC DECOMPOSITION : When decomposition is carried out in presence of sunlight.



- Silver chloride turns grey on exposure to sunlight.
- Above reactions are used in black and white photography.



4. ENDOTHERMIC REACTIONS : The reactions which require energy in the form of heat, light or electricity to break reactants are called endothermic reactions.



Key Points

- ✓ Energy is absorbed.
- ✓ Temperature of surroundings decreases.
- ✓ Mostly decomposition reactions are endothermic.

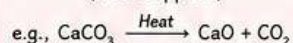


QUICK RECAP



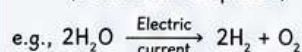
Thermal Decomposition

By heating
(Heat supplied)



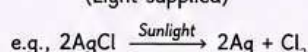
Electrolytic Decomposition

By electricity
(Electric current passed)



Photolytic Decomposition

By sunlight
(Light supplied)

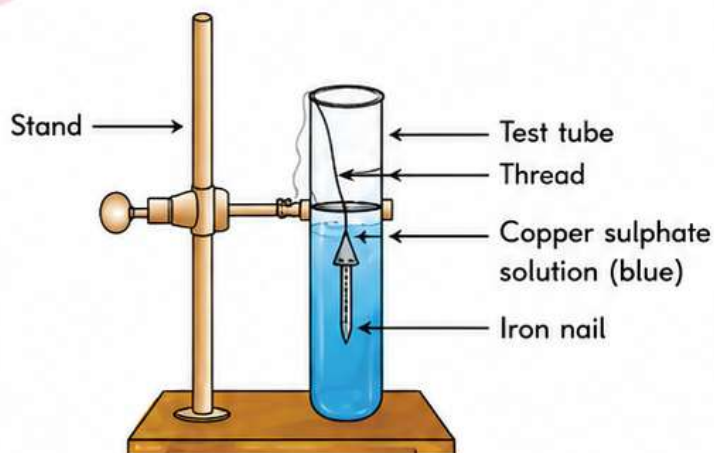
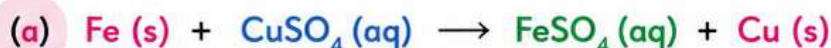


Endothermic Reactions

Energy absorbed
(Heat / light / electricity)

e.g., Decomposition reactions

III. DISPLACEMENT REACTION



The iron nail becomes brownish in colour by deposition of Cu and blue colour of CuSO_4 changes to dirty green colour due to formation of FeSO_4 .



★ Zn is more reactive than copper.

The chemical reaction in which **more** reactive element displaces less reactive element from its salt solution.



What happens?



- Copper (Cu) gets deposited on the iron nail.



- Blue colour of CuSO_4 solution changes to dirty green due to formation of FeSO_4 .

Activity in daily life

Displacement reactions are used in extraction of metals from their ores.



IV. DOUBLE DISPLACEMENT REACTION



(Sodium sulphate)

(Barium chloride)

(Barium sulphate)

(Sodium chloride)



+



→



+



Na_2SO_4
(aq)

BaCl_2
(aq)

BaSO_4
(s)

2NaCl
(aq)

What happens?

- ✓ White precipitate of BaSO_4 is formed.



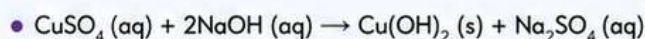
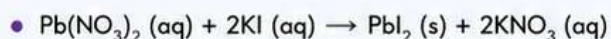
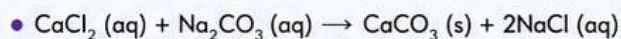
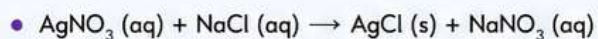
White precipitate

★ White precipitate of BaSO_4 is formed, so it is also called precipitation reaction.

A reaction in which new compounds are formed by mutual exchange of ions between two compounds.



Examples of other double displacement reactions





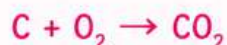
V. OXIDATION AND REDUCTION



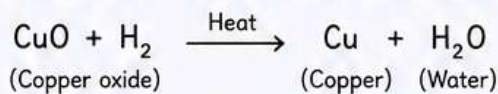
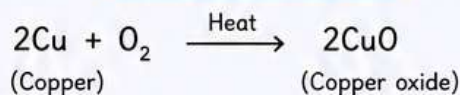
OXIDATION

- ★ (i) The addition of oxygen to reactant.
- ★ (ii) The removal of hydrogen from a reactant.

General Representation



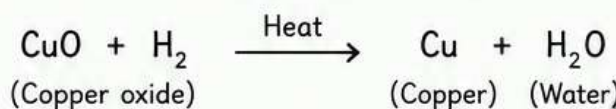
Examples of Oxidation



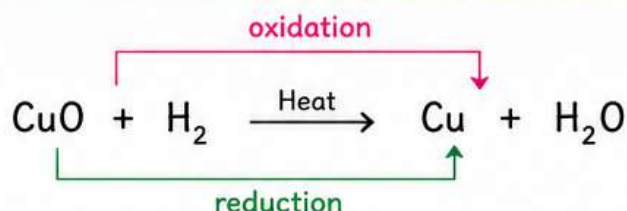
REDUCTION

- ★ (i) The addition of hydrogen to reactant.
- ★ (ii) The removal of oxygen from a reactant.

Example of Reduction



Oxidation and Reduction Together (Redox Reaction)



In this reaction **CuO** is reduced to **Cu** and **H₂** is oxidized to **H₂O**. So, oxidation and reduction taking place together is redox reaction.



Oxidation and reduction occur simultaneously in a redox reaction!

EFFECTS OF OXIDATION IN DAILY LIFE

1 CORROSION

- When a metal is exposed to moisture, air, acid etc. for some time, a layer of hydrated oxide is formed which weakens the metal and hence metal is said to be corroded.
- Rusting of iron, black coating on silver and green coating on copper are examples of corrosion.
- Corrosion can be prevented by **galvanization**, electroplating or by **applying paints**.

Ways to Prevent Corrosion



Galvanization
(zinc coating)



Electroplating
(chrome coating)



Applying
paints

Examples of Corrosion

Rusting of iron



Black coating
on silver

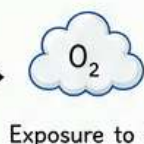


Green coating
on copper



2 RANCIDITY

The oxidation of fats and oils when exposed to air is known as rancidity. It leads to bad smell and bad taste of food.



Exposure to air



Rancidity



Bad smell
Bad taste

Methods to Prevent Rancidity



- (i) By adding antioxidants



- (ii) Keeping food in air tight containers