



Types of Changes on Basis of Change in Chemical Composition Or chemical built-up

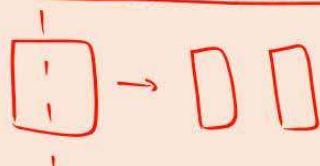
A process in which the final state of substance is different from its initial or original state is called a change.

new substance is formed with different chemical composition

PHYSICAL CHANGE

- No change in chemical composition or chemical built-up of substance.
- Change in physical properties like shape, size, physical state etc.

Example: Melting of ice, Cutting of paper etc.



CHEMICAL CHANGE

- Change in chemical composition or chemical built-up of substance.
- Change in physical properties like shape, size, physical state etc. (can also happen in C.C.)

Example: Rusting of iron, Combustion of charcoal etc. $\text{Iron} + \text{Oxygen} + \text{Water} \rightarrow \text{Rust}$
Vapour

Process of chemical change is known as a chemical reaction.



Characteristics of a Chemical Reaction



Visible indicators that tell whether a rxn has occurred or not

- Change in colour
- Formation of precipitate (insoluble solid)

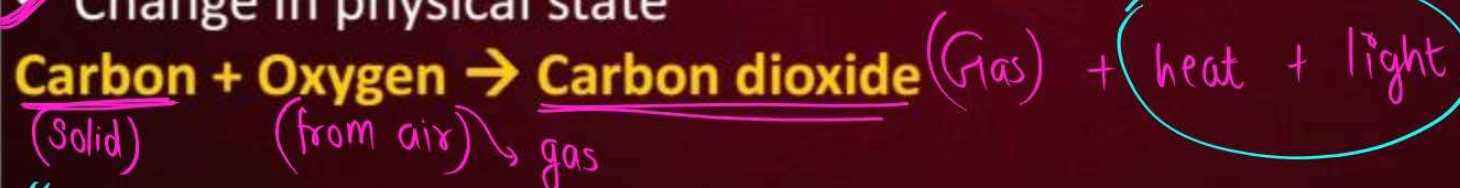


↓ Colourless Soln

↓ White precipitate

↓ Colourless Soln

- Evolution of gas
- Change in physical state



- Change in temperature (Energy is released majorly in form of heat it is called exothermic reaction while energy is given/absorbed majorly in form of heat is called endothermic reaction).



Example of Endothermic and Exothermic Reactions



exit of heat

EXOTHERMIC REACTIONS

- Burning of natural gas, hydrogen gas etc.
- Respiration
- Decomposition of vegetable matter into compost
- Rusting of iron

entry of heat

ENDOTHERMIC REACTIONS

- → Photosynthesis (Sunlight)
- → Thermolysis of lead nitrate, calcium carbonate etc.
- → Electrolysis of water
- → Photolysis of silver chloride and silver bromide



Balancing and Need to Balance a Chemical Equation



WAYS TO REPRESENT A CHEMICAL REACTION

❶ Word Equation:

Representing a chemical reaction through words.

❷ Skeletal Chemical Equation:

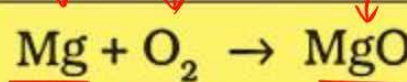
In this reactants and products are represented by chemical symbols and formulae. Number of atoms on reactant side is not equal to product side.

• Balanced Chemical Equation:

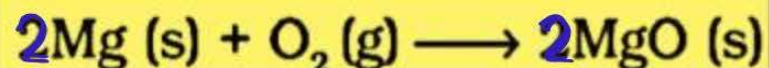
In this number of atoms on reactant side are equal to the product side. This is done so that it follows the law of conservation of mass, i.e. mass of reactants is equal to mass of products.

EXAMPLES

Magnesium + Oxygen → Magnesium oxide
(Reactants) (Product)



Unbalanced / Skeletal
C.E.

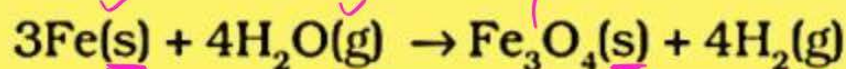




Making Chemical Equations Informative – After Balancing



(i) Physical States of Reactants and Products

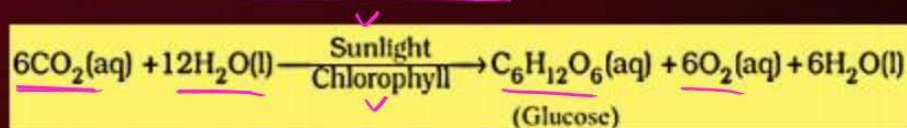
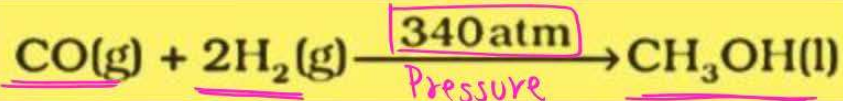


Steam / water-vapour

$\text{FeO} \cdot \text{Fe}_2\text{O}_3$

Physical state	Symbol
Solid	(s)
Liquid	(l)
Gas	(g) or (↑) → gas is evolved
Aqueous solution (Water as solvent)	(aq)
Precipitate	(ppt.) or (↓) or (s)

(ii) Sometimes the reaction conditions, such as temperature, pressure etc., for the reaction are indicated above and/or below the arrow in the equation





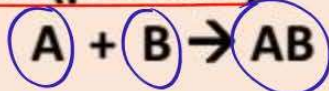
Types of Chemical Reactions



TYPE OF REACTION

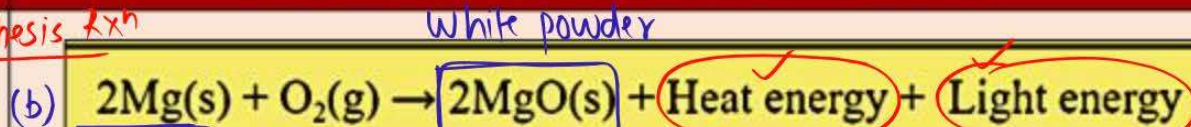
Combination Reaction

A chemical reaction in which **two or more elements or compounds (reactants)** react to form a **single compound (product)**.



Exothermic rxn

REACTION DETAILS AND EXAMPLES



Strongly heating Mg ribbon in air

dazzling white flame

Important to Remember: (20.95% in air)

(a) Magnesium reacts with oxygen present in air to form a white layer of magnesium oxide on its surface.

Hence, it is cleaned with a sandpaper before burning.

(c) When magnesium ribbon burns in air, dazzling white light is produced which contain ultraviolet light that can cause photokeratitis or it can permanently damage the eye. To avoid this it is advised to wear an eye protection.



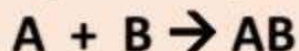
Types of Chemical Reactions



TYPE OF REACTION

Combination Reaction

A chemical reaction in which **two or more elements or compounds (reactants)** react to form **a single compound (product)**.



$CaCO_3 \rightarrow$ common names
[limestone, marble,
chalk]

REACTION DETAILS AND EXAMPLES

$CaO(s)$
(Quick lime)

+

$H_2O(l)$

Lime / Burnt
lime

$\rightarrow Ca(OH)_2(aq)$
(Slaked lime)

+ heat

Observations:

- ✓ It is a very fast reaction (vigorous).
- ✓ Heat is evolved (exothermic reaction).
- ✓ Water boils to form steam and produces a hissing sound with bubbles.

Important to Remember:

A solution of slaked lime is used for whitewashing the walls.
After 2-3 days of whitewash, a thin layer of calcium carbonate (shiny finish) on the walls.

$Ca(OH)_2(aq) + CO_2(g)$

\rightarrow

$CaCO_3(s)$

+ $H_2O(l)$

evaporates



Types of Chemical Reactions



TYPE OF REACTION

Decomposition Reaction

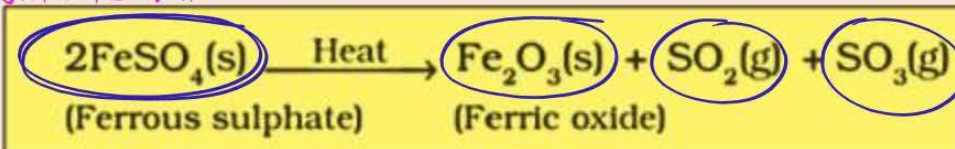
A chemical reaction in which a single compound breaks down into two or more elements or compounds when the energy is supplied in the form of heat, electricity or sunlight.



↙
Inverse of
Combination
Rxn

REACTION DETAILS AND EXAMPLES

Endothermic Rxn



The above reaction is an example of thermolytic decomposition reaction or thermolysis.

Observations:

- Ferrous sulphate crystals lose water and colour changes from pale green ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) to white (FeSO_4) on heating.
- Further heating decomposes FeSO_4 to Fe_2O_3 (reddish-brown), SO_3 and SO_2 gas (smell similar to the smell of burnt matches).



Precautions While Performing Thermal Decomposition Reactions

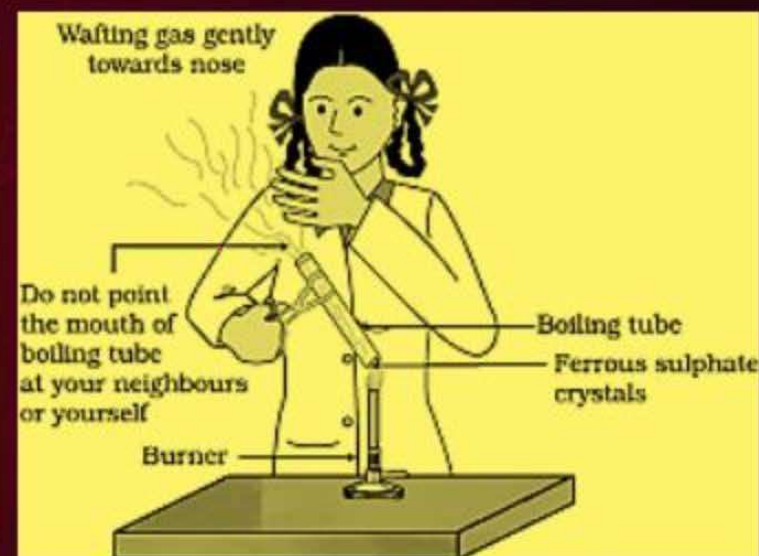


(i) Do not point the mouth of the boiling tube at your neighbours or yourself.

(ii) Waft the gases – Don't sniff them.

This is done to confirm the presence of sulphur dioxide and sulphur trioxide gases released.

(iii) Always use a test tube holder while heating the test tube.





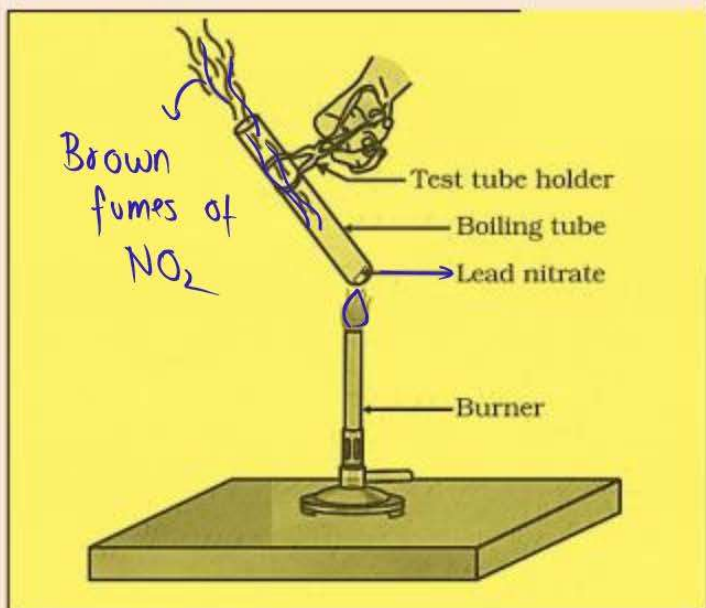
Types of Chemical Reactions



TYPE OF REACTION

$\Delta \rightarrow$ Delta

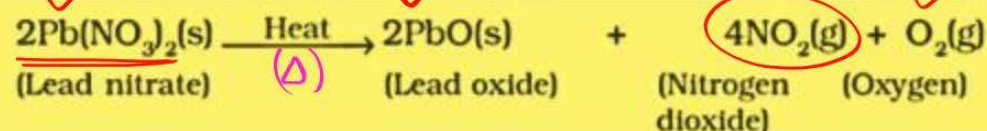
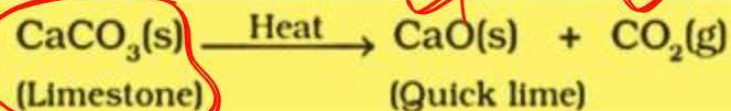
Endothermic



REACTION DETAILS AND EXAMPLES

Both reactions are example of **thermolytic decomposition reaction or thermolysis**.

(Used in cement industry)



Observations:

- (i) A crackling sound is heard while thermal decomposition of lead nitrate and this process is known as decrepitation.
- (ii) Brown fumes of nitrogen dioxide are evolved.
- (iii) A yellow residue of lead oxide is left behind in the test tube.

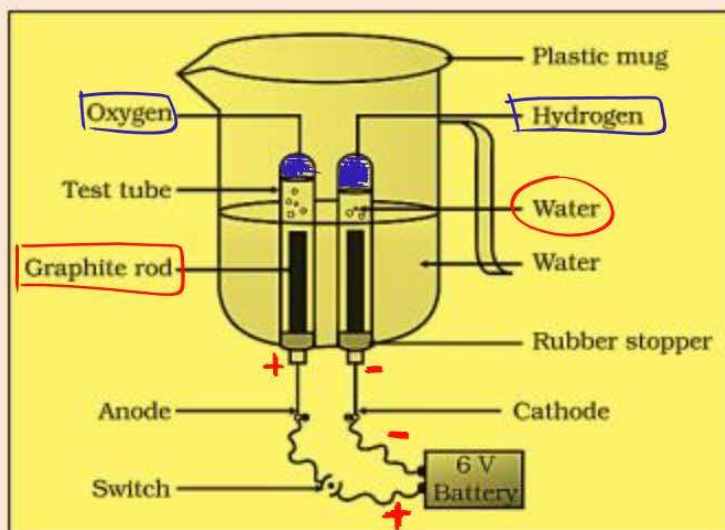


Types of Chemical Reactions



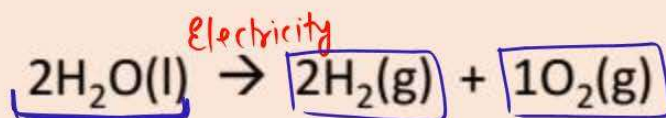
TYPE OF REACTION

Endothermic



REACTION DETAILS AND EXAMPLES

The below reaction is an example of electrolytic decomposition reaction or electrolysis.



Important to Remember:

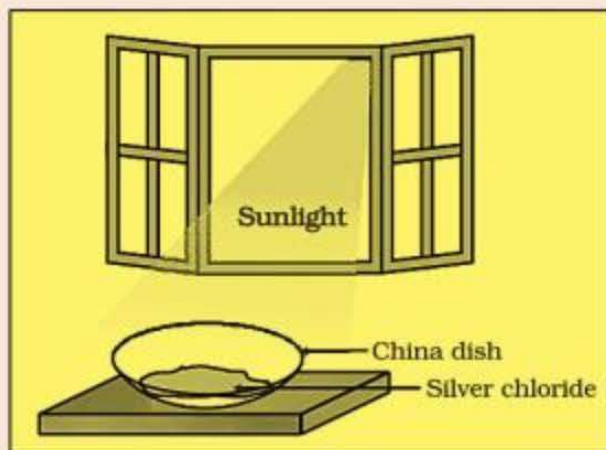
- Volume ratio of H_2 and O_2 gas produced will be **2:1**.
- Here small amount of acid or table salt (acts as electrolyte that dissociates into ions and conducts electricity) is added to water before starting its electrolysis because water is a poor conductor of electricity but these electrolytes speeds-up the electrolysis process.



Types of Chemical Reactions



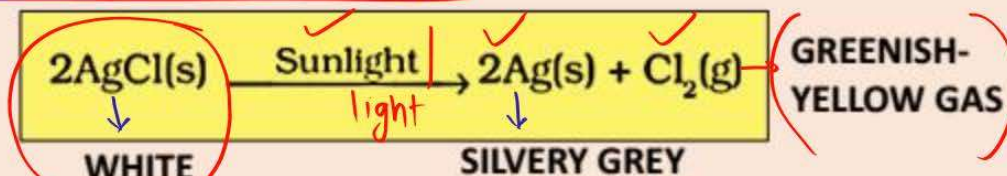
TYPE OF REACTION



REACTION DETAILS AND EXAMPLES

The below reaction is an example of photolytic decomposition or photolysis.

Endothermic





Types of Chemical Reactions

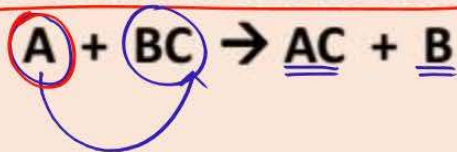


TYPE OF REACTION

Displacement Reaction

A chemical reaction in which a **more active or reactive element displaces a less active or reactive element** from its compound.

These reactions are generally found to occur in the solution.



TRICK TO LEARN REACTIVITY SERIES

K	← Kudi	Potassium
Na	← Naal	Sodium
Ca	← Car	Calcium
Mg	← Mango	Magnesium
Al	← Alto	Aluminium
Zn	← Zisko	Zinc
Fe	← Fir	Iron
Pb	← Lekar	Lead
H	Hum	Hydrogen
Cu	← Chale	Copper
Hg	← Mathura	Mercury
Ag	← Sath	Silver
Au	← Ghumne	Gold

because it
can lose electron
like metals

Pt ← prateek Platinum



Types of Chemical Reactions



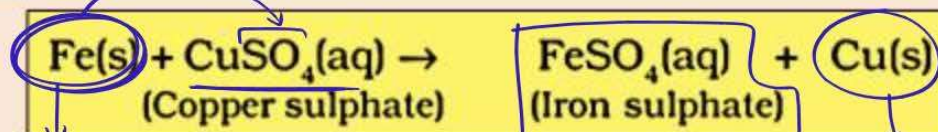
TYPE OF REACTION

Displacement Reaction

A chemical reaction in which a **more active or reactive element displaces a less active or reactive element** from its compound. These reactions are generally found to occur in the solution.



REACTION DETAILS AND EXAMPLES

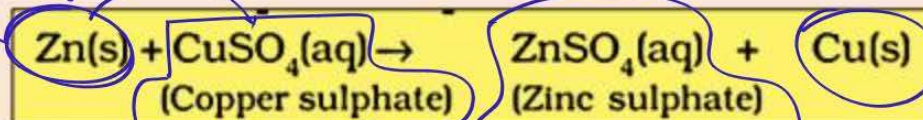


BLUE solⁿ

PALE GREEN

Silvery gray

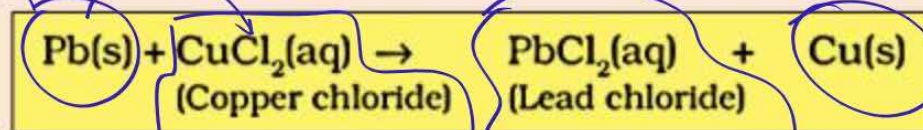
Reddish brown & deposits on iron nail



BLUE solⁿ

COLOURLESS

Silvery gray



BLUE-GREEN solⁿ

COLOURLESS



Types of Chemical Reactions



TYPE OF REACTION

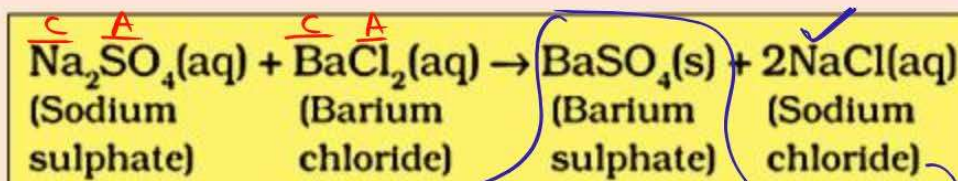
Double Displacement Reaction

A chemical reaction in which there is an exchange of ions, i.e. **cations** and **anions** between reactants.



These double displacement rxn are also called precipitation rxn

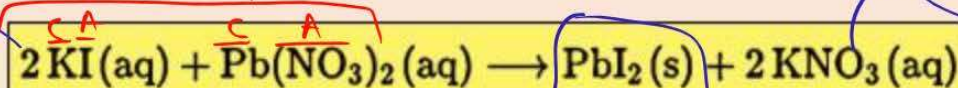
REACTION DETAILS AND EXAMPLES



WHITE INSOLUBLE SOLID

Colourless soln

Colourless soln



YELLOW INSOLUBLE SOLID



Types of Chemical Reactions



TYPE OF REACTION

Redox Reaction

A chemical reaction in which reduction and oxidation take place simultaneously.

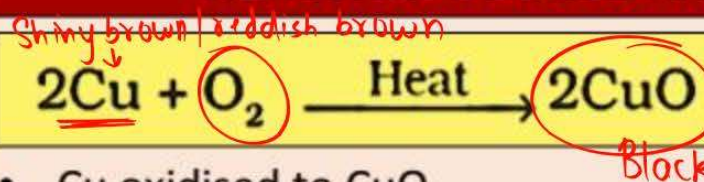
Reduction: OXIDATION:

- Addition of oxygen
- Removal of hydrogen
- Both

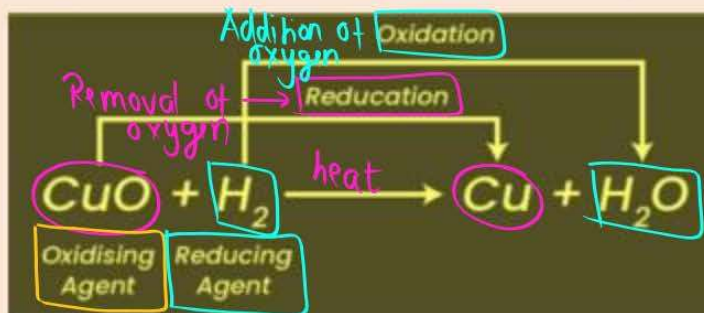
Oxidation: REDUCTION

- Addition of hydrogen ✓
- Removal of oxygen ✓
- Both ✓

REACTION DETAILS AND EXAMPLES



- Cu oxidised to CuO
- O₂ reduced to CuO
- Oxidising Agent/Oxidant: One that gets reduced
- Reducing Agent/Reductant: One that gets oxidised





Types of Redox Reactions



TYPES OF REDOX REACTIONS

Rancidity/Rancidification

Oxidation of oil/fat containing food items resulting in bad smell and taste.

Corrosion

It is a surface deterioration (degradation) process of metals in which they convert to a more stable form, i.e. oxides, sulphides, carbonates and more, due to the attack of atmospheric gases.

OTHER DETAILS

Ways to Prevent Rancidity

- Addition of antioxidants (Vitamin C, Vitamin E etc.) that inhibit the oxidation. *unreactive gases with chips*
- Filling of nitrogen/helium gas like in chip packets that are placed in place of air.
- Refrigeration of food items lowers down the speed of oxidation of food items

Types of Corrosion

- Rusting: Happens in iron and a reddish-brown layer is formed on iron. *name of layer formed is RUST*
- Tarnishing: Happens in copper, silver etc. and a green layer is formed on copper while a black layer is formed on silver. *name of layer formed is PATINA*