

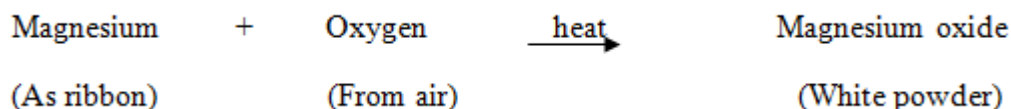
CHEMISTRY

Class X

CHAPTER 1 (CHEMICAL REACTIONS AND BALANCED CHEMICAL EQUATIONS)

Chemical reactions are the processes in which new substances with new properties are formed.

- Only a rearrangement of atoms takes place in a chemical reaction.
- The substances which take part in a chemical reaction are called reactants.
- The new substances produced as a result of chemical reaction are called products.
- In a chemical reaction, reactants are transformed into products.
- The burning of magnesium in air to form magnesium oxide is an example of a chemical reaction.



Before burning in air, the magnesium ribbon is cleaned by rubbing with a sand paper. This is done to remove the protective layer of basic magnesium carbonate from the surface of magnesium ribbon so that it may readily combine with the oxygen of air.

Characteristics of Chemical reactions

- The conversion of reactants into products in a chemical reaction is often accompanied by some features which can be easily observed easily.
- The important characteristics of chemical reactions are:
 1. Evolution of a gas
 2. Formation of a precipitate
 3. Change in colour
 4. Change in temperature
 5. Change in state

Evolution of a Gas:

Some chemical reactions are characterized by the evolution of a gas.

The chemical reaction between zinc and dilute sulphuric acid is characterized by the evolution of hydrogen gas.

- Take some zinc granules in a conical flask.
- Add dilute sulphuric acid over zinc granules.
- We will see the bubbles of hydrogen gas being formed around zinc granules.
- If we touch the conical flask with our hand, we will find that it is somewhat hot. So, a change in temperature also occurs in this chemical reaction.

Formation of a precipitate:

Some chemical reactions are characterized by the formation of precipitate. A precipitate is a 'solid product' which separates out from the solution during a chemical reaction.

The chemical between potassium iodide and lead nitrate is characterized by the formation of a yellow precipitate of lead iodide.

- Take some lead nitrate solution in test tube.
- Add potassium iodide solution to it.
- A yellow precipitate of lead iodide is formed at once.
- A change in colour also takes place in this chemical reaction.

Change in colour:

Some chemical reactions are characterized by a change in colour.

The chemical reaction between citric acid and purple coloured potassium permanganate solution is characterized by a change in colour from purple to colourless.

- Take some dilute potassium permanganate solution in a test tube. It has purple colour.
- Add some lemon juice (it contains citric acid) to it with the help of a dropper and shake the test tube.
- The purple colour of potassium permanganate solution goes on fading and ultimately it becomes colourless.

Change in temperature:

Some chemical reactions are characterized by a change in temperature.

The chemical reaction between quicklime and water to form slaked lime is characterized by a change in temperature.

- Take a little of quicklime in a hard-glass beaker.
- Add water to it slowly.
- Touch the beaker.
- The beaker feels to be quite hot.

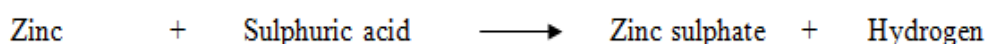
Change in state:

- Some chemical reactions are characterized by a change in state.
- When wax is burned (in the form of wax candle), then water and carbon dioxide are formed.
- Now, wax is a liquid whereas carbon dioxide is a gas. This means that during the combustion reaction of wax, the physical state changes from solid to liquid and gas.

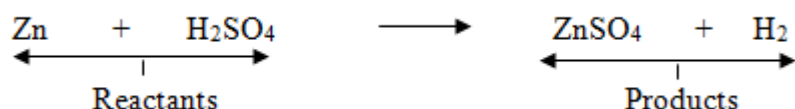
Chemical equations:

The method of representing a chemical reaction with the help of symbols and formula of the substances involved in it is known as a chemical equation.

- Zinc metal reacts with dilute sulphuric acid to form zinc sulphate and hydrogen gas.



- This is known as word equation. Putting the symbols and formula of all the substances in the above word equation, we get the following chemical equation:



- The substances which combine or react are known as reactants.
- The new substances produced in a reaction are known as products.
- A chemical equation is a short-hand method of representing a chemical reaction.

Balanced and unbalanced chemical equations:

A balanced chemical equation has an equal number of atoms of different elements in the reactants and products.

Zinc metal reacts with dilute sulphuric acid to form zinc sulphate and hydrogen gas.



Count the number of atoms of all the elements in the reactants and products separately.

	In reactants	In products
No. of Zn atoms	1	1
No. of H atoms	2	2
No. of S atoms	1	1
No. of O atoms	4	4

- There are an equal number of atoms of different elements in the reactants and products, so the above chemical equation is a balanced equation.

- An unbalanced chemical equation has an unequal number of atoms of one or more elements in the reactants and products.
- Hydrogen reacts with oxygen to form water



Count the number of atoms of all the elements in the reactants and products separately.

	In reactants	In products
No. of H atoms	2	2
No. of O atoms	2	1

The above chemical equation contains an unequal number of oxygen atoms in reactants and products, so it is an unbalanced equation.

Types of chemical reactions

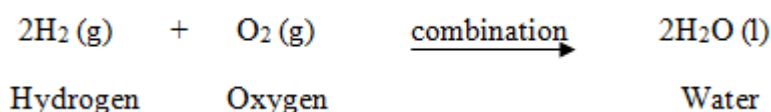
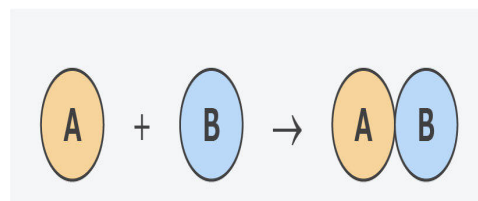
Some of the important types of chemical reactions are:

1. **Combination reactions**
2. **Decomposition reaction**
3. **Displacement reactions**
4. **Double displacement reactions**
5. **Oxidation and Reduction reactions**

Combination reactions:

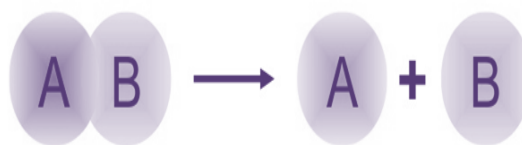
Those reactions, in which two or more substances combine to form a single substance, are called combination reactions.

For eg. hydrogen burns in oxygen to form water: In this reaction, two elements, hydrogen and oxygen are combining to form single compound water, so this is an example of a combination.

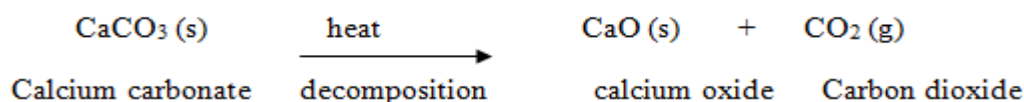


Decomposition Reactions:

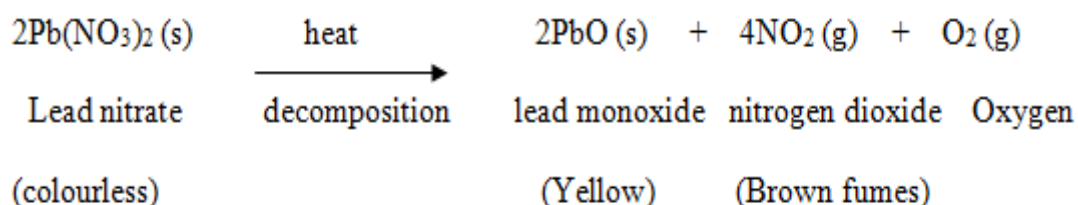
Those reactions in which compound splits up into two or more simple substances are known as decomposition reactions. The decomposition reactions are carried out by applying heat.



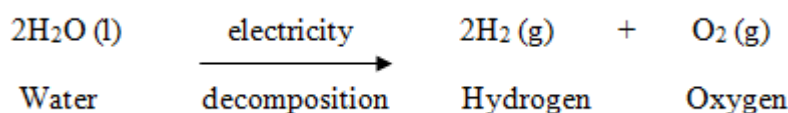
For eg. When calcium carbonate is heated, it decomposes to give calcium oxide and carbon dioxide.



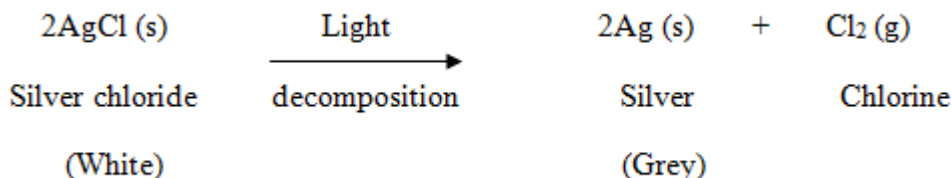
When a decomposition reaction is carried out by heating, it is called 'thermal decomposition.' For eg.



Some decomposition reactions are carried out by using electricity. For eg. When electric current is passed through acidified water, it decomposes to give hydrogen gas and oxygen gas. It is called electrolysis of water.



Some decomposition reactions are carried out by light. For eg. When silver chloride is exposed to light, it decomposes to form silver metal and chlorine gas.



Uses of Decomposition reactions:

- The decomposition reactions carried out by electricity are used to extract several metals from their naturally occurring compounds like chlorides and oxides.
- For example, sodium metal is extracted by the electrolysis of molten aluminum oxide.

Decomposition reactions in our body:

- The digestion of food in the body is an example of decomposition reaction.
- When we eat foods like wheat, rice or potatoes, then the starch present in them decomposes to give simple sugar like glucose in the body; and protein decompose to form amino acids.

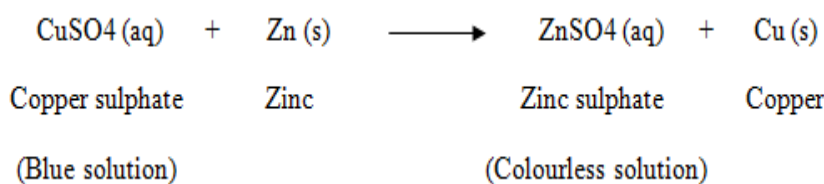
Displacement reactions:

Those reactions, in which one element takes the place of another element in a compound, are known as displacement reactions.

- In general, a more reactive element displaces a less reactive element from its compound.

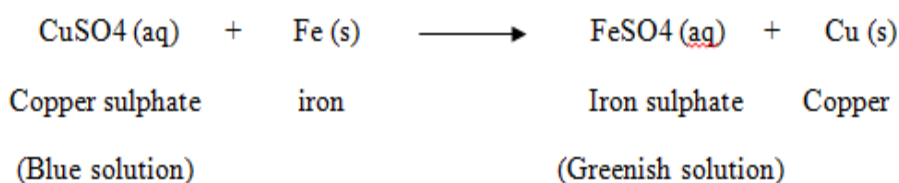
Examples:

- When a strip of zinc metal is placed in copper sulphate solution, then zinc sulphate solution and copper are obtained.



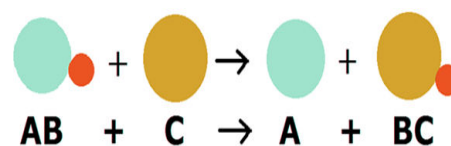
In this reaction, zinc displaces copper from copper sulphate compound so that copper is free. This displacement reaction takes place because zinc is more reactive than copper.

- When a piece of iron metal (or iron nail) is placed in copper sulphate solution, then iron sulphate solution and copper metal are formed.



In this reaction, iron displaces copper from copper sulphate solution.

The deep blue colour of copper sulphate solution fades due to the formation of green solution of iron sulphate. A red-brown coating (or layer) of copper metal is formed on the surface of iron metal (or iron nail).

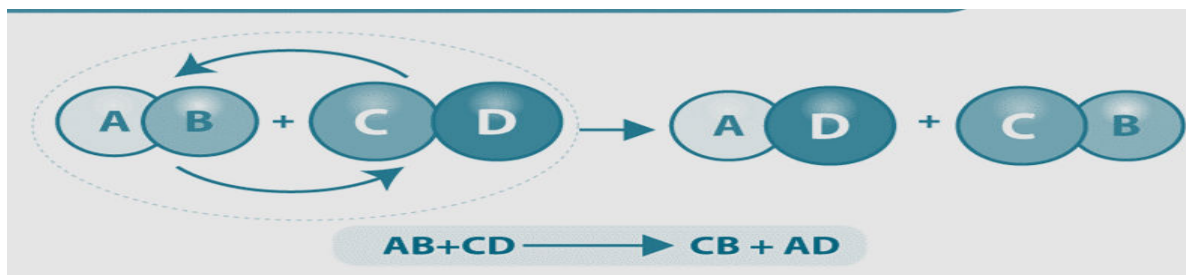


potassium	most reactive	K
sodium		Na
calcium		Ca
magnesium		Mg
aluminium		Al
carbon		C
zinc		Zn
iron		Fe
tin		Sn
lead		Pb
hydrogen		H
copper		Cu
silver		Ag
gold		Au
platinum	least reactive	Pt

- This displacement reaction takes place because iron is more reactive than copper.

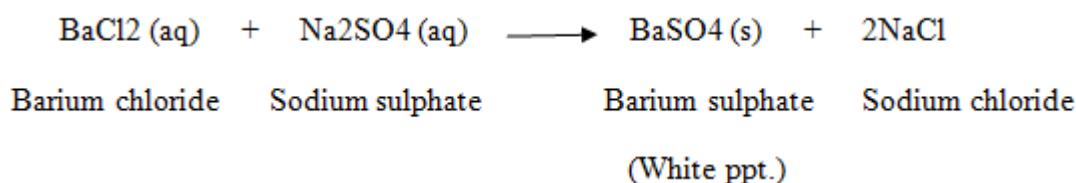
Double Displacement reactions:

Those reactions, in which two compounds react by an exchange of ions to form two new compounds, are called double displacement reactions.



Example:

When barium chloride solution is added to sodium sulphate solution, then a white precipitate of barium sulphate is formed along with sodium chloride solution.



In this reaction, two compounds barium chloride and sodium sulphate react to form two new compounds, barium sulphate and sodium chloride. An exchange of ions takes place in this reaction.

In this reaction, barium sulphate is formed as a white, insoluble solid called precipitate which separates out suddenly from the solution.

Any reaction in which an insoluble solid called precipitate is formed that separates from the solution is called a **precipitation reaction**.

Oxidation and Reduction reactions:

Oxidation:

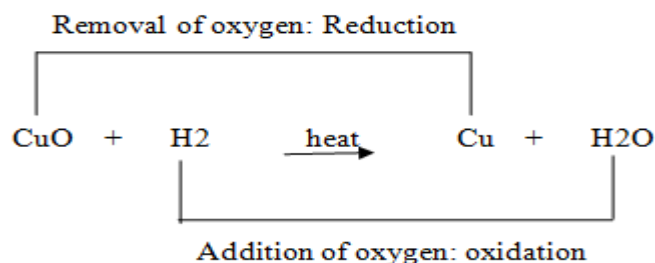
The addition of oxygen to a substance or the removal of hydrogen from a substance is called oxidation.

Reduction:

The addition of hydrogen to a substance and the removal of oxygen from a substance is called reduction.

The oxidation and reduction reactions are also called **Redox Reactions**. Example:

When copper oxide is heated with hydrogen, then copper metal and water are formed.



In the above reaction, copper oxide (CuO) is changing into copper (Cu), so copper oxide is being reduced to copper.

Hydrogen is changing into water (H₂O), so hydrogen is being oxidized to water.

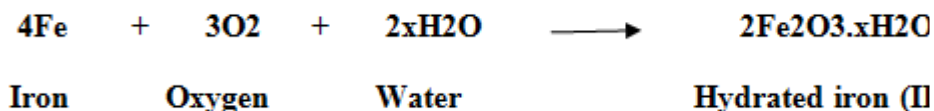
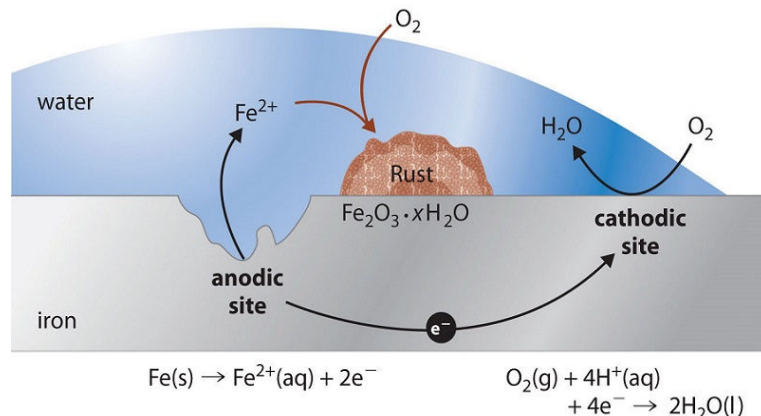
Copper oxide is giving oxygen required for the oxidation of hydrogen, therefore, copper oxide is oxidizing agent and hydrogen is reducing agent.

Oxidation reactions in everyday life:

Oxidation has damaging effect on metals as well as on food. There are two common effects of oxidation reactions which we observe in daily. These are:

1. Corrosion of metals:

Corrosion is the process in which metals are eaten up gradually by the action of air, moisture or a chemical (such as an acid) on their surface. Corrosion is caused mainly by the oxidation of metals by oxygen of air. Rusting of iron metal is the most common form of corrosion. During the corrosion of iron (rusting of iron), iron metal is oxidized by the oxygen of air in the presence of water (moisture) to form hydrated iron (III) oxide called rust.



2. Rancidity

When the fats and oils present in food materials get oxidized by the oxygen (of air), their oxidation products have unpleasant smell and taste. The condition produced by aerial oxidation of fats and oils in foods marked by unpleasant smell and taste is called **Rancidity**.

a. Rancidity can be prevented by adding anti-oxidants to foods containing fats and oils:

Anti-oxidant is a substance (or chemical) which prevents oxidation. Anti-oxidants are actually reducing agent.

The two common anti-oxidants used in foods to prevent the development of rancidity are BHA (Butylated Hydroxy – Anisole) and BHT (Butylated Hydroxy-Toluene).

b. Rancidity can be prevented by packaging fats and oils containing foods in nitrogen gas:

When the packed is surrounded by unreactive gas nitrogen, there is no oxygen to cause its oxidation and make it rancid.

The manufacturers of potato chips fill the plastic bags containing chips with nitrogen gas.

c. Rancidity can be retarded by keeping food in a refrigerator.

d. Rancidity can be retarded by storing food in air-tight containers.

e. Rancidity can be retarded by storing food away from light.

