

CHEMICAL REACTIONS AND EQUATIONS NOTES



Chemical reaction: Chemical reactions are the processes in which new substances with new properties are formed. A chemical reaction rearranges the constituent atoms of the reactants to create different substance as products.



Reactant: The substances which take part in a chemical reaction are called reactants.

Product: The new substances produced as a result of chemical reaction are called products.



Reactant = H_2 and O_2

Product = H_2O

Souring of milk, formation of curd from milk, cooking of food, digestion of food in our body, process of respiration, fermentation of grapes, rusting of iron, burning of fuel and Ripening of fruits, are all chemical changes which involve chemical reactions.

Characteristic of chemical Reactions

- (i) Evolution of gas,
- (ii) Formation of a precipitate,
- (iii) Change in color,

- (iv) Change in temperature,
- (v) Change in state,

Evolution of gas: Some chemical reactions are characterized by evolution of gas.

For Ex 1: Chemical reaction between zinc and dilute sulphuric acid to form hydrogen gas.

For Ex 2: Chemical reaction between sodium carbonate and dilute hydrochloric acid is characterized by the evolution of carbon dioxide gas.

Formation of precipitate: Some chemical reactions are characterized by evolution of gas.

For Ex 1: Chemical reaction between potassium iodide and lead nitrate is characterized by the formation of a yellow precipitate of lead iodide.

For Ex 2: Chemical reaction between sulphuric acid and barium chloride solution is characterized by the formation of the white precipitate of barium sulphate.

Change in colour:

For Ex 1: Chemical reaction between citric acid and purple colored potassium permanganate solution is characterized by a change in color from purple to colorless.

For Ex 2: Chemical reaction between sulphur dioxide gas and acidified potassium dichromate solution is characterized by a change in color from orange to green.

Change in temperature

For Ex 1: Chemical reaction between quicklime and water to form slaked lime is characterized by a change in temperature. The reaction between quicklime and water to form slaked lime is an exothermic reaction.

For Ex 2: The chemical reaction between zinc granules and dilute sulphuric acid is also characterized by a change in temperature.

Exothermic reaction: Those reactions in which heat is produced or evolved are called exothermic reactions.

Endothermic reactions: Those reactions in which heat is absorbed are called endothermic reaction.

Change in state:

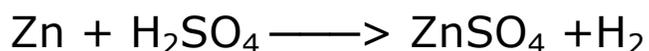
For Ex: The combustion reaction of candle wax is characterized by a change in state from solid to liquid and gas.

Chemical Equations

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



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

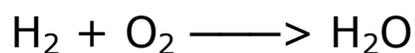


In reactants

In products

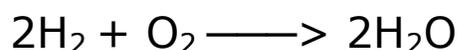
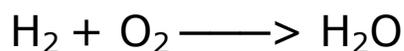
No. of Zn atoms:	1	1
No. of H atoms:	2	2
No. of S atoms:	1	1
No. of O atoms:	4	4

Unbalanced Chemical Equations: An unbalanced chemical equation has an unequal number of atoms of one or more elements in the reactants and products.



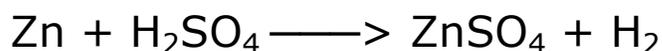
	In reactants	In reactants
No. of H atoms:	2	2
No. of O atoms:	2	1

Balancing of Chemical Equations: The process of making the number of different types of atoms equal on both the sides of an equation is called balancing of equation.

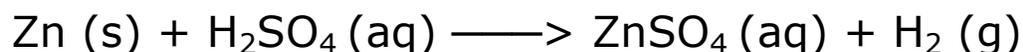


To make Equations More Informative: The chemical equation can be made more informative in three ways:

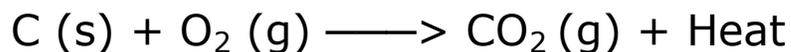
- (i) By indicating the "physical states" of the reactants and products.



To make above equation more informative;



- (ii) By indicating the "heat changes" taking place in the reaction.



The burning of carbon in oxygen is an exothermic reaction.

- (iii) By indicating the "conditions" under which the reaction takes place.

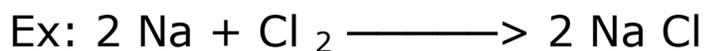
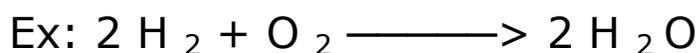
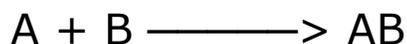


Types of chemical reaction

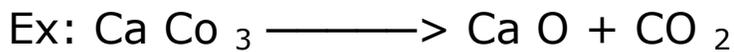
Some of the important types of chemical reactions are:

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

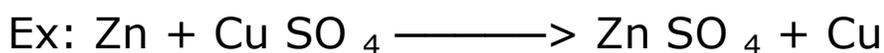
Combination reactions: A reaction in which two or more reactants combine to form a single product is known as a combination reaction. Combination reaction is also called synthesis reaction.



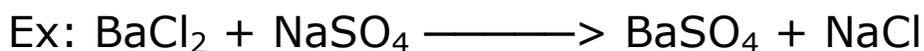
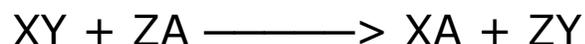
Decomposition reactions: Those reaction in which a compound splits up into two or more simpler substances are known as decomposition reactions.



Displacement reaction: A chemical reaction in which a more reactive element displaces a less reactive element from its aqueous salt solution. It is also called a substitution reaction.



Double Displacement Reaction: A chemical reaction in which ions get exchanged between two reactants which form a new compound is called double displacement reaction. It is also called a metathesis reaction.



Precipitation Reaction: Any reaction in which an insoluble solid is formed that separates from the solution is called a precipitation reaction.

Ex: If barium chloride solution is added to copper sulphate solution, then a white precipitate of barium sulphate is produced along with copper chloride solution:



Oxidation and Reduction reactions:

Oxidation Reactions

(i) The addition of oxygen to a substance is called oxidation.

(ii) The removal of hydrogen from a substance is also called oxidation.

Reduction Reaction

(i) The addition of hydrogen to a substance is called reduction.

(ii) The removal of oxygen from a substance is also called reaction.

Reducing agent: The substance which gets oxidized is the reducing agent.

Oxidizing agent: The substance which gets reduced is the oxidizing agent.

Example:



- (i) Oxidized substance : H_2
- (ii) Reduced substance : CuO
- (iii) Oxidizing agent : CuO
- (iv) Reducing agent : H_2

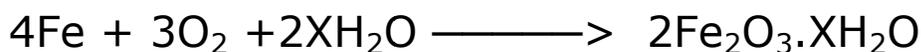
Redox Reaction: The oxidation and reduction reactions are also called redox reactions. In the name 'redox' the term 'red' stands for 'reduction' and 'ox' stands for oxidation.

Effect of oxidation reactions in everyday life

There are two common effects of oxidation reactions which we observed in daily life. These are:

1. Corrosion of metals
2. Rancidity of food

Corrosion: Corrosion is the process in which metals are eaten up gradually by the action of air, moisture or a chemical on their surface. Rusting of iron metal is the most common form of corrosion.



The rusting of iron is a redox reaction.



Rancidity: The condition produced by aerial oxidation of fats and oils in foods marked by unpleasant smell and taste is called rancidity.

Rancidification: It is the process of complete or incomplete oxidation or hydrolysis of fats and oils when exposed to air, light or moisture or by bacterial action, resulting in unpleasant taste and odor.

Antioxidants: Antioxidants are often used as preservatives in fat-containing foods to delay the onset or slow the development of rancidity due to oxidation.

- (i) Natural antioxidants include ascorbic acid (vitamin C) and tocopherols (vitamin E).
- (ii) Synthetic antioxidant include butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate and ethoxyquin.

The development of rancidity of food can be prevented in the following ways:

1. Rancidity can be prevented by adding antioxidants to foods containing fats and oils.
2. Rancidity can be prevented by packaging fat and oil containing foods in nitrogen gas.
3. Rancidity can be retarded by keeping food in a refrigerator.
4. Rancidity can be retarded by storing food in air-tight containers.
5. Rancidity can be retarded by storing foods away from light.

Oxygen scavenging technology: It can be used to remove oxygen from packaging and therefore prevent oxidative Rancidification.

Oxidative stability instrument (OSI): It is measure of oil or fat resistance to oxidation.