

STUDY COURSE MATERIAL

CHEMISTRY

SESSION-2020-21

CLASS-X

TOPIC: CHEMICAL REACTIONS AND EQUATION

DAY-1

❖ TEACHING MATERIAL

✚ **Chemical Reaction**

A chemical reaction is the process of breaking the chemical bonds of the reacting substances and making new bonds to form new products.

A chemical bond is the force that holds the atoms of a molecule together, as in a compound.

A chemical reaction occurs when particles collide.

Eg: $H_2 + Cl_2 \rightarrow 2HCl$

✚ **Characteristics of Chemical reactions**

Certain chemical reactions are characterized by changes that are quite easily observed.

Evolution of gas: In many chemical reactions, one of the product is gas.

Example: When zinc reacts with dilute sulphuric acid hydrogen gas is evolved, with effervescence.

$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

Note: The formation of gas bubbles in a liquid during a reaction is called effervescence.

Change of colour: Certain chemical reactions are characterized by change in colour of reactants

Example: $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
[Iron] [blue solution] [green solution] [red deposit]

Formation of precipitates: Some chemical reactions are characterized by the formation of precipitate.

Example: $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
[white ppt]

Change of state: In many chemical reactions, a change of state is observed.

Example: $NH_3(g) + HCl(g) \rightleftharpoons NH_4Cl(s)$

✚ **Chemical Equation**

A chemical equation is the symbolic representation of a chemical reaction using the symbols and formulae of the substances involved in the reaction.

The reaction can be represented by either a word equation or a chemical equation.

Word equation:

Carbon + Oxygen → Carbon dioxide

Chemical equation

C + O₂ → CO₂

✚ Steps involved in writing a chemical equation:

1. Write the symbols or the formulae of the reactants on the left side with a (+) sign between them.
2. Write the symbols or the formulae of the products on the right side with a (+) sign between them.
3. Put the sign of an arrow (→) in between the reactant side and the product side.
4. Represent the reactants and the products in their molecular forms.

✚ Skeleton equation

It is defined as an equation that represents a chemical reaction but is unbalanced i.e. the total number of atoms of each element on the two sides are not equal.

Example: KNO₃ -----> KNO₂ + O₂

✚ Balanced equation

It is an equation in which the total number of atoms of each element in the reactants, on the left side of equation is same as the number of atoms in the products formed, on the right side of equation.

Example: 2 KNO₃ -----> 2 KNO₂ + O₂

An equation must be balanced in order to comply with the "Law of conservation of mass".

Balancing the chemical equation by hit and trial method

Count the number of times an element occurs on either side and note down in following format.

Elements	Number of atoms	
	Reactants	Products

Now balance the elements having maximum number of occurrence or non-metal by multiplying with natural number.

Note: The multiplicative number should always note down as co-efficient.

When the number of atoms in both the reactant and product side are equal then note down the balanced chemical equation.

Example: Balance the chemical equation - Pb(NO₃)₂ -----> PbO + NO₂ + O₂

Elements	Number of atoms	
	Reactants	Products
Pb	1 x 2	1 x 2
N	2 x 2	1 x 4
O	6 x 2	1 x 2 + 2 x 4 + 2

Hence balanced chemical equation is $2\text{Pb}(\text{NO}_3)_2 \text{ -----} \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$

❖ VIDEO-LINKS

LINK-1

<https://www.khanacademy.org/science/biology/chemistry--of-life/chemical-bonds-and-reactions/v/chemical-reactions-introduction>

LINK-2

<https://www.youtube.com/watch?v=8w9yRxBZzSo>

LINK-2

<https://www.youtube.com/watch?v=zmdxMlb88Fs>

❖ ASSIGNMENT

❖ Fill in the blanks:-

- 1.Addition of hydrogen in a substance in a reaction is known as _____ reaction.
- 2.In a _____ reaction two or more substances combine to form a new single substance.
- 3.Unbalanced reactions are also known as _____

Question 4.Balance the following chemical equitations:-

- a) $\text{HNO}_3 + \text{Ca}(\text{OH})_2 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- b) $\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$
- c) $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
- d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{HCl}$

DAY-2

❖ TEACHING MATERIAL

✚ Types of chemical reaction

1. Combination reaction
2. Decomposition reaction
3. Displacement reaction
4. Double displacement reaction
5. Double decomposition
6. Oxidation and reaction

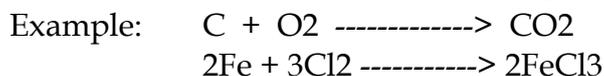
✚ Combination reaction

A reaction in which two or more substances combined together to form a single substance is called a combination reaction.

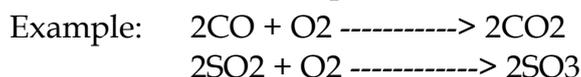


➤ In combination reactions:

(i) Two elements combine to form a compound



(ii) An element and a compound combine to give a new compound



(iii) Two or more compounds combine to form a single product.



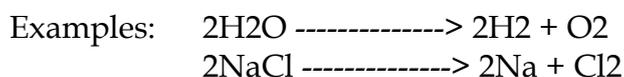
✚ Decomposition reaction

- It is the breaking up of a compound either into elements or simpler compounds, such that these products do not recombine to form the original compound.
- It may occur in the presence of heat, light or by passage of an electric current.
- It is of three types

(i) **Thermal decomposition reaction:** A decomposition reaction that is brought about by heat is known as thermal decomposition reaction.



(ii) **Electrolytic decomposition:** A decomposition reaction that is brought about by electric current is known as electrolytic decomposition.



(iii) **Photolytic decomposition:** A decomposition reaction that is brought by light energy is known as photolytic decomposition.



✚ Displacement reaction

A chemical reaction in which a high reactive element displaces low reactive element from its salt solution is called displacement reaction.

Example: $\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$

➤ It is of two types.

(i) **Cation displacement reaction:** A reaction in which high reactive metal displaces low reactive metal from its salt solution.

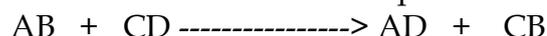
Example: $2\text{Na} + \text{ZnSO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + \text{Zn}$

(ii) **Anion displacement reaction:** A reaction in which high reactive anion (non-metal) displaces less reactive anion from its solution.

Example: $2\text{KI} + \text{Cl}_2 \longrightarrow 2\text{KCl} + \text{I}_2$

✚ Double displacement reaction

A chemical reaction in which two compounds in a solution react to form two new compounds by mutual exchange of radicals is called double displacement reaction.



➤ It is of two types.

(i) **Precipitation reaction:** A chemical reaction in which two compounds in their aqueous state react to form an insoluble salt as one of the products is known as a precipitation reaction.

Example: $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$
[White ppt]

(ii) **Neutralization reaction:** The reaction between an acid and a base that forms salt and water only is referred as a neutralization reaction.

Example: $\text{NaOH} + \text{HCl} \longrightarrow \text{NaCl} + \text{H}_2\text{O}$

✚ Exothermic reaction

A chemical reaction in which heat is given out is called exothermic reaction.

Example: $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + \text{Heat}$

✚ Endothermic reaction

A chemical reaction in which heat is absorbed is called endothermic reaction.

Example: $\text{N}_2 + \text{O}_2 \longrightarrow 2\text{NO}$

✚ Oxidation

Oxidation is defined as a chemical process that involves:

➤ Addition of oxygen



➤ Addition of electronegative ion



➤ Removal of hydrogen



➤ Removal of electropositive ion



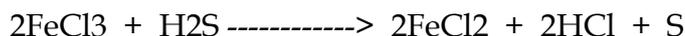
✚ Reduction

Reduction is defined as a chemical process that involves:

- Removal of oxygen



- Removal of electronegative ion



- Addition of hydrogen

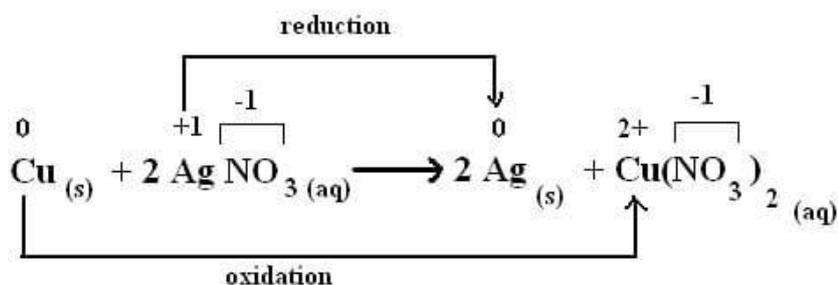


- Addition of electropositive ion



✚ Redox reaction

A reaction in which oxidation and reduction take place simultaneously is known as redox reaction.



✚ Rancidity

Rancidity is the complete or incomplete oxidation of fats and oils when exposed to air, light or moisture.

- It can be prevented using the following methods:
 - (i) Adding antioxidants to food
 - (ii) Storing food in air-tight containers
 - (iii) Refrigerating food
 - (iv) Replacing oxygen in the container with another gas.

❖ VIDEO-LINKS

LINK 1:

<https://www.youtube.com/watch?v=HmNsQKLRgh8>

LINK 2:

<https://www.youtube.com/watch?v=HeKq9V54xlM>

LINK 3:

<https://www.youtube.com/watch?v=gWPjVF3WFzU>

❖ LAB ACTIVITY

- 1) <https://www.youtube.com/watch?v=eLkGX2jAKoM>
- 2) <https://www.youtube.com/watch?v=lDas5ekKT94>

❖ ASSIGNMENT

<https://physicscatalyst.com/Class10/chemical-reactions-and-equations-class-10-test.php>

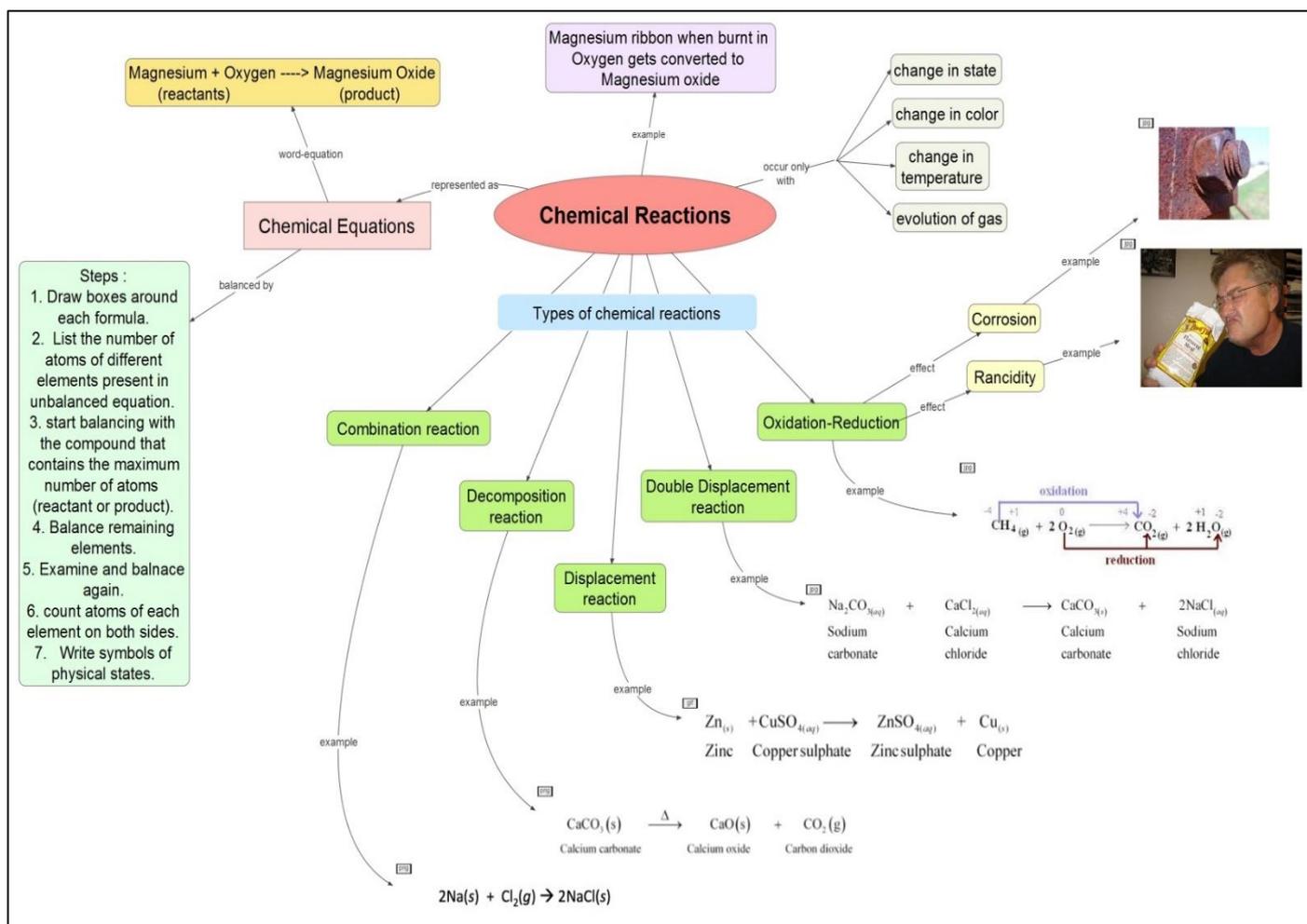
<https://www.learncbse.in/ncert-solutions-class-10-science-chapter-1/>

❖ LAB MANUAL

<http://ncert.nic.in/ncerts/l/jelm102.pdf>

<https://www.cbsetuts.com/ncert-class-10-science-lab-manual-types-reactions/>

❖ CONCEPT MAP



DAY-3

❖ TEACHING MATERIAL :- ACID AND BASES

✚ ACIDS

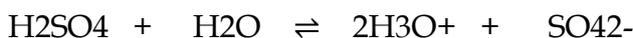
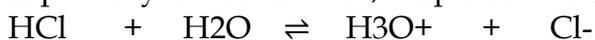
Acids are defined as compounds which contain one or more hydrogen atom and when dissolved in water, they produce hydronium ions (H_3O^+).

➤ The word 'acid' comes from the Latin word *acidus*, meaning 'sour'.

Note: (i) At first, the acid molecule furnishes hydrogen ion i.e., H^+ ion in aqueous solution. But this H^+ ion cannot exist independently. Therefore, it combines with a water molecule to form hydronium ion.

(ii) Hydrogen is common in all acids.

Examples: Hydrochloric acid, Sulphuric acid, Nitric acid, etc.



The hydrated hydrogen ion that exists in the solution of acids is called a hydronium ion.



✚ CLASSIFICATION OF ACIDS

Acids can be classified in following ways.

1. Depending on their sources

- Organic acids:** Acids which are obtained usually from plants are called organic acids. They contain carbon.
Examples: Oxalic acid (COOH)₂, Acetic acid (CH_3COOH)
- Inorganic acids:** Acids which are obtained usually from minerals are called inorganic acids. They do not contain carbon (except carbonic acid H_2CO_3).
Examples: Hydrochloric acids (HCl), Sulphuric acids (H_2SO_4), Nitric acid (HNO_3), etc.

2. Depending on their strength

Strength of an acid depends on the degree of ionization and concentration of hydronium ions produced by that acid in aqueous solution.

- Strong acids:** Acids which vigorously ionizes in aqueous solution and produce high concentration of hydronium ions are called strong acids.
Examples: All mineral acids (except carbonic acid)
- Weak acids:** Acids which ionizes partially in aqueous solution and produce less concentration of hydronium ions are called weak acids.
Examples: All organic acids, Carbonic acids.

Note:

1. Degree of ionization = $\frac{\text{No. of acid molecules ionised}}{\text{total no. of acids present in aqueous solution}} \times 100$

2. If the degree of ionization for an acid, bases or salt in aqueous solution is greater than 30%, it is strong and if less than 30%, it is weak.

3. Depending on their concentration

Concentration of an acid means the amount of acid present in a definite amount of its aqueous solution.

- (a) **Concentrated acid:** An acid which contains a very small amount of water or no water is called concentrated acid.
- (b) **Dilute acid:** An acid which contains far more amount of water than its own mass is known as dilute acid.

Note: (i) In order to dilute an acid, pour acid into water in small amounts and stir constantly.

(ii) Water is not added to acid as it is an exothermic process.

4. Depending on molecular composition

- (a) **Oxy-acids:** Those acids which contain oxygen along with hydrogen and some other element.
Examples: Nitric acid, Sulphuric acid, Phosphoric acid, etc.
- (b) **Hydracids:** Those acids which contain hydrogen and a non-metallic element, and no oxygen.
Examples: Hydrochloric acid (HCl), Hydro bromic acid (HBr), Hydro iodic acid (HI)

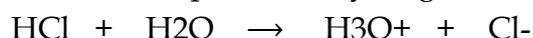
5. Depending on their basicity

The basicity of an acid is defined as the number of hydronium ions that can be produced by the ionization of one molecule of that acid in aqueous solution.

- (a) **Monobasic acids:** Acids which on ionization in water produce one hydronium ion per molecule of the acid.

Example: Hydrochloric acid, Nitric acid, Hydro bromic acid, etc.

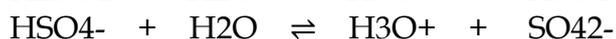
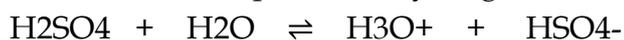
- These acids have one replaceable hydrogen ion, so they ionize in one step.



- (b) **Dibasic acids:** Acids which on ionization in water produce two hydronium ions per molecule of the acid.

Examples: Sulphuric acid (H₂SO₄), Oxalic acid (H₂C₂O₄), Sulphurous acid (H₂SO₃), etc.

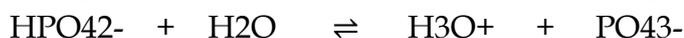
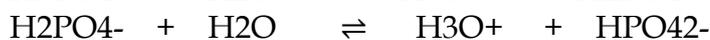
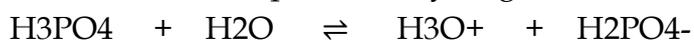
- These acids have two replaceable hydrogen ions, so they ionize in two steps.



- (c) **Tribasic acids:** Acids which on ionization in water produce three hydronium ions per molecule of the acid.

Examples: Phosphoric acid (H₃PO₄), Phosphorous acid (H₃PO₃)

- These acids have three replaceable hydrogen ions, so they ionize in three steps.



❖ VIDEO-LINKS

LINK 1: <https://www.youtube.com/watch?v=B5AZxV2-Sv0>

LINK 2: <https://www.youtube.com/watch?v=DwJ7L6R0tLQ>

❖ ASSIGNMENT

- Which one of the following is acidic?
(a) Lemon juice (b) Tomatoes (c) Milk (d) All
- Which one of the following will turn red litmus blue?
(a) Vinegar (b) Baking soda solution (c) Lemon juice (d) Soft drinks
- Which one of the following will turn blue litmus red?
(a) Vinegar (b) Lime water (c) Baking soda solution (d) Washing soda solution

DAY-4

❖ TEACHING MATERIAL :- PROPERTIES OF ACIDS

✚ Physical properties

- Taste: Acids have a sour taste.
- Physical State: Some acids are solid and some are liquid at room temperature.

Examples:

Acids	Formula	State
Boric acid	H ₃ BO ₃	Solid Acids
Oxalic acid	(COOH) ₂	
Tartaric acid	C ₄ H ₆ O ₆	
Citric acid	C ₆ H ₈ O ₆	
Phosphoric acid	H ₃ PO ₄	
Acetic acid	CH ₃ COOH	Liquid Acids
Formic acid	HCOOH	

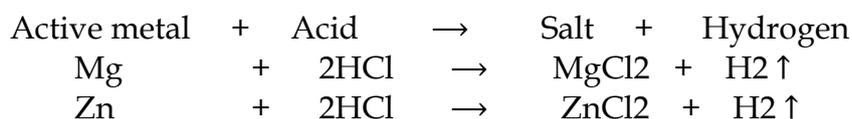
- Effect on skin: All strong mineral acids have corrosive action on the skin and cause painful burns.
- They change the colour of indicators.

Indicators	Colour change in acidic medium
Litmus	Blue to red
Methyl orange	Orange to pink
Phenolphthalein	Remains colourless

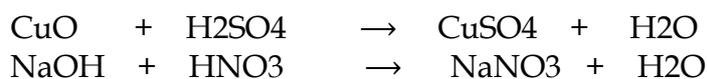
- They are strong electrolytes.

✚ Chemical properties

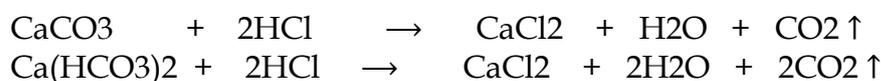
(i) Reaction with active metals: Metals react with acid to form metallic salt and hydrogen.



(ii) Reaction with bases: Acids neutralize bases to form salt and water only.



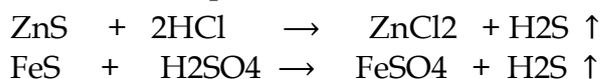
(iii) Reaction with carbonates and bicarbonates: Acids liberate carbon dioxide on reaction with metallic carbonates and bicarbonates.



(iv) Reaction with sulphites and bisulphites: Acids react with sulphites and bisulphites of metals to liberate sulphur dioxide.



(v) Reaction with sulphides: Acids react with metal sulphides to liberate hydrogen sulphide.



❖ VIDEO-LINKS

LINK 1: <https://www.youtube.com/watch?v=9P-qsbmIrz4>

LINK 2: <https://www.youtube.com/watch?v=NLJvrveyeV0Q>

LINK 3: <https://www.youtube.com/watch?v=Isrhnyglqf0>

❖ ASSIGNMENT

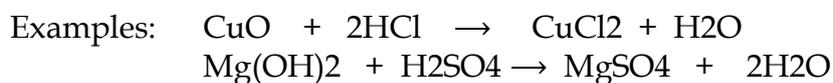
- 1) Take few samples of acidic solution used in your daily life and classify them according to their sources.
- 2) Why does lemon juice changes the color of floor when poured?

DAY-5

❖ TEACHING MATERIAL :-

✚ BASES:

A base is either metallic oxide or a metallic hydroxide or aqueous ammonia which reacts with hydronium ions of an acid to form salt and water only.



- They contain either displaceable oxide (O^{2-}) or displaceable hydroxide ion (OH^-).

✚ Alkalis

An alkali is a basic hydroxide which when dissolved in water produces hydroxyl (OH^-) ions as the only negatively charged ions.

- All alkali is a base soluble in water

Examples: Sodium Hydroxide (NaOH , Caustic soda), Potassium hydroxide (KOH , caustic potash), Calcium hydroxide [$\text{Ca}(\text{OH})_2$, slaked lime], etc.

Note: All alkalis are bases but all bases are not alkalis.

Examples: Ferric hydroxide [$\text{Fe}(\text{OH})_3$], cupric hydroxide [$\text{Cu}(\text{OH})_2$]

✚ CLASSIFICATION OF BASES

1. On the basis of their strength

- Strong base:** It undergoes almost complete ionization in aqueous solution and produce high concentration of OH^- .
Examples: NaOH , KOH etc.
- Weak base:** It undergoes only partial ionization in aqueous solution to produce a low concentration of OH^- .
Examples: NH_4OH , $\text{Ca}(\text{OH})_2$

2. On the basis of their acidity

The number of hydroxyl ions [OH^-] which can be produced per molecule of the base in aqueous solution.

- Monoacidic base:** It is a base that dissociates in aqueous solution to produce one OH^- ion per molecule of that base.
Examples: NaOH , KOH and NH_4OH
- Diacidic base:** It is a base that dissociates in aqueous solution to produce two OH^- ion per molecule of that base.
Examples: $\text{Ca}(\text{OH})_2$ and $\text{Cu}(\text{OH})_2$
- Triacidic base:** It is a base that dissociates in aqueous solution to produce three OH^- ion per molecule of that base.
Examples: $\text{Al}(\text{OH})_3$ and $\text{Fe}(\text{OH})_3$

✚ Properties of bases

Physical properties

1. They have a sharp and bitter taste.
2. They change the colour of indicators.

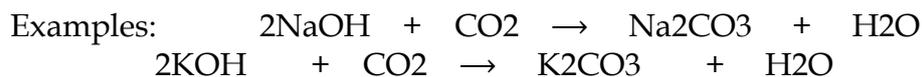
Indicators	Colour change in acidic medium
Litmus	Red to blue
Methyl orange	Orange to yellow
Phenolphthalein	Colourless to pink

3. They are soapy substances, i.e., they are slippery to touch.

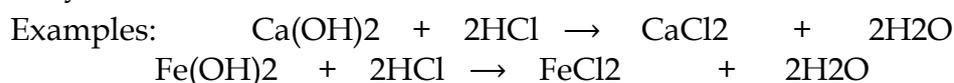
4. They are strong electrolytes.
5. They show a mild corrosive action (slight burn) on the skin.

Chemical properties

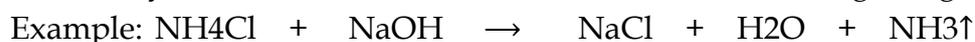
1. Strong alkalis absorb carbon dioxide from the air to form carbonates.



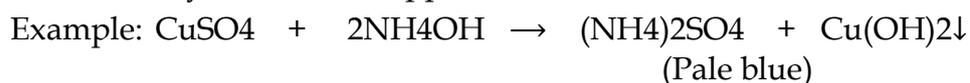
2. They neutralize acids to form salt and water.



3. When they are warmed with an ammonium salt, ammonia gas is given out.



4. They precipitate as insoluble metallic hydroxides when added to the solutions of the salts of heavy metals like copper, iron, zinc, etc.



❖ VIDEO-LINKS

LINK 1: <https://www.youtube.com/watch?v=zH-u2OzXPZE>

LINK 2: <https://www.youtube.com/watch?v=tDffmdkbXv0>

❖ LAB ACTIVITY

<https://www.youtube.com/watch?v=5Gov3XUXJHE>

<https://www.youtube.com/watch?v=FCNYhFyhk3U>

https://www.youtube.com/watch?v=DZY_28kLgY0

❖ LAB MANUAL

<https://www.cbse-samplepapers.info/cbse/cbse-class-10-science-practical-skills-properties-of-acids-and-bases>

❖ ASSIGNMENT

1. Differentiate between the chemical properties of acid and base.
2. Write down the bases used in our daily life. Also mention their types.

❖ CONCEPT MAP

