



CHAPTER 3 ACIDS, BASES AND SALTS

NOTES

Acids:

- Sour in taste
- Corrosive in nature

Types of acids:

1. Organic acids: acids present in food materials.

Examples: Citric acid ($C_3H_4OH(COOH)_3$); Malic acid $C_2H_3(OH)_2(COOH)_2$; Tartaric acid $C_2H_2(OH)_2(COOH)_2$ etc.

2. In-organic Acids (Mineral acids): Acids prepared from minerals

Examples: Sulphuric acid (H_2SO_4), Hydrochloric acid (HCl), Nitric acid (HNO_3) etc.

Bases:

- Bitter in taste
- Soft and slippery to touch
- Strong bases are corrosive
- Oxides and Hydroxides generally constitute bases.
Examples: Sodium hydroxide (NaOH), Potassium hydroxide (KOH); Calcium hydroxide [$Ca(OH)_2$]

Acid Base Indicators:

- Chemical substances which indicate the presence of an acid or base in a solution.

Types of Indicators:

1. Natural indicators. **Example:** Litmus, Turmeric, etc.
2. Man-made (Synthetic) Indicators. **Example:** Methyl Orange, Phenolphthalein.

Table : Colouration of indicators

Sl. No.	Name of the indicator	Colour change with acid	Colour change with base
1.	Blue litmus solution	Red	No change
2.	Red litmus solution	No change	Blue
3.	Methyl orange	orange red	Yellow
4.	Phenolphthalein	Colourless	Pink

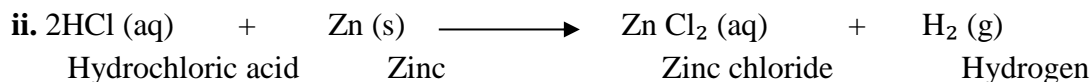
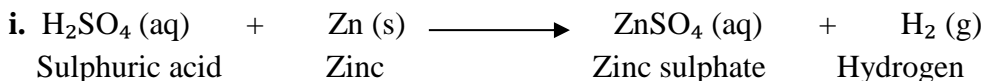
Indicators tell us the nature of a solution whether it is acidic or basic by a change in their colour in different solutions



Chemical Properties of Acids and Bases

1. Acid + Metal → Salt + Hydrogen gas

Examples:

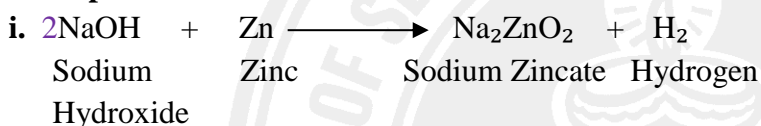


Pop Test (Test for Hydrogen Gas):

When a burning candle is brought near a test tube containing H_2 gas, it burns with a pop sound. This test is conducted for examining the presence of H_2 gas.

2. Base + Metal → Salt + Hydrogen

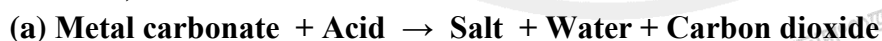
Examples:



- Aluminium powder and Sodium hydroxide solution is used to prepare hydrogen for gas balloon sold in the market.
- Tin and silicon also react with sodium hydroxide to liberate Hydrogen gas.

NOTE: Such reactions are not possible with all the metals.

3. Reactions of acids with metal carbonates and metal hydrogen carbonates (metal bicarbonates)



Example:



Example:

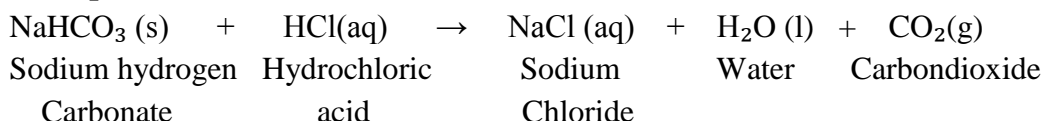




Table: Some of the acids found naturally in plants, fruits and insects which have acidic properties.

Plants and animal sources	Name of the acid present	Chemical formula
Lemon and oranges etc (citrus fruits)	Citric acid	$C_3H_4(OH)(COOH)_3$
Apple, Peach etc	Malic acid	$C_2H_3(OH)_2(COOH)_2$
Tamarind and grapes	Tartaric acid	$C_2H_2(OH)_2(COOH)_2$
Oxalis	Oxalic acid	$(COOH)_2$
Sour Milk (Curd)	Lactic acid	$C_2H_4(OH)COOH$
Vinegar	Acetic acid	CH_3COOH
Ants, Bees, Wasp	Formic acid	$HCOOH$
Cabbage, green leafy vegetables etc.	Ascorbic acid (Vitamin C)	$C_6H_8O_6$ or $C_5H_3(OH)_4COOH$

Alkalis:

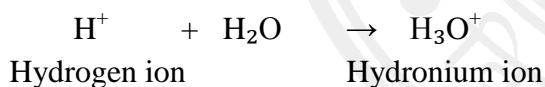
All bases do not dissolve in water. An alkali is a base that dissolves in water.

Example: NaOH ; KOH ; Ca(OH)₂ ; NH₄OH etc.

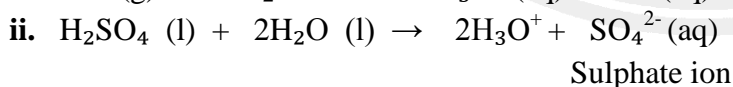
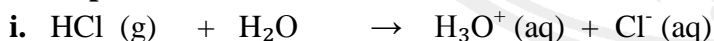
Note: All alkalis are bases but all bases are not alkalis.

Acids or bases in a water solution

➤ Acids produce hydrogen ions (H⁺ ions) or Hydronium ions (H₃O⁺) in the presence of water.

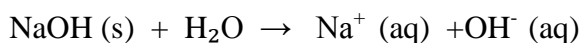


Examples:



The acidic reactions of acids are due to the presence of ionisable or replaceable hydrogen in them. Actually it is the reaction of hydronium ion (H₃O⁺) in solution.

➤ Bases provide hydroxide ion (OH⁻) in water.



➤ NaOH also known as caustic soda and KOH also known as caustic potash are highly corrosive.



Dissolution of acids and alkalis in water involve heat change:

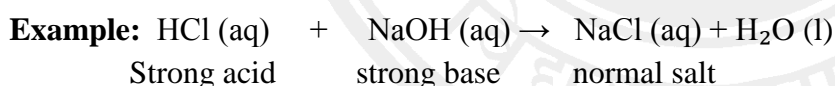
When an acid or a base is mixed with water they become dilute. This results in the decrease in the concentration of hydronium ion or hydroxide ion per unit volume in acids and bases respectively.

Strength of an acid or a base

- Strength of an acid depends on the number of hydronium ions (H_3O^+) it can produce in equimolar solutions.
- Strength of a base (alkali) depends upon the number of hydroxide ion (OH^-) it can produce in equimolar solutions.
- With the help of a universal indicator the strength of an acid or base can be determined. It is known as p^{H} scale. The scale of p^{H} value ranges from 0 to 14.
- Acidic solutions have p^{H} value less than 7 and that of basic solutions above 7.
- Stronger Acid \rightarrow Higher concentration of hydronium ion \rightarrow Lesser p^{H} value
- Solutions with lower p^{H} values are stronger acids.
- Stronger Base \rightarrow Higher concentration of hydroxide ion \rightarrow Higher p^{H} value
- Solutions with higher p^{H} values are more alkaline.

Different kinds of salts:

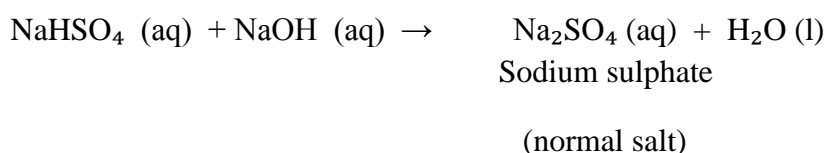
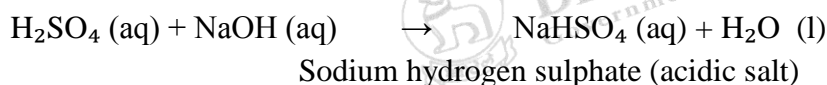
1. **Normal salts:** Salts formed by the complete neutralization of a strong acid with a strong base.



Some other normal salts are Na_2SO_4 , MgCl_2 , KNO_3 , CuSO_4 etc.

2. **Acid salts:** Salts which can behave as an acid and react with a base to give normal salt. They are formed by incomplete neutralisation of an acid by a base.

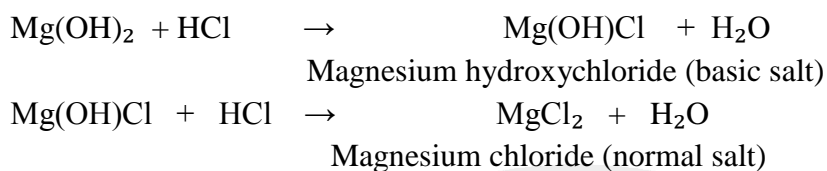
Example: Reaction between dilute NaOH and dilute H_2SO_4





3. **Basic salts:** Salts which contains replaceable OH group and can behave as a base and can react with an acid to give normal salt. They are formed by incomplete neutralization of a base with an acid.

Examples: Reaction between $Mg(OH)_2$ and HCl



Hydrolysis of salt with water

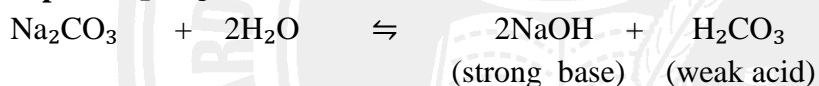
When a salt is dissolved in water, the solution obtained may be neutral, acidic or alkaline.

1. Soluble normal salts derived from strong acids and strong bases give neutral solution.

Example: $NaCl$ solution

2. Salt derived from weak acid and a strong base on hydrolysis give an alkaline solution.

Example: Na_2CO_3



3. Salt derived from strong acid and weak base on hydrolysis give an acidic solution.

Example: $AlCl_3$

