CHAPTER – 2 ACIDS BASES AND SALTS

ACIDS:

- These are the substances that have a sour taste.
- They turn blue litmus paper red.
- They give H^+ ions in aqueous solution.
- The term 'acid' has been derived from the Latin word, acidus, which means sour.

Strong Acids (mineral acid): HCl (hydrochloric acid), H_2SO_4 (sulphuric acid), HNO_3 (nitric acid)

Weak Acids: acetic acid, Oxalic acid, Lactic acid, citric acid etc.

Concentrated Acid: Having more amount of acid + less amount of water

Dilute Acid: Having more amount of water + less amount of acid

BASES:

- These are the substances that are bitter in taste and soapy in touch.
- They turn red litmus paper blue.
- They give OH^- ions in aqueous solution.

Strong Bases: NaOH (sodium hydroxide), KOH (potassium hydroxide),

Weak Bases: $Ca(OH)_2$(calcium hydroxide) etc.

Alkalis:

Water soluble base is called alkali.

CHEMICAL PROPERTIES OF ACIDS AND BASES

The reaction of Metals with Acids

$$Acid + Metal \rightarrow Salt + Hydrogen\ gas$$

$$2HCl + Zn \longrightarrow ZnCl_2 + H_2$$

The reaction of Metals with bases

$$Base + Metal \rightarrow Salt + Hydrogen\ gas$$

$$2NaOH + Zn \longrightarrow \underbrace{Na_2ZnO_2}_{Sodium\ zincate} + H_2$$

- Hydrogen gas released can be tested by bringing a burning candle near gas bubbles, it burst with a pop sound.

The reaction of Metal Carbonates/Metal Hydrogen Carbonates with Acids

$$Acid + Metal\ Carbonate/Metal\ Hydrogen\ Carbonate \longrightarrow Salt + CO_2 + H_2O$$

i. $2HCl + Na_2CO_3 \rightarrow 2NaCl + CO_2 + H_2O$

ii. $HCl + NaHCO_3 \rightarrow NaCl + CO_2 + H_2O$

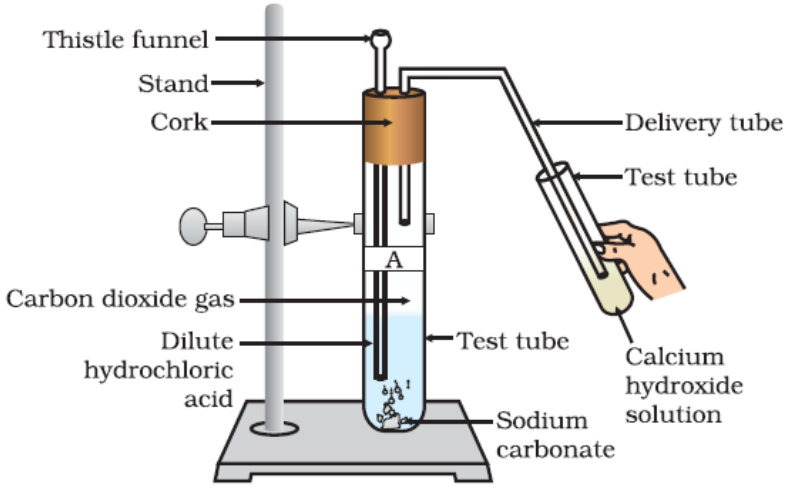
- Carbon dioxide can be tested by passing it through lime water.

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$$

(Lime water turns milky.)

- When excess carbon dioxide is passed,

$$CaCO_3 + CO_2 + H_2O \rightarrow \underbrace{Ca(HCO_3)_2}_{Milkiness\ disappears}$$



The reaction of Metal Carbonates/Metal Hydrogen Carbonates with bases

$$Base + Metal\ Carbonate/Metal\ Hydrogen\ Carbonate \longrightarrow No\ Reaction$$

The reaction of Metallic Oxides with Acids

Metallic oxides are basic.

Example- CaO (calcium oxide), MgO (magnesium oxide) are basic oxides.

$$Metallic\ Oxide + Acid \rightarrow Salt + water$$

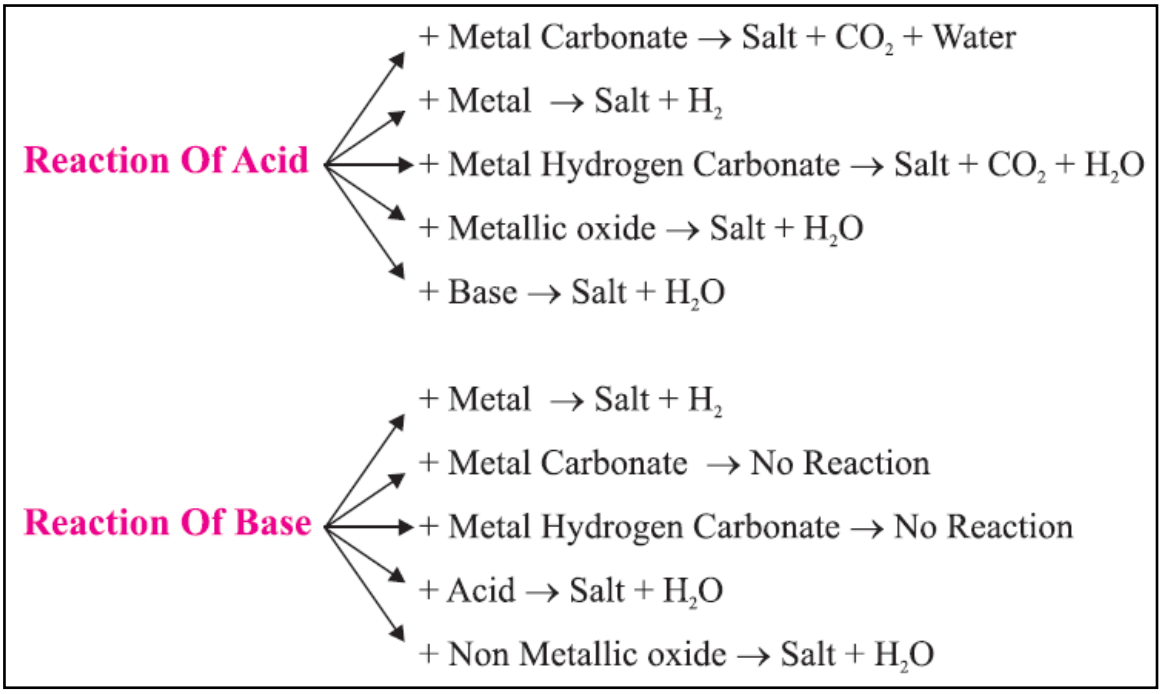
$$CaO + 2HCl \rightarrow CaCl_2 + H_2O$$

The reaction of Non-metallic Oxides with Bases

Non-metallic oxides are acidic.

$$Non\ metallic\ Oxide\ +\ Base \rightarrow Salt\ +\ H_2O$$

$$CO_2\ +\ Ca(OH)_2 \rightarrow CaCO_3\ +\ H_2O$$



Acid or Base in Water Solution

Acids produce H^+ ions in presence of water.

H^+ Ions cannot exist alone, they exist as H_3O^+ (hydronium ions).

$$H^+\ +\ H_2O \rightarrow H_3O^+$$

or

$$HCl\ +\ H_2O \rightarrow H_3O^+\ +\ Cl^-$$

Bases when dissolved in water gives OH^- ions.

$$NaOH \xrightarrow{H_2O} Na^+ + OH^-$$

$$Mg(OH)_2 \xrightarrow{H_2O} Mg^{2+} + 2OH^{-1}$$

Indicators

Indicators are the substance that change their colour or odour when added into an acid or alkaline solution. Indicators can be classified as natural, synthetic indicators, olfactory indicators and universal indicators.

	s.no.	indicator	Smell/colour in acid solution	Smell/ colour in basic solution
Natural indicator	1	litmus	red	blue
	2	Red cabbage leaf extract	red	Green
	3	Flowers of hydrangea plant	blue	Pink
	4	turmeric	No change	Red
Synthetic indicator	1	phenolphthalein	colorless	pink
	2	Methyl orange	Red	yellow
Olfactory indicator	1	onion	Characteristic smell	No smell
	2	Vanilla essence	Retains smell	No smell
	3	Clove oil	Retains smell	Loses smell

Universal indicator:

To judge how strong a given acid or base is, a universal indicator is a mixture of several indicators. It shows different colours at different concentrations of H^+ ions in the solution.

Strength of Acid and Base

- Strength of an acid or base depends on the number of H^+ ions or OH^- ions produced by them respectively.
- Larger the number of H^+ ions produced by an acid, stronger is the acid. Similarly, larger the number of the OH^- ions produced by a base, stronger is the base.

pH Scale:

A scale for measuring H^+ ion concentration in a solution. P in pH stands for **potenz** a German word that means **power**. It has values ranging from 0 (very acidic) TO 14 (very alkaline).

thus, pH is a number which indicate the acidic or basic nature of a solution.