

**Acids, Bases and Salts** are three main categories of chemical compounds. These have **certain definite properties** which distinguish one class from the other.

We study these 3 categories of compounds.

## BASICS

1. **Indicators:** Indicate the presence of an acid or base **in a solution**. Substances which show the acidic or basic behaviour of other substance by change in colour are known as indicator.

Type of Indicator:

- (i) Natural
- (ii) Olfactory Indicator
- (iii) Synthetic Indicator
- (iv) Universal Indicator

(i) **Natural Indicator:** Indicators obtained from natural sources are called natural indicators. Litmus, turmeric, red cabbage, China rose, etc. are some common natural indicators.

**Litmus:** Litmus is obtained from Lichens. The solution of litmus is purple in colour. Litmus paper comes in two colour – blue and red.

- ◇ An acid turns blue litmus paper red.
- ◇ A base turns red litmus paper blue.

(ii) **Olfactory Indicators:** Substances which change their smell when mixed with acid or base are known as olfactory indicators. For example, onion, vanilla, clove, etc.

**Onion:** Paste or juice of onion loses its smell when added with base. It does not change its smell with acid.

(iii) **Synthetic Indicator:** Indicators that are synthesized in laboratory are known as synthetic indicators. For example; phenolphthalein, methyl orange, etc.

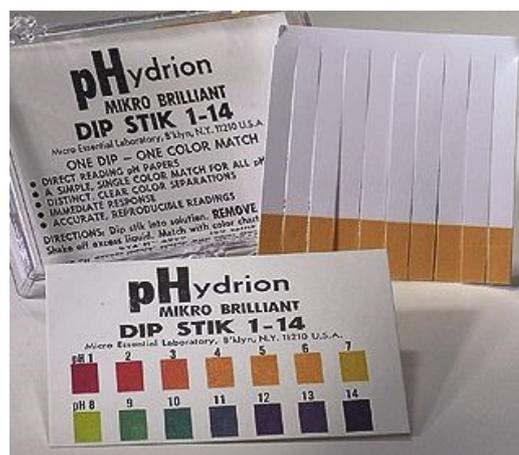
**Phenolphthalein** is a colourless liquid. It remains colourless with acid but turns into pink with a base.

**Methyl orange** is originally orange in colour. It turns into red with acid and turns into yellow with base.

Indicator	Original colour	Acid	Base
<b>Red litmus</b>	Red	No change	Blue
<b>Blue litmus</b>	Blue	Red	No change
<b>Turmeric</b>	Yellow	No change	Reddish brown
<b>Phenolphthalein</b>	Colourless	Colourless	Pink
<b>Methyl orange</b>	Orange	Red	Yellow
<b>Onion</b>	n/a	No change	Smell vanishes

(iv) **Universal Indicator:** To get the strength as well as acidic and basic nature of a given solution universal indicator is used. Universal indicator shows different colour over the range of pH value from 1 to 14 for a given solution. **Universal indicator is available both in the form of strips and solution.** Universal indicator is the combination of many indicators, such as water, propanol, phenolphthalein, sodium salt, sodium hydroxide, methyl red, bromothymol blue monosodium salt, and thymol blue monosodium salt.

The colour matching chart is supplied with universal indicator which shows the different colours for different values of pH.



2. **pH Scale:** The strength of acid or base depends upon the hydrogen ion concentration. A scale for measuring hydrogen ion concentration in a solution, called pH scale. pH is a scale which quantifies the concentration of hydrogen ion in a solution. The range of pH scale is between 0 (very acidic) to 14 (very alkaline).

pH is defined as negative logarithm of  $H^+$  concentration or  $H_3O^+$  concentration.

$$pH = -\log [H] \text{ or } -\log [H_3O^+]$$

If the concentration of hydrogen ion is greater than hydroxide ion, the solution is called **acidic**. If the concentration of hydrogen ion is smaller than the hydroxide ion, the solution is called **basic**. If the concentration of hydrogen ion is equal to the concentration of hydroxide ion, the solution is called **neutral solution**.

pH < 7 is acidic  
 pH = 7 is neutral  
 pH > 7 is basic

The paper which is coated with **universal indicator** is called **pH paper**.

## Application of pH

- (i) **pH in our digestive system** - Our **stomach produces hydrochloric acid**. It helps in the digestion of food without harming the stomach. During indigestion, the stomach produces too much acid and this causes pain and irritation. To get rid of this pain, people use bases called **antacids**. These antacids neutralise the excess acid. **Magnesium hydroxide (Milk of magnesia)**, a mild base, is often used for this purpose.
- (ii) **pH change as the cause of tooth decay** - Tooth enamel, made up of calcium phosphate is corroded when the pH in the mouth is below 5.5. Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating. Using toothpastes, which are basic, for cleaning the teeth neutralise the acid and prevent tooth decay.
- (iii) **Self-defence by animals and plants** - Bee-sting leaves an acid which causes pain and irritation. Use of a mild base like baking soda on the stung area gives relief. Stinging hair of nettle leaves inject **methanoic acid** causing burning pain and can be neutralized by use of a base.

