بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

PH and Buffer solution : -

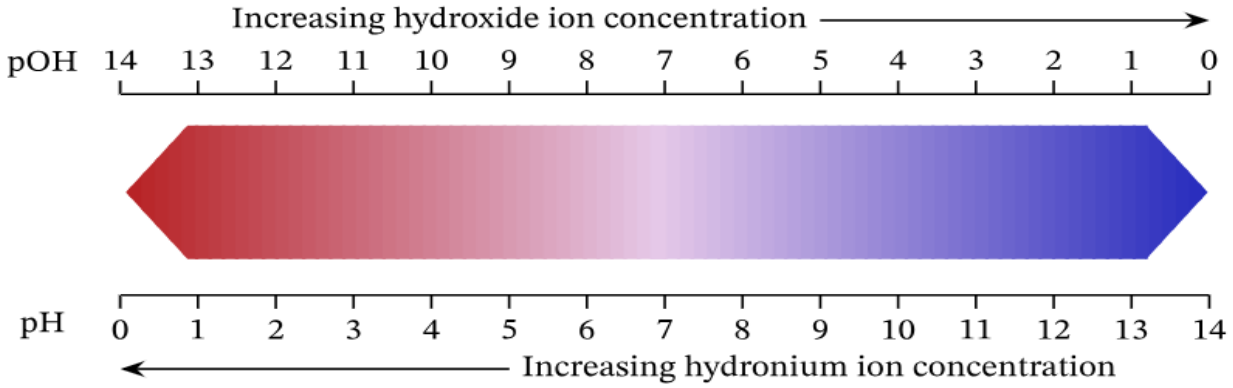
PH: It is negative log of the hydrogen concentration.

pH = -log [H+]

pH is a unit of measure which describes the degree of acidity or alkalinity (basic) of a solution.

It is measured on a scale of 0 to 14 .

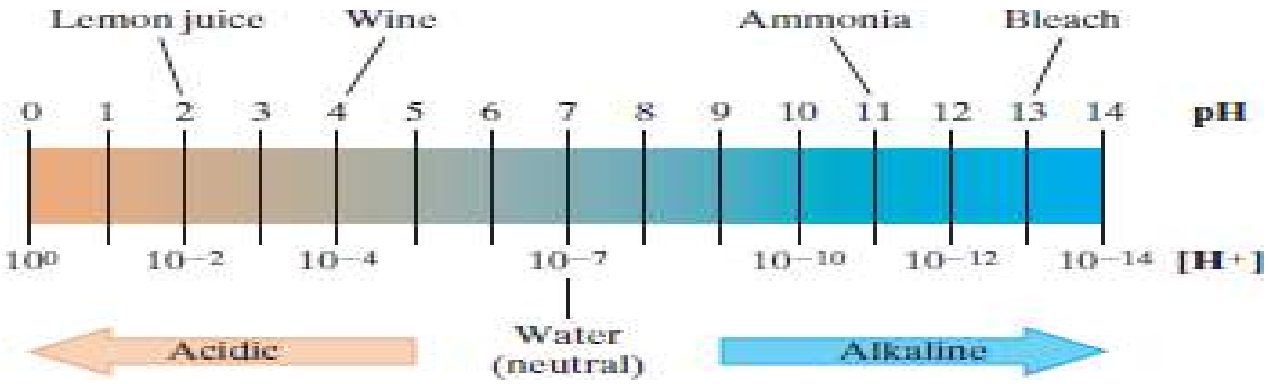
- Low PH correspond to high concentrations of H+ and high pH values correspond to low concentrations of H+.



- **PH Value**

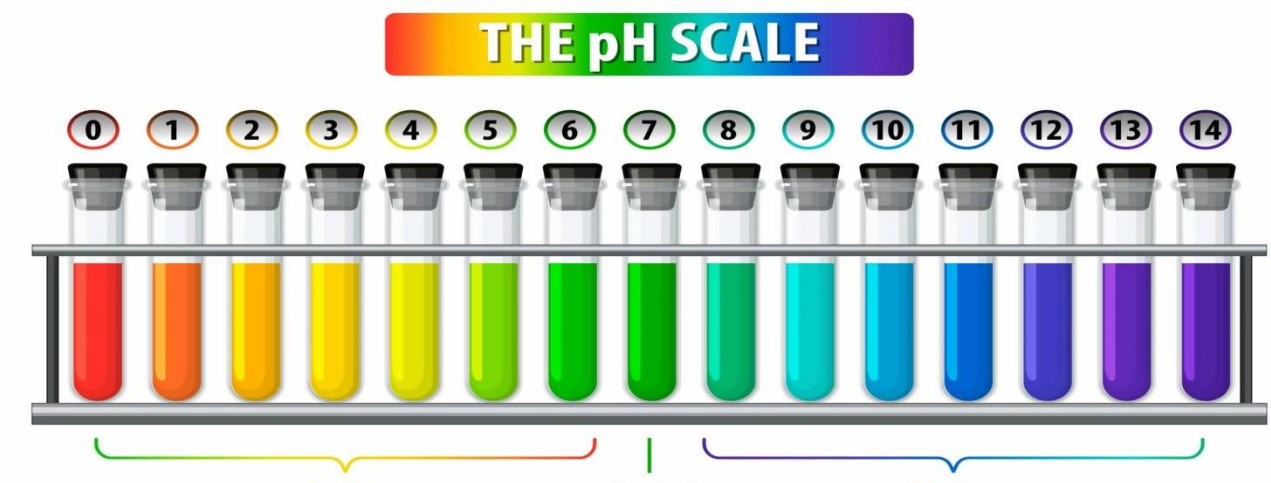
The pH value of a substance is directly related to the ratio of the hydrogen ion and hydroxyl ion concentrations.

1) If H+ concentration is higher than OH - the material is acidic.
2) If the OH - concentration is higher than H+ the material basic.
3) 7.0 is neutral,
4) PH < 7.0 is acidic
5) PH >7.0 is basic



- The PH scale

pH is a measure of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pHs of less than 7 indicate acidity, whereas a pH of greater than 7 indicates a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water.



- Acid- Base Balance

PH normal : 7.35 – 7.45

1. Acidosis :

Physiological state resulting from low plasma.

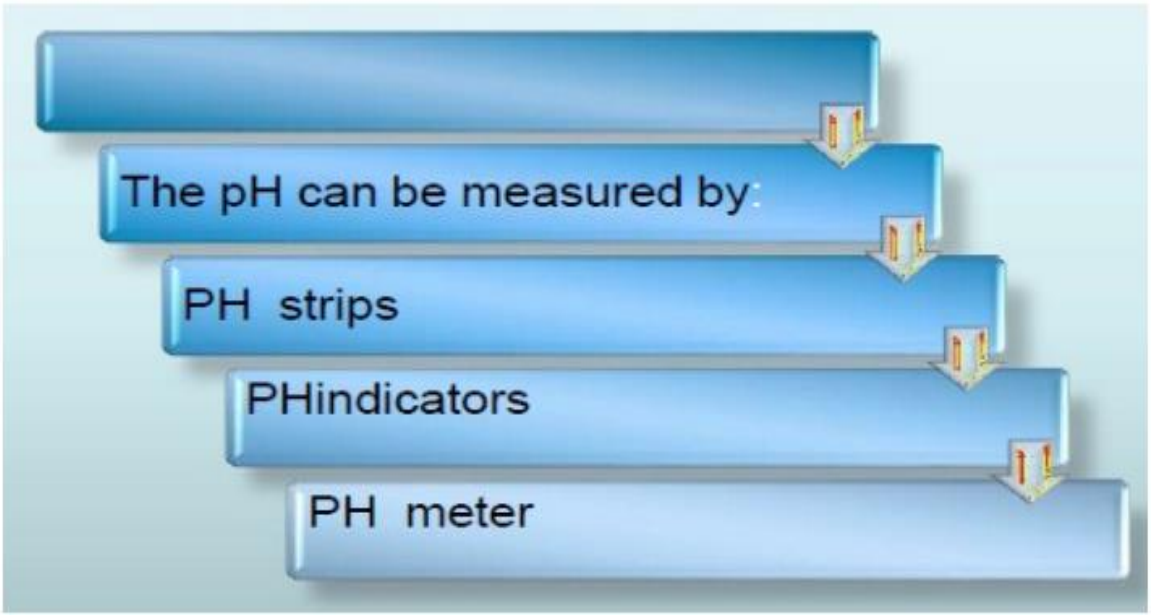
Acidemia :plasma pH <7.35

2. Alkalosis

Physiological State resulting from high plasma .

Alkalemia :plasma plasma pH >7.45.

- Measurement of PH



- PH meter

The PH meter is a laboratory equipment which used to measure acidity or alkalinity of a solution.



The PH meter measures the concentration of hydrogen of ions [H +] using sensitive electrode.

$$pH = -\log[H^+]$$
$$pOH = -\log[OH^-]$$

$$pH + pOH = 14 \rightarrow pH = 14 - pOH$$

$$H_2O \rightleftharpoons H^+ + OH^- \; K_{eq} = [H^+][OH^-] = 10^{-14}$$
$$-\log(10^{-14}) = -\log[H^+] + -\log[OH^-]$$
$$14 = pH + pOH$$

Ex: What is the pH for a 0.05M solution of hydrochloric acid?

$$pH = -\log[H^+]$$
$$pH = -\log[0.05]$$
$$= -\log[5*10^{-2}]$$
$$= 2 - \log 5$$
$$= 2 - 0.69$$
$$= 1.31$$

Ex: What is the pH of the solution has a pOH of 2.13 ?

P OH + pH = 14

pH = 14 – p OH

pH = 14 - 2.13

pH = 11.87

- Buffer solution

A buffer solution is an aqueous solution consisting of a mixture of a weak acid and its salt (acidic buffer) or a weak base and its salt (basic buffer).

It is able to neutralize(Its pH changes very little) when a small amount of strong acid or base is added to it and thus it is used to prevent changes in the pH of a solution and maintaining the pH of the solution relatively stable.

- Buffer solutions are used in a wide variety of chemical applications.

- One example of a buffer solution found in nature is blood. The normal pH of human blood is 7.4.

maintaining the pH of the solution relatively stable.

Uses of Buffer Solutions :-

There exists a few alternate names that are used to refer buffer solutions, such as pH buffers or hydrogen ion buffers .An example of the use of buffers in pH regulation is the use of bicarbonate and carbonic acid buffer system in order to regulate the pH of animal blood. Buffer solutions are also used to maintain an optimum pH for enzyme activity in many organisms.

Types of buffer :

Buffer solution can be classified into two types:

1-Acidic buffer solutions (Weak acid and salt): An acidic buffer solution is simply one which has a pH less than 7. Acidic buffer solutions are commonly made from a weak acid and one of its salts - often a sodium salt. A common example would be a mixture of acetic acid and sodium acetate in solution.

Ex: $CH_3COOH + CH_3COONa$.

2-Alkaline (basic) buffer solutions (Weak base and salts): An alkaline buffer solution has a pH greater than 7. Alkaline buffer solutions are commonly made from a weak base and one of its salts. A frequently used example is a mixture of ammonia solution and ammonium chloride solution.

Ex: $NH_4OH + NH_4Cl$

Some common weak acids and bases and their salts usually used for the preparation of buffer solutions

Acid or Base	Salt
Acetic acid	Sodium acetate
Phosphoric acid	Potassium phosphate
Oxalic acid	Lithium oxalate
Carbonic acid	Sodium carbonate
Ammonia	Ammonium chloride