

Estimation of pH

Introduction:

pH may be defined as negative logarithm of hydrogen ion concentration (By Sorenson. 1904). All phases of water supply and wastewater treatment such as acid base neutralization, water softening, precipitation, coagulation, disinfection and anticorrosion measures are pH dependent. pH is used as alkalinity and CO₂ measurements.

pH is an intensity factor of acidity and alkalinity. Pure water is very slightly ionized and at equilibrium, the conc. of hydrogen and hydroxyl ions will be equal and their product will be equal to 1.01×10^{-14} at 25⁰ C

$$[H^+][OH^-] = k_w = 1.01 \times 10^{-14} \text{ at } 25^0 \text{ C}$$

The pH varies with temperature. The pH of water at 0⁰ C is 7.5 and at 60⁰ C is about 6.5. If the water contains more of alkali earth metals like Na, Ca, K, then the water will be alkaline. If contains more of organic matter, then due to microbial activity, organic acids will be released and will render the water to be acidic. By the dissolution of carbonates and bicarbonates, the pH increases.

Depending on the predomination of [H⁺] or [OH⁻], the pH varies. When the pH is above 7, the solution is alkaline and when it is below 7, the solution is acidic. The lower the pH, the higher is the hydrogen ion concentration.

For Acids: [H⁺] > [OH⁻] - pH is below 7.

Pure water: [H⁺] = [OH⁻] - pH is 7.

Bases: [H⁺] < [OH⁻] - pH is above 7.

The productive quality of water is increased by increasing the alkalinity and not the acidity.

Methods Involved in Determination of pH of Water Sample:

1. By Using pH Paper:

pH papers are used to find out the approximate pH of water in the field conditions. It only gives a rough idea about whether the water sample is acidic or alkaline. There are 3 types of papers namely:

- (i) Wide range pH paper (pH ranges from 1 to 14)
- (ii) Acid range pH paper (pH ranges from 2 to 4.5)
- (iii) Narrow range pH paper (pH ranges from 8 to 9)

pH papers consists of a small booklet over which there is a wrapper with different colours with given pH values. We have to compare the colour on the wrappers.

2. By Using Lovibond pH Comparator:

This instrument gives slightly accurate values as compared to pH papers. It is little sensitive than pH papers. Here, there will be a provision for inserting different indicator discs with different pH values in it.

Insert the disc into the frame. The frame is provided with provisions for inserting two cassettes, one with reference solutions to be placed in the left cavity and another sample to be placed to the right of reference solution. The frame will also be provided with a window to see and compare the colours between the indicator disc and the sample. When a particular colour in the reference solution, which is imparted by the indicator disc resembles the sample, then write down the pH of that particular sample based on the pH value which appears in the sample window at the lower right corner.

3. By Electronic Technique (pH Meter):

It is very sensitive instrument that is used for determining the pH of a given water sample accurately.

When the electrode is dipped into the solution, depending on the pH, which rotates the points, which shows a particular reading. Before using a pH meter, it has to be standardized using reference solutions of known pH (pH say 7). Dip the electrode into the known reference solution, wait for a minute then press the button and the pointer tilts. If it does not show exactly 7. Then, with the button pressed, press the adjustment and get the pointer showing exactly 7. Then, remove the electrode and flush it with distilled water and again place it in another reference solution with slightly alkaline or acidic pH. Standardize the pH meter as said above. Now, the pH meter is ready for use. Dip the electrode in the given samples and note down the reading. Ensure that the electrode is washed with distilled water after each observation is over.

Result: