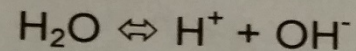

pH & electrochemistry basics

- Sumita Som
17th Aug. 2015

What is pH ?

1.1 INTRODUCTION

pH in an aqueous solutions is a measure of hydrogen and hydroxide ions. Water molecules dissociate in hydrogen (H^+) and hydroxide (OH^-) ions,



but the number of ions formed is very small. Water at $25^\circ C$ contains 1×10^{-7} mol/l of hydrogen ions and the same concentration of hydroxide ions, where the concentration (mol/l) of hydrogen ions $[H^+]$ multiplied by the concentration (mol/l) of hydroxide ions $[OH^-]$ is constant:

$$K_w = [H^+] [OH^-] \quad <1>$$

K_w is the dissociation constant for water and it depends on temperature.

Temperature $^\circ C$	K_w
10	$0,2920 * 10^{-14}$
15	$0,4505 * 10^{-14}$
20	$0,6809 * 10^{-14}$
25	$1,008 * 10^{-14}$
30	$1,469 * 10^{-14}$

pH definition:

Acids in water increase the $[H^+]$ and, because the product $[H^+][OH^-]$ must be constant, acids decrease the $[OH^-]$. Bases increase $[OH^-]$ and decrease $[H^+]$. For example, suppose an acid is added to water at 25°C and the acid raises the $[H^+]$ to 1.0×10^{-3} mol/l. Because $[H^+][OH^-]$ must always equal 1.00×10^{-14} , $[OH^-]$ will be 1.0×10^{-11} mol/l.

pH is the common way of expressing the hydrogen ion concentration $[H^+]$. pH is defined as:

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

<2>

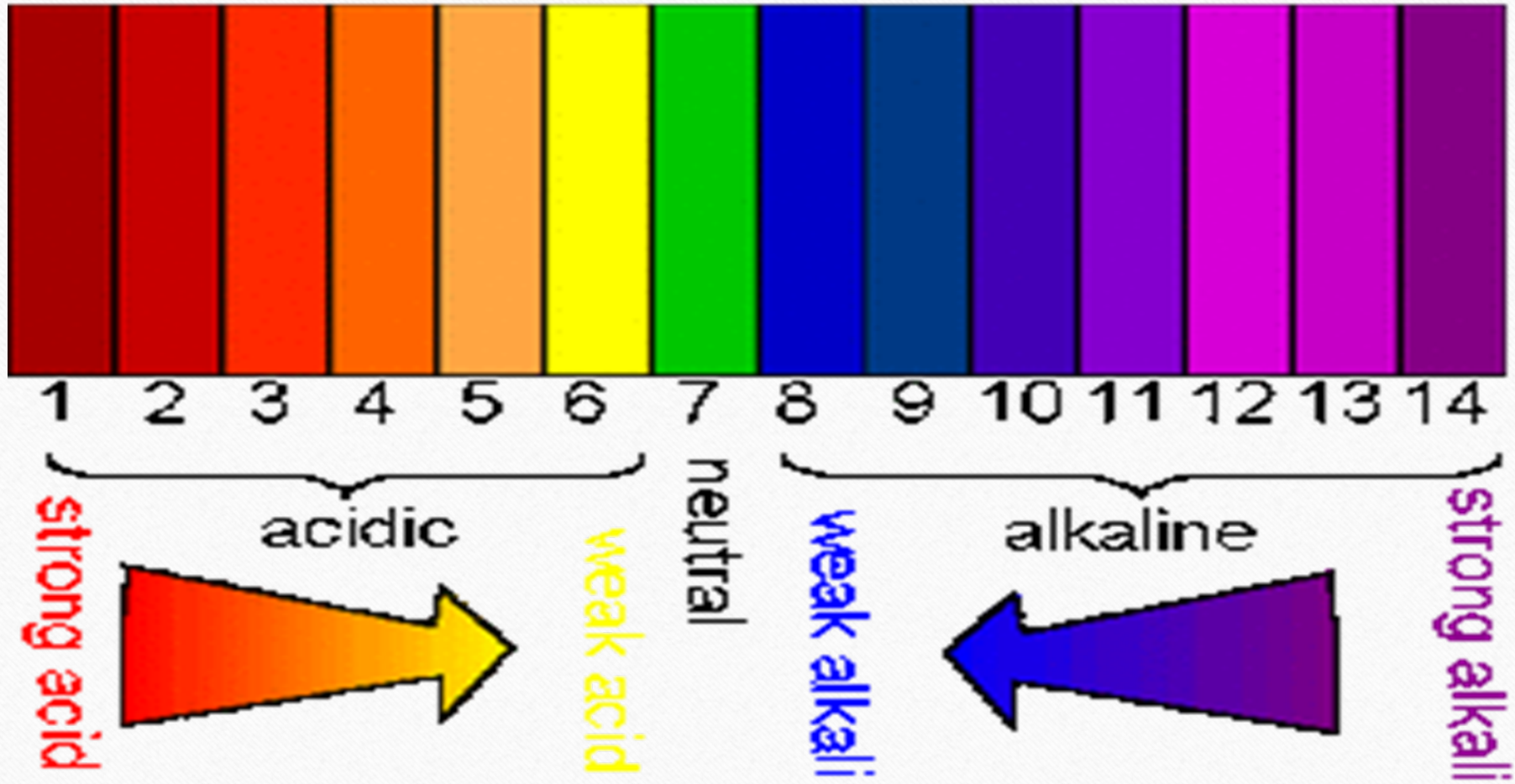
pH:

- pH is a logarithmic measure of hydrogen ion concentration, originally defined by Danish biochemist Søren Peter Lauritz Sørensen in 1909

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

- The hydrogen ion concentration in pure water around room temperature is about 1.0×10^{-7} M. A pH of 7 is considered "neutral", because the concentration of hydrogen ions is exactly equal to the concentration of hydroxide (OH^-) ions produced by dissociation of the water.
- Increasing the concentration of hydrogen ions above 1.0×10^{-7} M produces a solution with a pH of less than 7, and the solution is considered "acidic".
- Decreasing the concentration below 1.0×10^{-7} M produces a solution with a pH above 7, and the solution is considered "alkaline" or "basic".
- pH is often used to compare solution acidities.

pH Scale



The pH Scale



2.1 GENERAL

In nearly every industrial and scientific application, pH is determined by measuring the potential of an electrochemical cell. Figure 2 shows a simplified diagram of a pH cell.

combined pH electrode

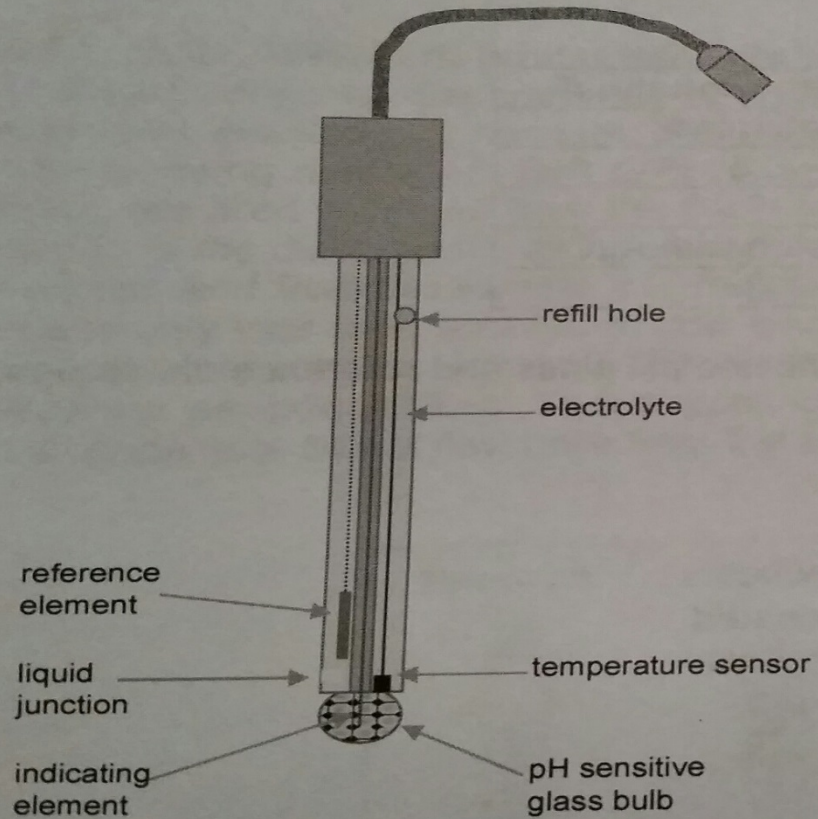


Figure (2): combined pH glass electrode

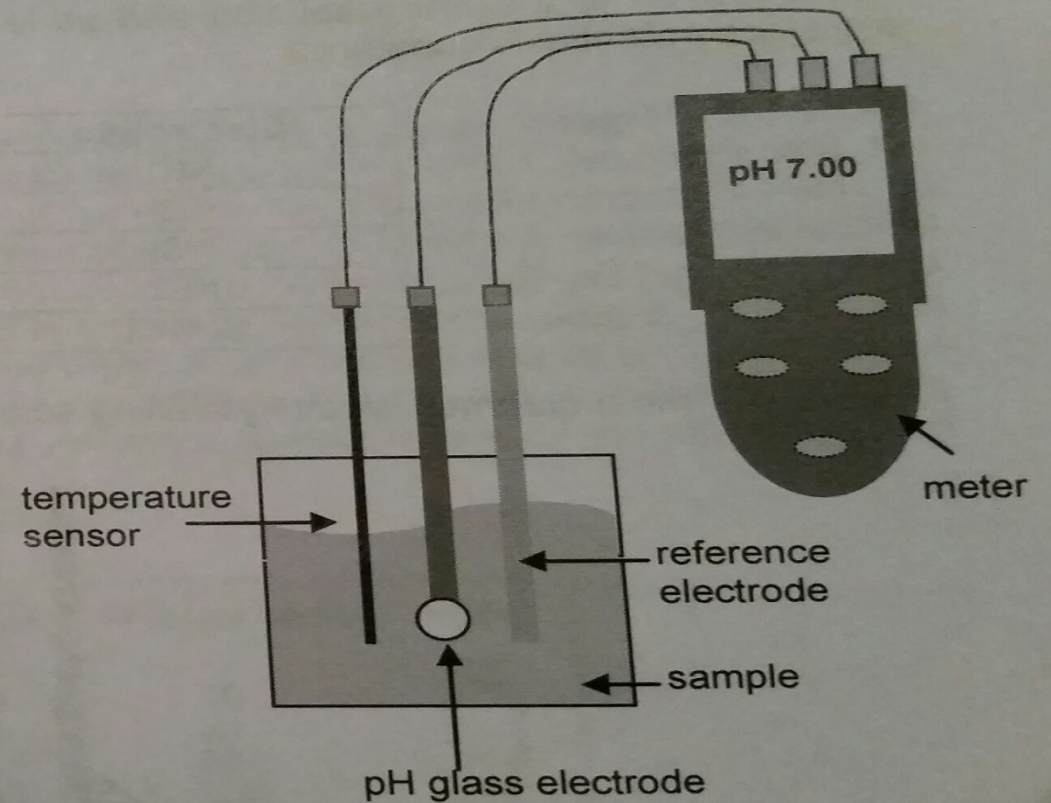


Figure (3): pH measurement system

A pH measurement system (figure 3) consists of a pH probe, reference probe, temperature sensor, pH meter and the sample to be measured. In most cases the three probes are combined in one electrode (figure 2). When the pH probe is in contact with a solution a potential forms between the pH probe and the reference probe (figure 4). The meter measures the potential and converts it, using the calibration curve parameters, into a pH value.

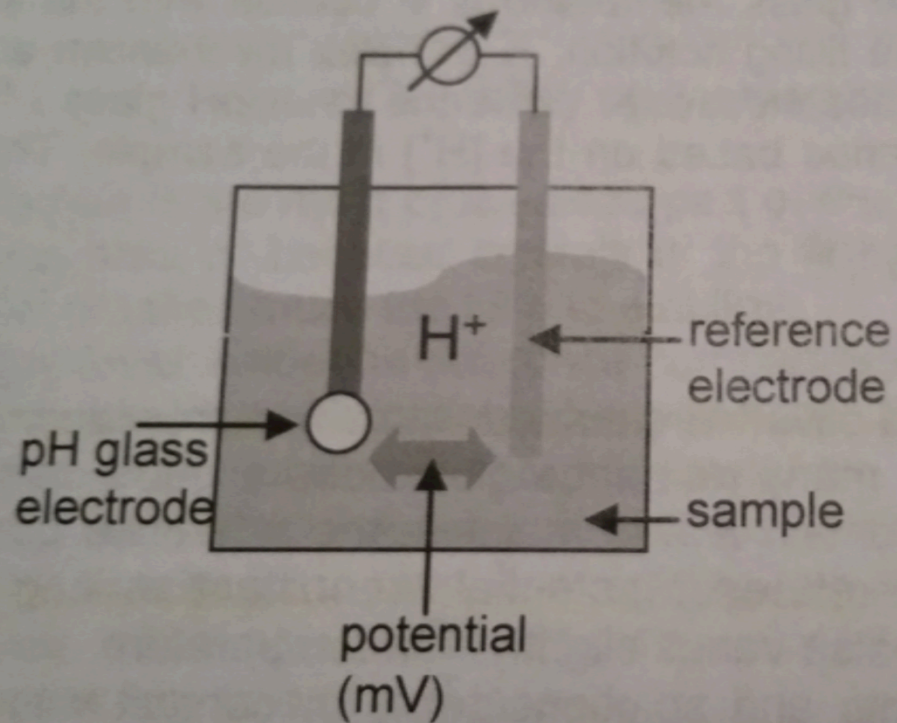


Figure (4): development of a potential (mV) between pH probe and reference probe: "pH cell"

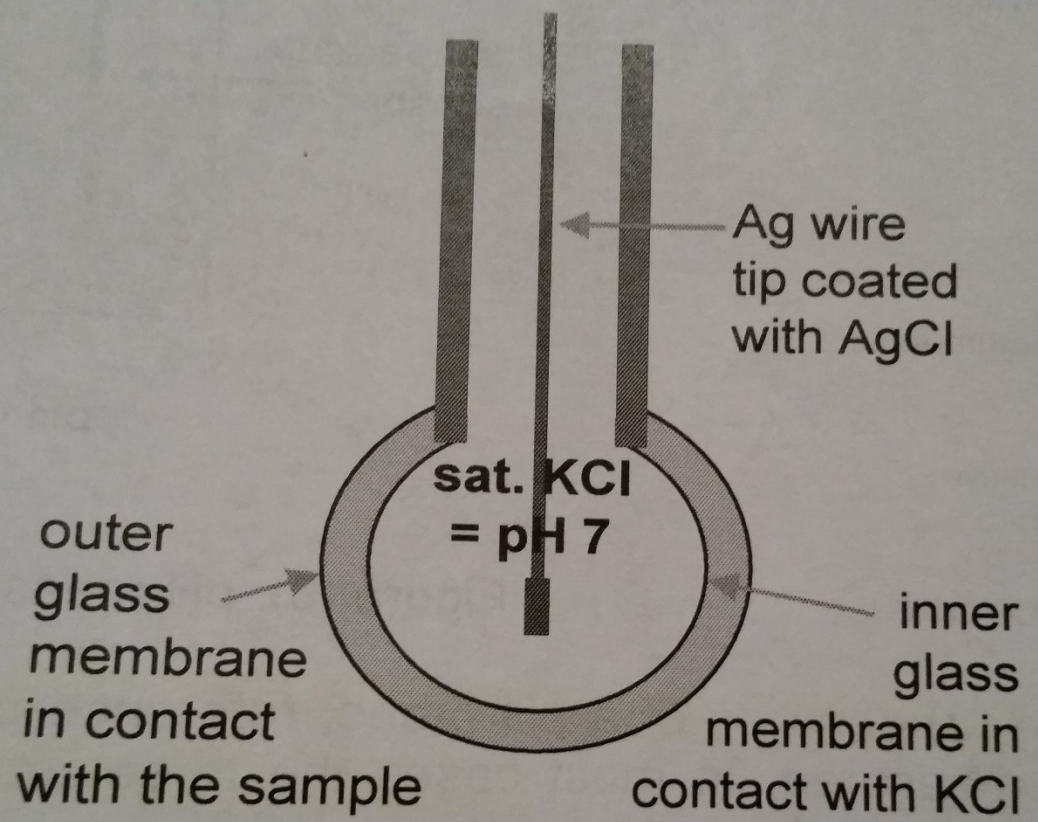


Figure (6): working principle of a pH glass membrane

pH paper method

- We do not sell
- Not a very accurate method, used for estimation only



References & pH meter videos

- <http://www.horiba.com/laquatwin/en/videos/index.html>
- <http://www.youtube.com/watch?v=ji8kEc4VCPQ>

<http://www.all-about-ph.com/ph-buffer.html>

Distributorship notes:

- Distribution center of Horiba in Irvine, California
- A white warranty sticker placed on the box at the time of shipping to us.
- No drop ship
- Products have a blue seal, not to be opened, no destructive inspection

Distributorship notes: ...contd

- Meter set-up and troubleshooting to be done by customer support
- Units available for Customer service (owner: Mike Alvarez)
- NO demo units to be issued to customers
- No repairs to be done by Decagon
- Repair items to go back to Horiba in Irvine, CA

Distributorship notes:

...contd

- All part numbers set –up in M3
- Sales and marketing to help customers with choosing electrodes for applications

Label on the box & shipping carton

