بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

Practical of General Chemistry

Department :- Radiology Techniques

Class:1st year

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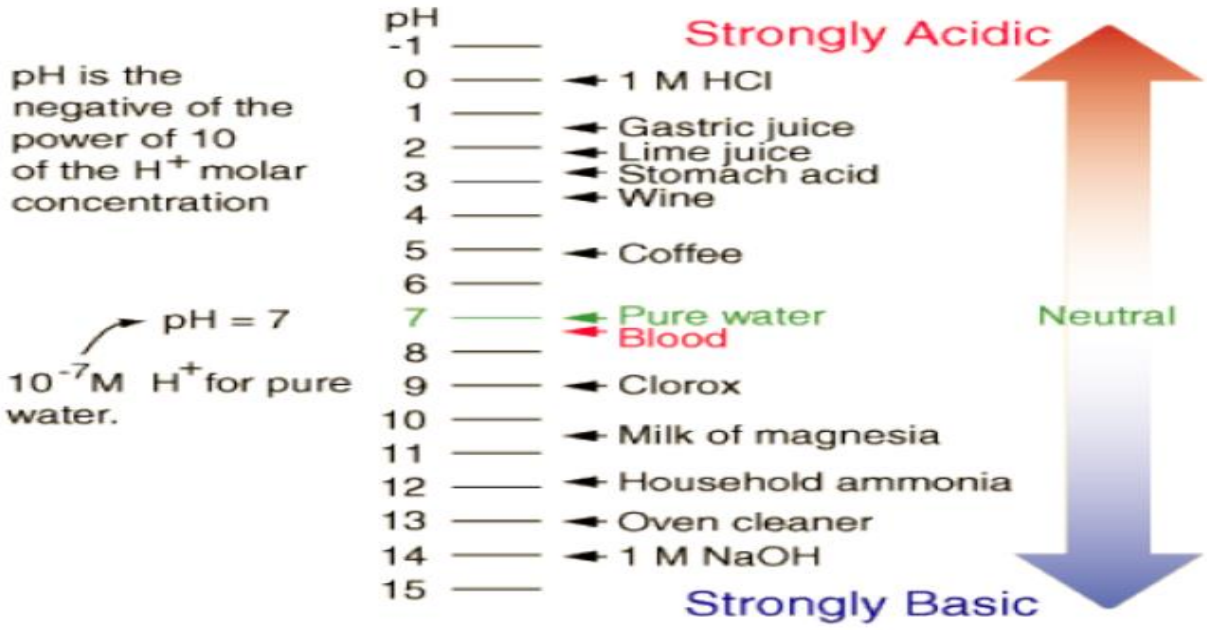
- Exp:. 4
- Name of experiment :. . Principles of pH meter
- Purpose of experiment: The determination of pH value for three differently mixed volume buffer solutions of acetic acid and lead acetates.

Theory

A pH meter is a device that measures the pH of a solution by measuring the voltage between two electrodes submerged in the solution. A pH meter is used to determine the acidity or alkalinity of the solution. pH is the concentration of hydrogen ions in the solution. A solution containing more H+ ions remains acidic while the solution containing more OH- ions remains alkaline. pH value of solutions ranges from 1 to 14.





pH Meter

The formal definition of pH : pH = -log [H +] Represent the logarithmic function of the concentration of H+ ions which express the reciprocal potential of hydrogen concentration on both sides of the bulb membrane. The pH value of a neutral solution equal to 7 according to the following

example:

If [H+] = 10-10 means that hydrogen concentration is low. It means that pH value = 10 so that the solution is alkaline. But when [H+] = 10-3 means that hydrogen concentration is high. It means that pH value = 3 so that the solution is acidic.

- A pH electrode is composed of two main parts :

1. A glass electrode is a type of ion-selective electrode made of a doped glass membrane that is sensitive to a specific ion.

2. A reference electrode is an electrode which has a stable and well known electro

Parts of glass electrode :

1. a sensing part of electrode, a bulb made from specific glass

2. internal electrode, usually silver chloride electrode or calomel electrode Ag/AgCl

3. 0.1 KCl solution (glass electrode internal filling solution pH =7).

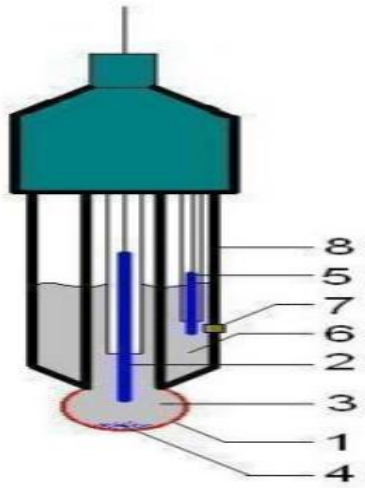
4. sometimes electrode contain small amount of AgCl precipitate inside the glass electrode

5. reference electrode, usually the same type as 4

6. junction with studied solution, usually made from ceramics or capillary with asbestos or quartz fiber.

7. reference junction

8. body of electrode made from non-conductive glass or plastics.



Buffer solutions:

Is an aqueous solution consisting of a mixture of a weak acid and its conjugate base, or vice versa. Its pH changes very little when a small or moderate amount of strong acid or base is added to it and thus it is used to prevent changes in the pH of a solution. Buffer solutions are used as a means of keeping pH at a nearly constant value in a wide variety of chemical applications. for Example: Bicarbonate buffer is a mixture of carbonic acid (the weak acid) and the bicarbonate ion (the conjugate base): $H_2CO_3 + HCO_3^-$

$$pH = \log pKa + \log salt/\ acid$$

Procedure:

1.Measurement of pH of strong acids

Step 1.

Prepare 5 solutions of H2SO4 (concentration from 1.0 to 0.0001 M, according to data in Table 1) in the beakers of capacity 25 mL.

Step 2.

Insert the clean and dry electrode of the pH meter to selected solution (e.g. 0.0001M).

Step 3.

Record the values of pH in Table 1.

Step 4.

Clean the electrode of the pH meter with distilled water and dry it with tissue.

Step 5.

Repeat measurement procedure (steps 2-4) to remaining acid solution (e.g.0.001, 0.01, 0.1 and 1.0M)

Table 1. Determined and calculated data for H2SO4

Concentration of H_2SO_4 [mol/L]	1.0	0.1	0.01	0.001	0.0001
pH calculated from equation: pH = - log $[H^+]$					
pH measured experimentally					

Questions:

1- What is pH-meter? Explain its parts.

2- Define reference electrode, glass electrode, buffer solution , pH ?