DETERMINATION OF STRENGTH OF AN ACID USING pH METER

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Introduction

- pH scale is a convenient means of expressing relative acidity or alkalinity of solutions. The pH of the system plays a very important role in many chemical and biochemical reactions. The pH of pure water is 7.0. therefore, the pH of any water sample may give an indication of the type of impurity present in water.
- It is measured on a scale of 0 – 14.The term pH is derived from “p”, the mathematical symbol for negative logarithm and “H”, the chemical symbol for hydrogen.

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- The pH value of a substance is directly related to the ratio of hydrogen ion $[H^+]$ and hydroxyl ion $[OH^-]$concentrations.
- There are several techniques used to measure pH. pH paper and litmus paper are commonly used when the measurements do not have to be precise.
- When accurate measurements are needed, pH meters are used.

Aim:

To find out the strength of given hydrochloric acid by titrating against NaOH (0.1N) using pH meter.

Apparatus Required:

pH meter, 250ml beaker, 100ml beaker ,Glass rod, 10ml pipette, 25ml burette

NaOH solution-0.1 N, HCl sample solution, Distilled water.

pH meter

250ml beaker

100ml beaker

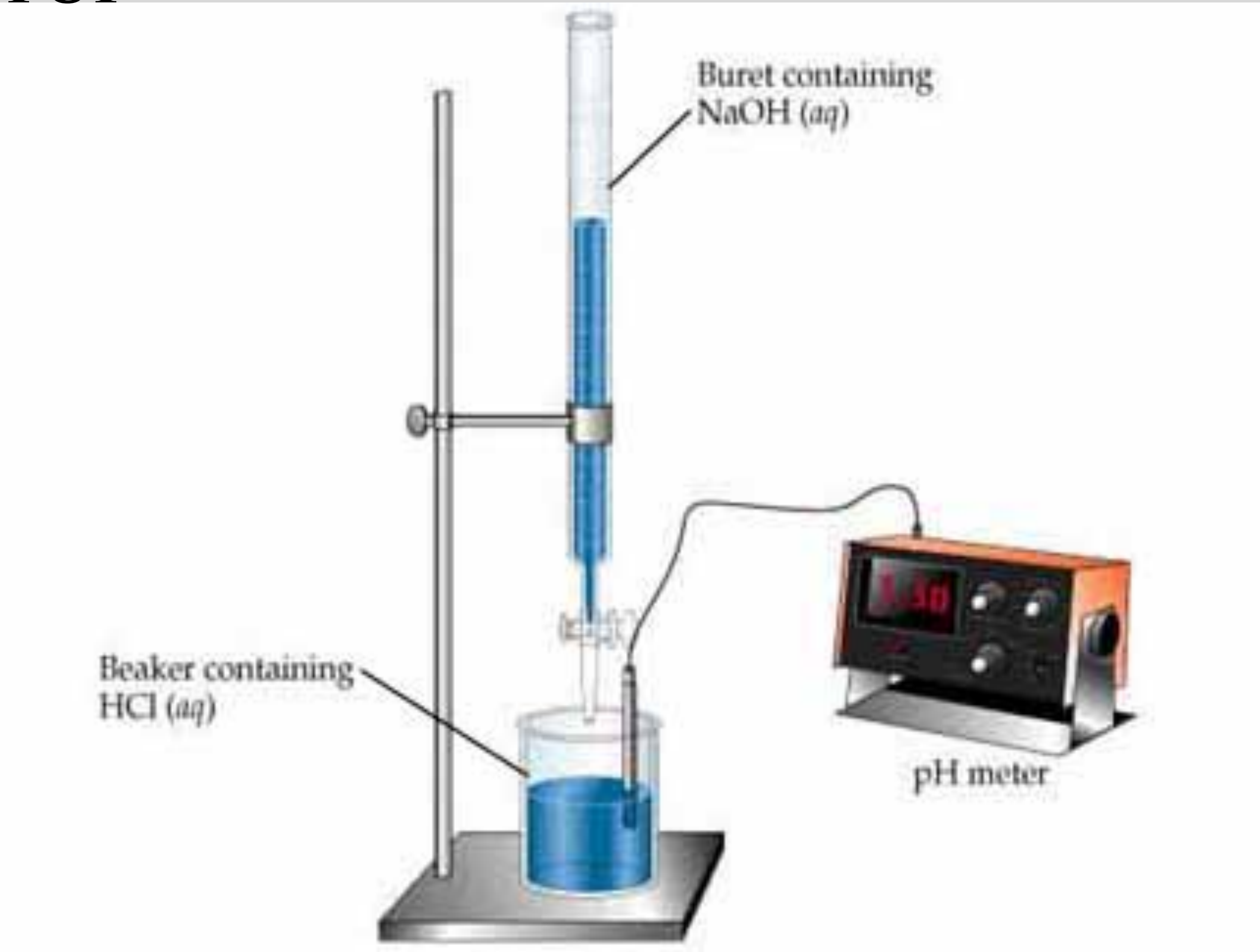
10ml pipette

25ml burette

Principle:

- Hydrogen ions in solution, like other ionic species, conduct an electric current. When a pH meter is dipped in a solution containing hydrogen ions, a potential difference develops around the pH meter which is an electronic voltmeter that converts it to a pH reading which is displayed on a scale.
- When an alkali is added to an acid solution, the pH of the solution increases slowly, but at vicinity of the end point, the rate of change of pH solution is very rapid.
- From the sharp peak in the curve, we can find out the end point from which the strength of HCl can be calculated.

pH METER EXPERIMENTAL SETUP



Procedure:

- Make up the given HCl solution to 100ml using distilled water.
- Pipette out10ml of this made up solution into a clean 250ml beaker and add 100ml distilled water. Dip the pH meter into the solution and note the pH.
- Fill the burette with Std.NaOH (0.1N) solution and add 1ml increments into the beaker and measure the pH after each addition.
- Continue the process till and well beyond neutralization point as indicated by abrupt change in pH.
- Calculate the range at which sudden rise in pH occurs.

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- Perform the similar titration by adding 0.2ml addition of Std.NaOH close to the end point (1ml on either side of the range).
- Tabulate the pH measured corresponding to each addition.
- Plot two graphs by taking

1. pH Vs Volume of NaOH added.
2. ΔpH/ΔV Vs Volume of NaOH added
3. The exact point should be calculated from the second graph.

Calculations:

Volume of HCl = V_1 ml

Normality of HCl = N_1

Volume of NaOH = V_2 ml (from the 2nd graph)

Normality of NaOH = N_2 (0.1 N)

$$V_1N_1 = V_2N_2$$

- $N_1 = \frac{V_2N_2}{V_1}$

The strength of the given solution = ------N

TABLE 1:Titration between Std.NaOH & unknown HCl (Pilot)

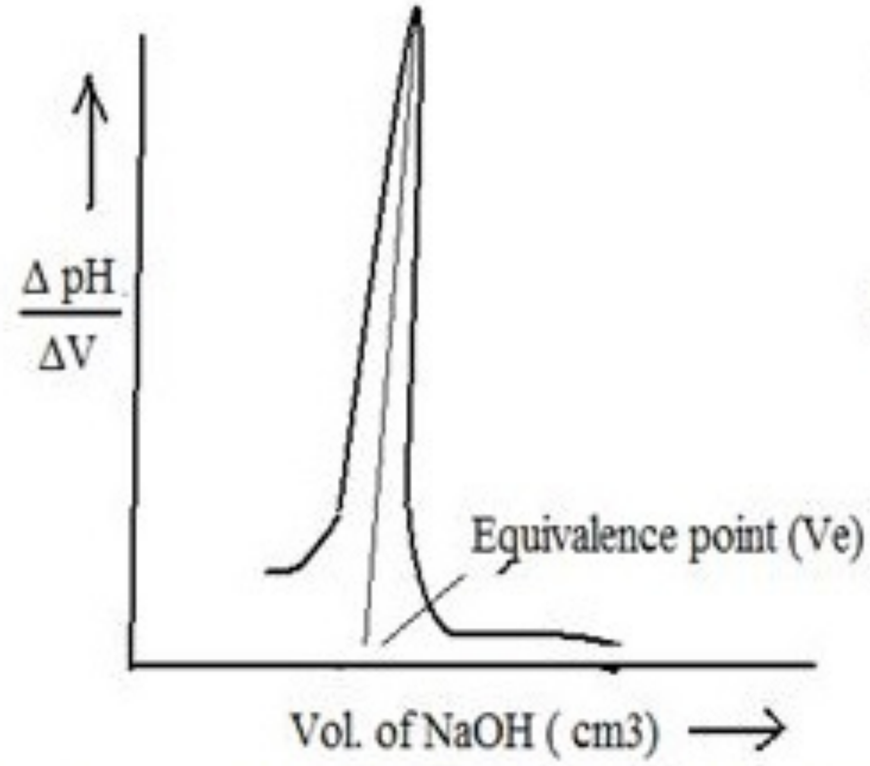
S.No	Volume of NaOH (ml)	pH
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		

TABLE 2: Titration between Std. NaOH and unknown HCl (Fair)

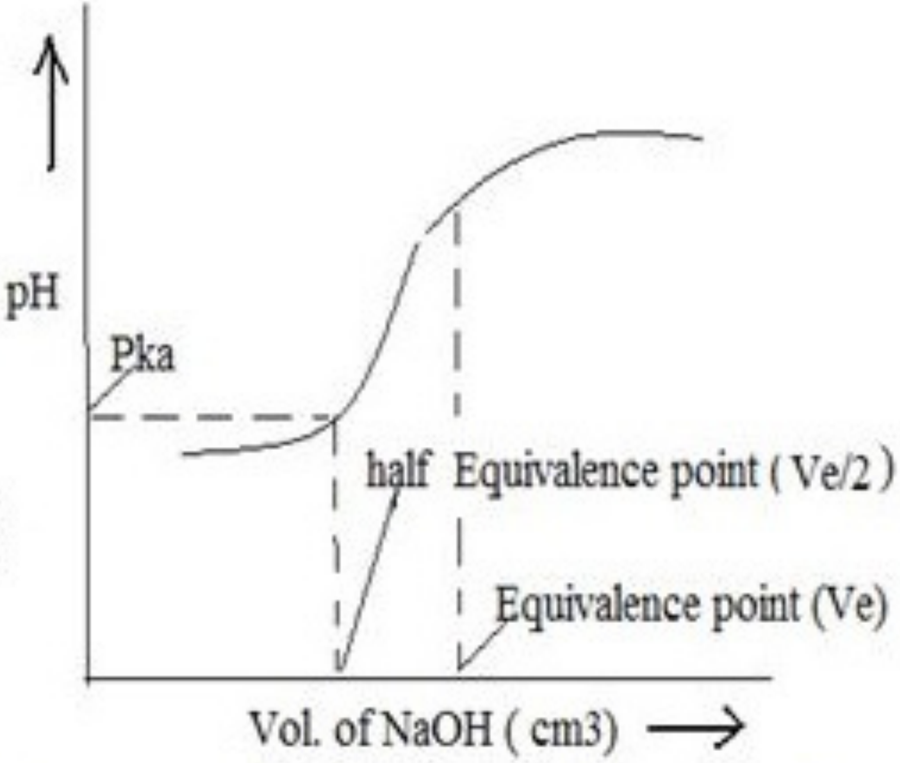
S.No	Volume of NaOH (ml)	pH	ΔpH	ΔV	ΔpH/ΔV
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

Graphs:

FAIR



PILOT



There is much of similarity in the graph of the two experiments, we need the second graph to know the pH at the half Equivalence point as shown.

Result:

The strength of the given solution = ------N

Video can be uploaded here