DETERMINE THE pH OF THE UNKNOWN SOLUTION BY pH METRY

AIM: To determine the pH of unknown solution using pH metry.

APPARATUS: pH meter, pH electrode, beaker, pipette, burette

CHEMICALSREQUIRED: Sodium hydroxide (NaOH), Hydrochloric acid (HCl), buffer of pH = 4 and pH = 9.2

PRINCIPLE:

The determination H^+ concentration depends on the fact that when a thin glass membrane is in contact with solutions of different hydrogen ion concentrations on its two sides, a potential difference is developed across the glass membrane, depending on the concentration of the hydrogen ions into solutions. The pH of a solution can be measured accurately with the help of a pH meter. Measurement of pH is employed to monitor the cause of acid - base titration. The pH values of the solution at different stage of acid - base neutralization are determined and plotted against the volume of alkali added on adding a base to an acid, the pH rises slowly in the initial stages as the concentration of H^+ ion decreases gradually. But, at the equivalence point, it increases rapidly as at the equivalent point H^+ ion concentration is very small. Then it flattens out after the endpoint. The end point of the titration can be detected where the pH value changes most rapidly. However, the shape of the curve depends upon the ionizability of the acid and the base used and on the acidity of base and basicity of the acid.

PROCEDURE

i. 0.2 (N) NaOH solution is provided.

ii. HCl solution of unknown strength is provided.

iii. Switch on the instrument and wait for10–15minutes so that machine gets warmed up.

iv. Prepare the buffer solution by adding buffer tablets of pH=4 and pH=9.2 in 100mL of water separately.

v. Wash the pH electrode with distilled water. Then, dip the pH electrode in the buffer solution (pH=4) taken in a beaker, so that the electrode immersed to the solution properly.

vi. Measure the temperature of the solution and set the temperature compensate control accordingly. Set the pointer to pH=7 exactly means of set=0 control.

vii. Put the selector switch to proper pH range 0–7 (as the buffer pH=4).

viii. So, the pointers to the known pH value of the buffer by burning the set buffer control. Put back the selector at zero position.

ix. Wash the electrode with distilled water and standardize the pH meter using basic buffer solution pH=9.2. Same procedure to be followed except this selector switch is put to range of 7–14.

x. pH-metric Titration: Clean the electrode with distilled water and wipe them with tissue paper or filter paper.

xi. Take 40mL of HCl solution in a100 mL beaker and immerse the electrode in it.

xii. Set the burette with NaOH solution. Put the selector at the expected range (0–7).

xiii. The reading shown on the scale of pH meter is pH value of the HCl solution.

xiv. Add NaOH solution drop wise from the burette (maximum 1mL at a time), shake the solution well and note the corresponding pH values.

xv. Near the endpoint, volume of NaOH added should be as small as possible because the acid is neutralized and there will a sharp increase in pH values. Further addition of even 0.01mL of NaOH, increase the pH value to about 9–10.

xvi. Put back the selector to zero position after pH measurement, and always keep the selector at zero position when it is not in use.

OBSERVATION AND CALCULATION

Table1: pH metric titration

S.No	Volume of NaOH added (V_2) (ml)	pH
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

12		
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Plot a graph between pH and volume of NaOH added and find out the volume of NaOH required (V_2ml) for complete neutralization of HCl from the graph. Then find out the strength of HCl (N_1).

$N_1 V_1 = N_2 V_2$

N_1=Normality of acid

V_1= Volume of acid

N_2 = Normality of base

V_2=Volume of base

N_1 X 40 = $N_2 V_2$

$N_1 = N_2 V_2/40$

RESULT:

The concentration of the unknown HCl is (N)