

DETERMINATION OF STRENGTH OF AN ACID USING PH METER

* AIM:

- To find the strength of given hydrochloric acid solution by titrating it against sodium hydroxide (0.1N) using pH meter.

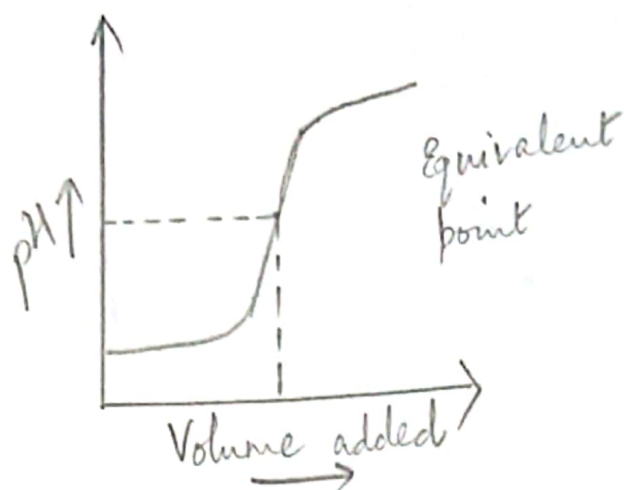
* PRINCIPLE:

- 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 of the solution is very rapid. From the sharp break in the curve, we can find out the end point, from which the strength of HCl can be calculated.

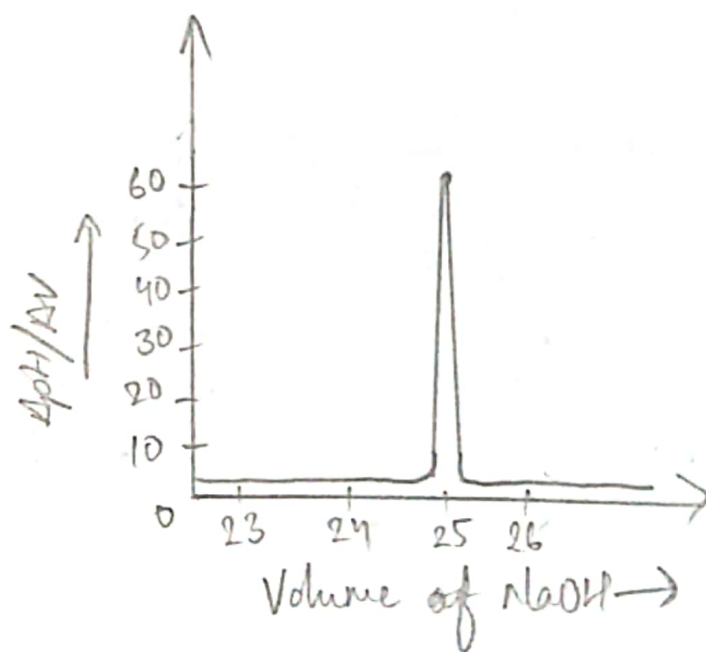
* PROCEDURE:

- First standardise the pH meter using different buffers of known pH, then wash the glass electrode and reference electrode with distilled water and then with the acid solution.
- The given acid is made up to 100 ml using distilled water.
- 10 ml of this made up solution is pipetted out into a 250 ml clean beaker and 100 ml of distilled water is added, so that the glass electrode as well as the reference electrode is completely dipped.
- Note the pH of the pure acid solution. Fill the burette with standard standard NaOH solution and run down into the beaker in small increments (1 ml).
- Stir the solution well using glass rod. Note down the pH of every successive addition.
- Continue the titration till beyond the neutralisation point as

Teacher's Signature _____



(1) Pilot Graph



(2) Fair Graph

- indicated by an abrupt change in pH.
- Plot a graph between volume of NaOH against pH. The midpoint of the 'S' shaped curve of the graph gives the equivalence point.
 - Near the end point add very small amount of NaOH, because change in pH will be very much appreciable when the acid is neutralised, further addition of such a small quantity of 0.01 ml raises the pH about 9 to 10.
 - In order to get an accurate end point, perform one more similar titration by adding 0.2 ml of standard NaOH solution close to the end point (1 ml on either side of the range) and measure the pH of every addition.
 - Plot a fair graph between volume of NaOH against $\Delta pH / \Delta V$.
 - Find out the exact end point from the fair graph.
 - The peak point of the curve from the fair graph gives the equivalence point.

* OBSERVATIONS:

(i) TABLE - 1: (PILOT TITRATION) (HCl vs NaOH)

| S.No. | Volume of NaOH (ml) | pH |
|-------|---------------------|------|
| 1 | 0 | 2.05 |
| 2 | 1 | 2.09 |
| 3 | 2 | 2.11 |
| 4 | 3 | 2.20 |
| 5 | 4 | 2.25 |
| 6 | 5 | 2.30 |
| 7 | 6 | 2.40 |

Teacher's Signature _____

| | | |
|----|----|-------|
| 8 | 7 | 2.80 |
| 9 | 8 | 2.54 |
| 10 | 9 | 2.70 |
| 11 | 10 | 2.91 |
| 12 | 11 | 3.40 |
| 13 | 12 | 6.00 |
| 14 | 13 | 7.42 |
| 15 | 14 | 9.86 |
| 16 | 15 | 10.09 |
| 17 | 16 | 10.50 |
| 18 | 17 | 10.53 |

(2) TABLE-2 (FAIR TITRATION) (HCl vs NaOH)

| S.No. | Volume of NaOH | pH | ΔpH | ΔV | $\Delta pH / \Delta V$ |
|-------|----------------|------|-------------|------------|------------------------|
| 1 | 0 | 2.05 | — | — | — |
| 2 | 10 | 2.91 | 0.86 | 10 | 0.086 |
| 3 | 10.2 | 3.00 | 0.09 | 0.2 | 0.45 |
| 4 | 10.4 | 3.10 | 0.10 | 0.2 | 0.5 |
| 5 | 10.6 | 3.16 | 0.06 | 0.2 | 0.3 |
| 6 | 10.8 | 3.26 | 0.10 | 0.2 | 0.5 |
| 7 | 11.0 | 3.40 | 0.14 | 0.2 | 0.7 |
| 8 | 11.2 | 3.60 | 0.20 | 0.2 | 1.0 |
| 9 | 11.4 | 3.96 | 0.36 | 0.2 | 1.8 |
| 10 | 11.6 | 5.05 | 1.09 | 0.2 | 5.45 |
| 11 | 11.8 | 5.70 | 0.65 | 0.2 | 3.25 |
| 12 | 12.0 | 6.00 | 0.30 | 0.2 | 1.5 |
| 13 | 12.2 | 6.40 | 0.40 | 0.2 | 2 |

Teacher's Signature _____

| | | | | | |
|----|------|------|------|-----|-----|
| 14 | 12.4 | 6.70 | 0.30 | 0.2 | 1.5 |
| 15 | 12.6 | 7.00 | 0.30 | 0.2 | 1.5 |
| 16 | 12.8 | 7.28 | 0.28 | 0.2 | 1.4 |
| 17 | 13.0 | 7.46 | 0.18 | 0.2 | 0.9 |

★ CALCULATIONS:

→ Volume of NaOH, $V_1 = 11.6$ ml (from fair graph)

Strength of NaOH, $N_1 = 0.1$ N (given)

Volume of HCl, $V_2 = 10$ ml

$$\text{Strength of HCl, } N_2 = \frac{N_1 \times V_1}{V_2} = \frac{0.1 \times 11.6}{10} \Rightarrow 0.116 \text{ N} //$$

★ RESULT:

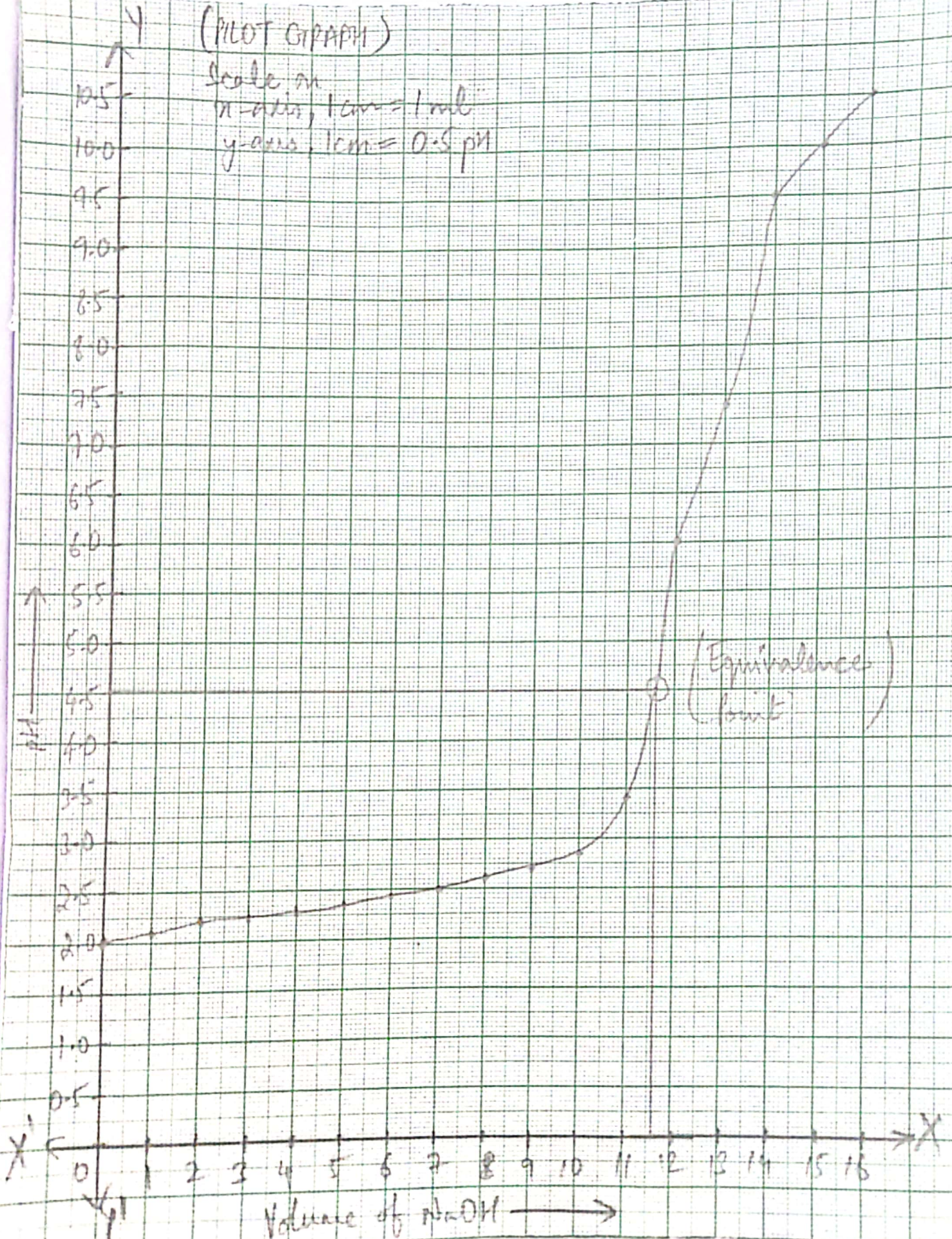
→ The Strength of given hydrochloric acid solution is 0.116 N.

————— X —————

Teacher's Signature _____

(PILOT GRAPH)

Scale on
x-axis, 1 cm = 1 ml
y-axis, 1 cm = 0.5 pH



Teacher's Signature _____

★ GRAPH :

