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Experiment - 5

* pH - metric titration of strong acid with strong base.

→ Objective: To determine strength of given HCl soln using a standard NaOH soln by performing a pH metric titration.

→ Principle :- The -ve logarithm of the hydrogen ion conc^n of given solution is defined as pH of solution.

$$pH = -\log [H^+]$$

Similarly, alkalinity of a solution can be expressed in terms of pOH, where,

$$pOH = -\log [OH^-]$$

In this experiment pH of a solution is utilised as an indicator for determining the endpoint of a strong acid - strong base titration. The base solution is standard while conc^n of acid is unknown.

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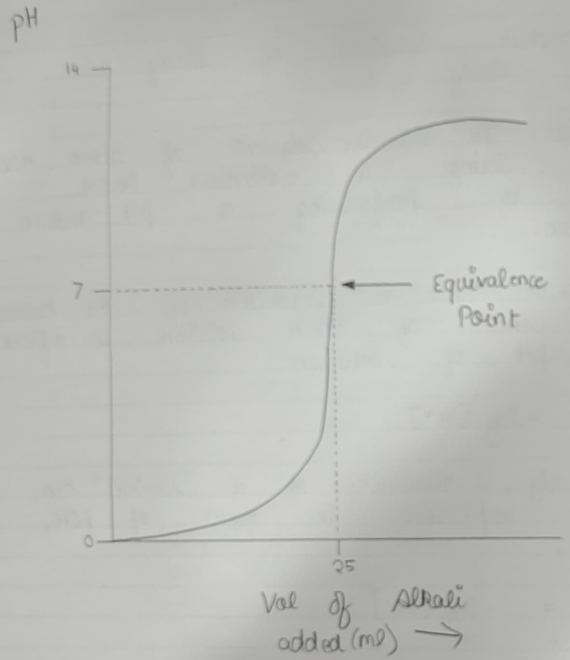

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A fixed quantity of strong acid is placed in a beaker, its initial pH is recorded with a pH meter. Adding a strong base results in sigmoid pH curve (see Graph).

★ Graph Description.

- pH starts low, rises slowly, then increases rapidly near equivalence point (pH ~ 7, 25 cm^3 alkali added).
- Equivalence point is where acid & base neutralize, marked by a sharp pH jump.

★ Key points

- Initial slow pH rise accelerates near the endpoint due to base ionization.
- The inflection point's shape & symmetry depend on base ionization.
- The endpoint can be found by noting alkali vol at pH 7.

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→ Observations

S.no	Vol of NaOH	pH
1	0.0	1.2
2	0.1	1.9
3	0.2	2.6
4	0.3	2.9
5	0.4	3.2
6	0.5	3.9
7	0.6	4.6
8	0.7	5.1
9	0.8	5.4
10	0.9	6.0
11	1.0	6.4
12	1.1	6.7
13	1.2	7.0
14	1.3	7.1
15	1.4	7.1
16	1.5	7.4
17	1.6	7.6
18	1.7	8.0
19	1.8	8.0
20	1.9	8.2
21	2.0	8.7
22	2.1	9.4
23	2.2	9.6
24	2.3	9.6
25	2.4	9.8
26	2.5	10.1
27	2.6	10.2
28	2.7	10.9
29	2.8	11.0
30	2.9	11.0

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→ Calculations

$N_1V_1 = N_2V_2$

$N_1 = \frac{N_2V_2}{V_1} = 0.0088\ N$

↓ Normality

Strength = N_1 × equivalent weight of HCl

= $0.0088 \times 36.5 = 0.3212$ g/L

→ Result

Strength of given HCl soln = 0.3212 g/L

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