TABLES ⟹

1) Standard NaOH vs unknown HCl.
(Pilot Titration)

Sr. No.	Volume of NaOH	ΔpH	pH
	ml		
1.	0	-	1.55
2.	1	0.01	1.56
3.	2	0.01	1.57
4.	3	0.04	1.61
5.	4	0.05	1.66
6.	5	0.07	1.73
7.	6	0.06	1.79
8.	7	0.09	1.88
9.	8	0.10	1.98
10.	9	0.15	2.13
11.	10	0.21	2.34
12.	11	0.33	2.64
13.	12	1.69	4.36
14.	13	2.46	6.82
15.	14	3.09	9.91
16.	15	0.93	10.34
17.	16	0.48	11.32
18.	17	0.35	11.67
19.	18	0.26	11.93
20.	19	0.20	12.13
21.	20	0.14	12.27

Date 17/06/2021

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DETERMINATION OF STRENGTH OF AN ACID USING pH METER.

AIM ⟹

To find out the strength of given Hydrochloric acid by titrating against NaOH (0·1N) using pH meter.

APPARATUS REQUIRED ⟹

pH meter, 250 ml beaker, 100 ml beaker, glass rod, 10 ml pipette, 25 ml burette, etc.

REAGENTS ⟹

1) Sodium hydroxide (NaOH) solution - 0·1N.
2) Sample HCl solution.
3) Distilled water.

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 electric 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 endpoint, the rate of change of pH solution is very rapid.

From the sharp peak in the curve, we can find out the endpoint from which the strength of HCl

Teacher's Signature

2) Standard NaOH vs unknown HCl.
(Fair Titration)

Sr. No.	Volume of NaOH	pH	ΔpH	ΔV	$\frac{\Delta pH}{\Delta V}$
	ml				
1.	10.0	2.40	-	-	-
2.	10.2	2.44	0.04	0.2	0.2
3.	10.4	2.50	0.06	0.2	0.3
4.	10.6	2.57	0.07	0.2	0.35
5.	10.8	2.65	0.08	0.2	0.4
6.	11.0	2.74	0.08	0.2	0.4
7.	11.2	2.85	0.11	0.2	0.55
8.	11.4	2.99	0.14	0.2	0.7
9.	11.6	3.11	0.13	0.2	0.65
10.	11.8	3.41	0.20	0.2	1
11.	12.0	4.26	0.85	0.2	4.25
12.	12.2	5.47	1.21	0.2	6.05
13.	12.4	5.91	0.44	0.2	2.2
14.	12.6	6.27	0.36	0.2	1.8
15.	12.8	6.52	0.25	0.2	1.25
16.	13.0	7.14	0.27	0.2	1.75
17.	13.2	8.83	0.44	0.2	1.35
18.	13.4	9.60	0.41	0.2	2.2
19.	13.6	10.01	0.52	0.2	6.25
20.	13.8	10.26	0.25	0.2	3.85
21.	14.0	10.48	0.22	0.2	2.05

can be calculated.

PROCEDURE ⟹

1) First standardize the pH-meter using different buffers of known pH, then wash the glass electrode with distilled water and then with the acid solution.
2) The given acid is diluted to 100ml using distilled water. 10ml of this made up solution is pipetted out into a 250 ml clean beaker and 100ml of distilled water is distilled water is added to it, so that the glass electrodes as well as the reference electrode are completely dipped.
3) Note the initial pH of pure and solution. Fill the burette with standard NaOH solution. Stir the solution well using glass rod.
4) Note down the pH along every successive addition. Continue the titration till beyond the neutralization point. An abrupt change in pH will be indicated.
5) Plot a graph of volume of NaOH versus pH. The midpoint of similar titration in a small volume range (10ml of range on either side of the abrupt change in pH) and measure there after addition of every 0·2ml of standard NaOH solution.
6) Plot a fair graph of volume of NaOH versus $\Delta pH/\Delta V$. Find out the exact endpoint from the fair graph. The peak point of the curve from the fair graph gives the endpoint.

22.	14.2	10.66	0.27	0.2	1.25
23.	14.4	10.68	0.51	0.2	1.1
24.	14.6	14.79	0.18	0.2	0.9
25.	14.8	10.80	0.14	0.2	0.7
26.	15.0	11.00	0.11	0.2	0.55

CALCULATIONS ⟹

Volume of NaOH (V_1) = 12.21 ml (from graph)

Strength of NaOH (N_1) = 0.1 N

Volume of HCl (V_2) = 10 ml

$\therefore$ Strength of HCl (N_2) = $\frac{V_1 \times N_1}{V_2} = \frac{12.21 \times 0.1}{10}$

$= \frac{1.221}{10} = 0.1221$ N

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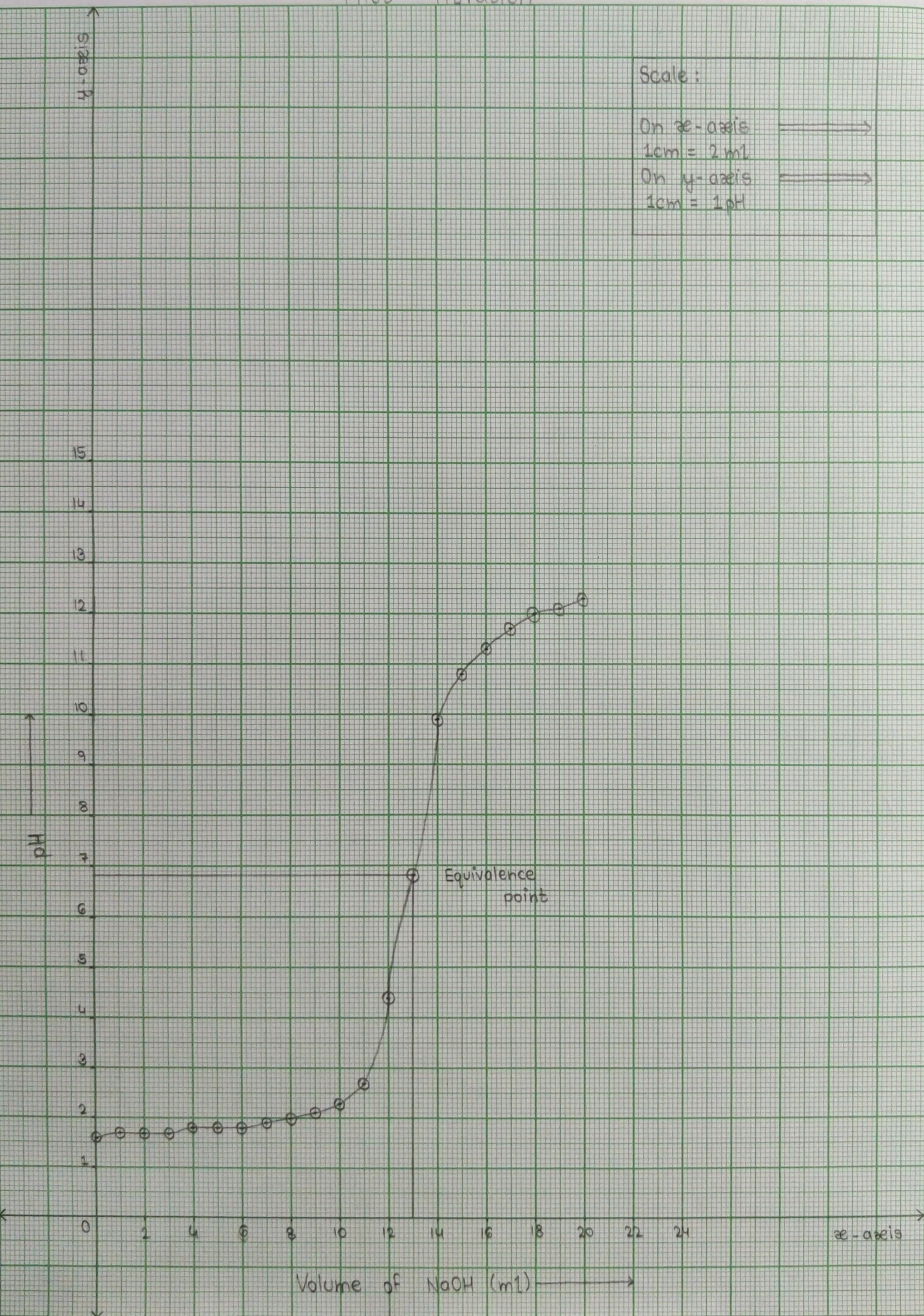
RESULT ⟹

The strength of given hydrochloric acid (HCl) solution = 0.1221 N.

Teacher's Signature _____

Pilot Titration



Fair Titration