Calculation:

The experiment is divided into two parts.

1. Determination of end point or equivalent point
2. Determination of pKa. (Using table-1 corresponding to pKa find out which weak acid is present)

Table-1

Acid	pKa	Gram equivalent weight
CH_3COOH (acetic)	4.7	60/1 = 60
HCOOH (formic)	3.7	46/1 = 46
H_2CO_3 (carbonic)	6.3	62/2 = 31
$H_2C_2O_4$ (oxalic)	1.2	126/2 = 63

From the equivalence point find out the normality of weak acid using the formula

$$(NV)_{acidl} = (NV)_{NaOH}$$

$$N_{acid} = \frac{(NV)_{NaOH}}{V_{acid}}$$

Amount of acid present in 1000 cm^3 of its solution = N_{acid} x gram equivalent weight of acid

Model Procedure /Flow Chart:

1) Take 50 cm^3 of soft drink which in this case is CH_3COOH in a clean 250 cm^3 beaker

2) Insert the glass calomel electrode such that it touches the bottom and connect it to pH meter

3) Read the initial pH and note down

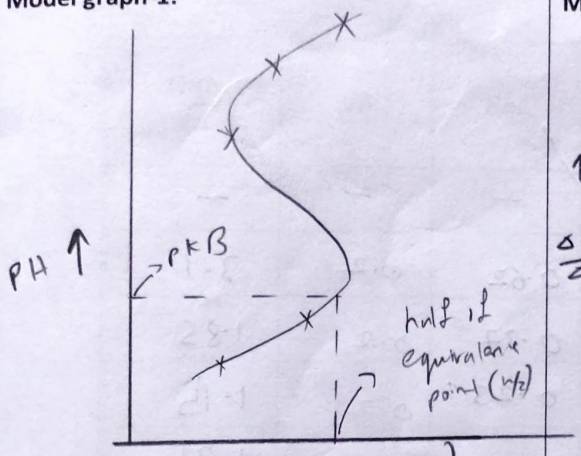
4) Fill the burette with sodium hydroxide

5) Note the initial reading and keep adding 0.2 cm^3 of NaOH at a time and take reading from pH meter

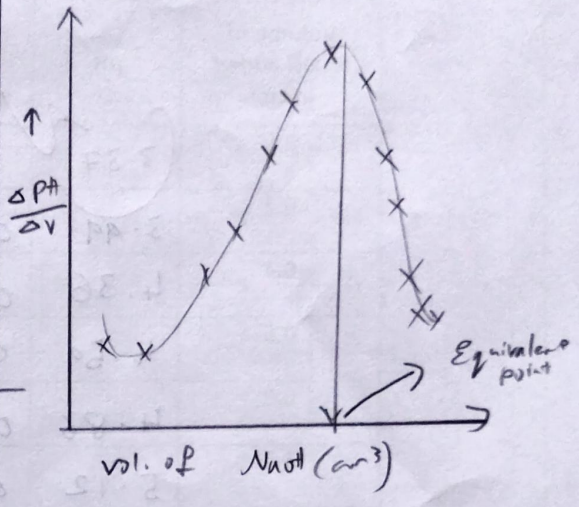
6) Continue the process till there is sudden jump in pH

7) Take five more readings and plot the graph.

Model graph-1:



Model graph-2:



Model Calculation:

For equivalence point,

Normality of a weak acid is:

$$(NV)_{acid} = (NV)_{NaOH}$$

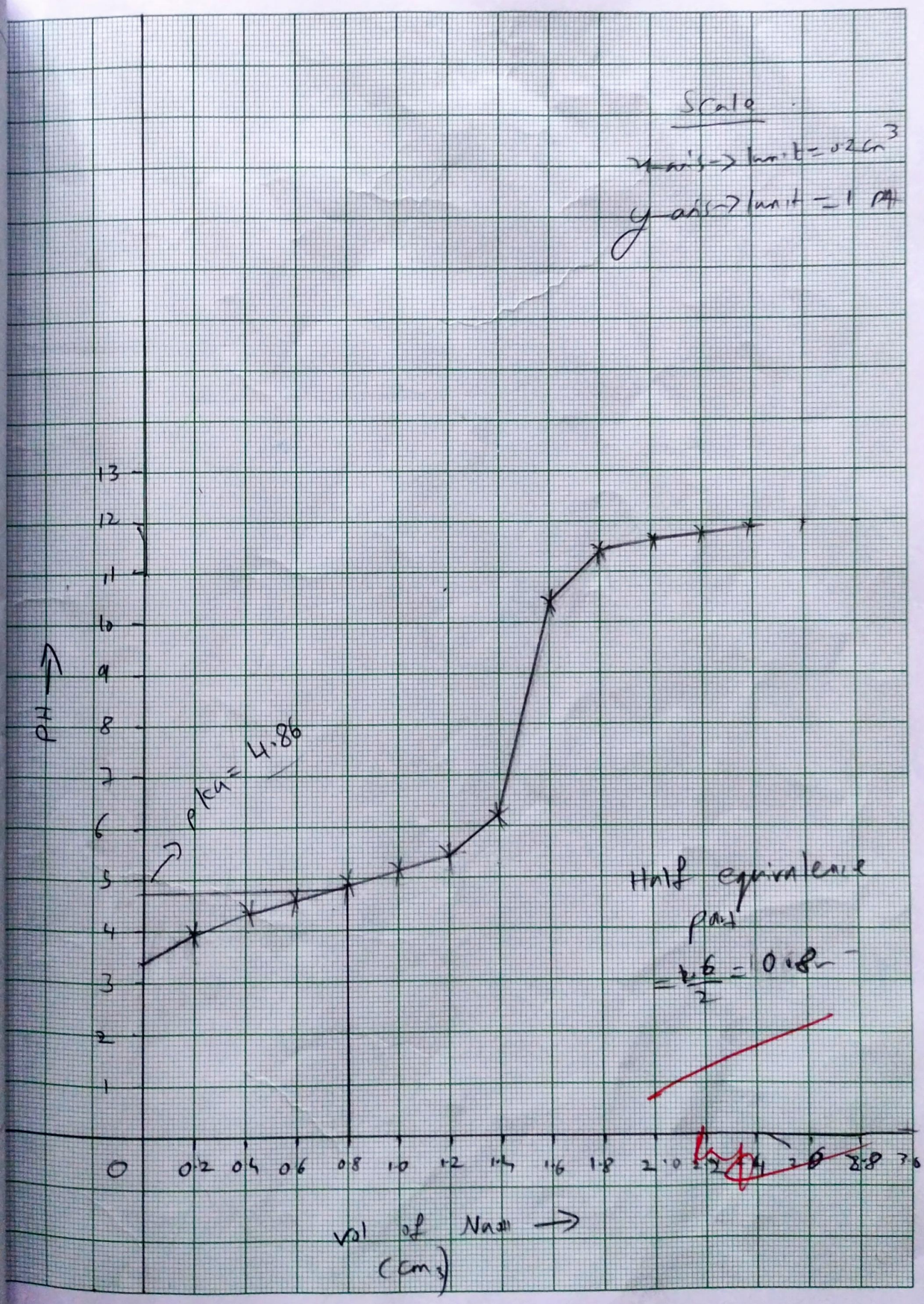
$$N_{acid} = \frac{(NV)_{NaOH}}{V_{acid}}$$

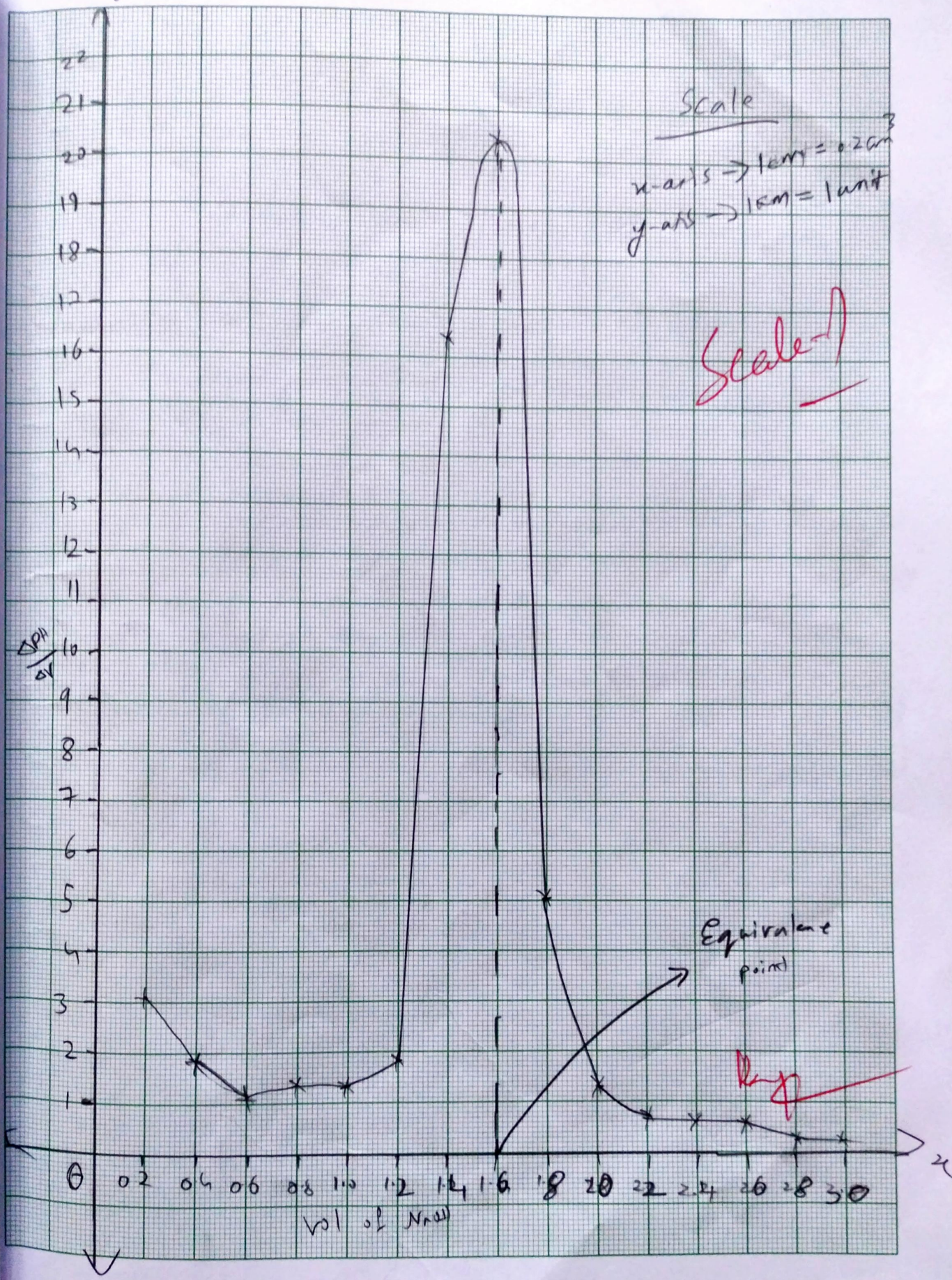
Amount of acid present in 1000 cm^3 of its solution

= Nacid × Gram molecular weight of acid

Tabulation:

Volume of NaOH added in cm^3	pH	ΔpH	ΔV	$\frac{\Delta pH}{\Delta V}$
0.0	3.37	—	—	—
0.2	3.99	0.62	0.2	3.1
0.4	4.36	0.37	0.2	1.85
0.6	4.59	0.23	0.2	1.15
0.8	4.86	0.27	0.2	1.35
1.0	5.12	0.26	0.2	1.30
1.2	5.48	0.36	0.2	1.80
1.4	~~6.18~~ 6.28	0.80	0.2	4.0
1.6	10.35	4.07	0.2	20.35
1.8	11.35	1.00	0.2	5
2.0	11.61	0.26	0.2	1.3
2.2	11.73	0.12	0.2	0.6
2.4	11.83	0.10	0.2	0.5
2.6	11.92	0.09	0.2	0.45
2.8	11.99	0.07	0.2	0.35
3.0	12.04	0.05	0.2	0.25
3.2	12.09	0.05	0.2	0.25
3.4	~~12.18~~ 12.14	0.05	0.2	0.25
3.6	12.20	0.06	0.2	0.30


Scale
x axis → 1 mm = 0.2 cm³
y axis → 1 mm = 1 pH
pH
13
12
11
10
9
8
7
6
5
4
3
2
1
pKa = 4.86
Half equivalent point
= 4.6/2 = 0.8
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
Vol of NaOH →
(cm³)


Scale
x-axis → 1cm = 0.2cm³
y-axis → 1cm = 1unit
Scale-1
ΔpH/ΔV
Equivalent point
Vol of NaOH
0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Calculation:

$(NV)_{acid} = (NV)_{NaOH}$

$N_{acid} = \frac{(NV)_{NaOH}}{V_{acid}} = \frac{0.05 \times 1.8}{50} = 0.0018$

Amount of acid present in $1000 cm^3$ of solution

= N acid × Gram equivalent weight of citric acid

$= (0.0018 \times 60)gm = 0.108gm \simeq 0.11gm$

Inference:

In this experiment we can measure the pH of solution which lies between 2.5 to 3.5 which is very good. By doing this experiment [using a combined glass calomel electrode formed due to addition of a strong base & weak acid] In endpoint, acid is neutralized

Relevance to Society & Environment:

We should be aware of pH of water. Very low pH can cause damage to our teeth and can also have various side effects.

High content of acid in softdrinks and water is harmful.

Report: Total ~~acidity~~ acid content of the given soft drink = 0.11gm

Evaluation of Experiment - 3		
Components	Marks	
	Max	Obtained
Model Procedure, Model Graph & Calculation	16	16
Equivalence Point & Execution	20	20
Inference & Societal Relevance	04	03
Total	40	39
Signature of Teacher		Rag