CHEMISTRY PRACTICAL

EXPERIMENT-I

DETERMINATION OF THE AMOUNT OF SODIUM CARBONATE AND SODIUM HYDROXIDE IN A MIXTURE BY TITRATION

Titration I: Standardisation of HCl

S.No	Volume of Na_2CO_3 (mL)	Burette Reading (mL)		Concordant Value (mL)	Indicator
		Initial	Final		
1.	20	0	18.7	18.7	Methyl Orange

Calculation:

Volume of HCl (V_2) = 18.7 mL

Normality of HCl (N_2) = ? N

Volume of Na_2CO_3 (V_1) = 20 mL

Normality of Na_2CO_3 (N_1) = 0.05 N.

$$N_1V_1 = N_2V_2$$

Na_2CO_3 HCl

$$N_2 = \frac{N_1V_1}{V_2}$$

$$= \frac{0.05 \times 20}{18.7}$$

$$N_2 = 0.05347$$

Titration II: Estimation of mixture (Na_2CO_3 + NaOH)

SNo	Volume of the mixture (mL)	Burette Reading (mL)			Concordant Value (mL)		Indicator
		Initial	Final - HPh	Final - MO	HPh	MO	
1.	20	0	23.5	32.5	23.5	32.5	Phenolphthalein
2.	20	0	23.5	32.5			Methyl Orange

A - Phenolphthalein end point - volume of acid used upto HPh end point.

B - Methy orange end point - Total volume of acid used till MO end point.

(B - A) = C which is the volume of acid used for $\frac{1}{2}CO_3^{2-}$ neutralization.

∴ 2C = Total volume of acid used for complete neutralization of CO_3^{2-} ions.

Calculations:

1. Estimation of Na_2CO_3

Volume of HCl (V_1) = 2C mL
= 18 mL

Normality of HCl (N_1) = 0.05347 N

Volume of the mixture (V_2) = 20 mL

Normality of the mixture (N_2) = ?

$C = B - A$
$= 32.5 - 23.5$
$= 9$
$2C = 18$ mL

$N_1V_1 = N_2V_2$
HCl Mixture

$N_2 = \frac{N_1V_1}{V_2} = \frac{0.05347 \times 18}{20}$

$= 0.04812$ N

∴ Amount of Na_2CO_3 present in the whole of the given solution $= \frac{\text{Normality of } Na_2CO_3 \times \text{Eq. wt of } Na_2CO_3}{10}$

$= \frac{0.04812 \times 53}{10}$

$= 0.2550$ g/L

2. Estimation of NaOH:

Volume of HCl (V_1) = A − C
= 23.5 − 9
= 14.5 mL

Normality of HCl (N_1) = 0.05347 N

Volume of mixture (V_2) = 20 mL

Normality of mixture (N_2) = ?

$$N_1 V_1 = N_2 V_2$$
HCl Mixture

$$N_2 = \frac{N_1 V_1}{V_2} = \frac{0.05347 \times 14.5}{20}$$

$$= 0.03876$$

∴ Amount of NaOH present in whole of the given solution = $\frac{\text{Normality of NaOH} \times \text{Eq wt of NaOH}}{10}$

$$= \frac{0.03876 \times 40}{10}$$

$$= 0.1550 \text{ g/L}$$

RESULT:

Amount of Na_2CO_3 present in 100 mL of the given solution is 0.2550 g/L.

Amount of NaOH present in 100 mL of the given solution is 0.1550 g/L.

EXPERIMENT - II

ESTIMATION OF HARDNESS OF A WATER SAMPLE BY EDTA METHOD

Titration 1: Standardisation of EDTA

S.No	Volume of Std. Hard Water (mL)	Burette Reading (mL)		Volume of EDTA (V_1) (mL)	Indicator
		Initial	Final		
1.	20	0	19.8	19.8	EBT

Calculation:

1 mL of Std. Hard water Contains 1mg of $CaCO_3$ equivalent hardness

∴ 20 mL of Std. Hard water Contains 20 mg of $CaCO_3$ equivalent hardness

20 mL of Std hard water Consumes = V_1 mL of EDTA = 19.8 mL

∴

(V_1) 19.8mL of EDTA = 20 mg of $CaCO_3$ equivalent Hardness.

1mL of EDTA = $\frac{20}{19.8(V_1)}$ mg of $CaCO_3$ equivalent Hardness.

= 1.1010 mg of $CaCO_3$ equivalent hardness.

Titration 2: Determination of Total Hardness

S.No	Volume of Sample hard water (mL)	Burette Reading (mL)		Volume of EDTA (V_2) (mL)	Indicator
		Initial	Final		
1.	20	0	12	12	EBT

Calculation:

20 mL of Sample hard water Consumes = V_2 mL of EDTA

= V_2 × 1 mL of EDTA

= $V_2 \times \frac{20}{V_1}$ mg of $CaCO_3$ eq. hardness

∴ 1000 mL of Sample hard water will consume = $V_2 \times \frac{20}{V_1} \times \frac{1000}{20}$ mg of $CaCO_3$ eq hardness

∴ Total hardness = $1000 \times \frac{V_2}{V_1}$ mg of $CaCO_3$ equivalent hardness

$= 1000 \times \frac{12}{19.8}$

$= 606.0606$ mg of $CaCO_3$ equivalent hardness

Titration 3: Determination of Permanent hardness

S.No	Volume of Boiled hard water (mL)	Burette Reading (mL)		Volume of EDTA (V_3) (mL)	Indicator
		Initial	Final		
1.	20	0	8.5	8.5	EBT

Calculations:

20 mL of boiled water Sample Consumes = V_3 mL of EDTA

= $V_3 \times 1$mL of EDTA

= $V_3 \times \frac{20}{V_1}$ mg of $CaCO_3$ eq. hardness

∴ 1000 mL of boiled water Sample Consumes = $V_3 \times \frac{20}{V_1} \times \frac{1000}{20}$ mg of $CaCO_3$ eq hardness

∴ Permanent hardness = $\frac{V_3}{V_1} \times 1000$ mg of $CaCO_3$ eq. hardness

$= \frac{8.5}{19.8} \times 100$

$= 429.2929$ mg of $CaCO_3$ equivalent hardness.

Total hardness = Temporary hardness + Permanent hardness

∴ Temporary hardness = Total hardness − Permanent hardness

$= 606.0606 - 429.2929$

$= 176.7677$ mg of $CaCO_3$ equivalent hardness.

RESULT:

Total hardness = 606.0606 ppm, Permanent hardness = 429.2929 ppm and Temporary hardness = 176.7677 ppm.

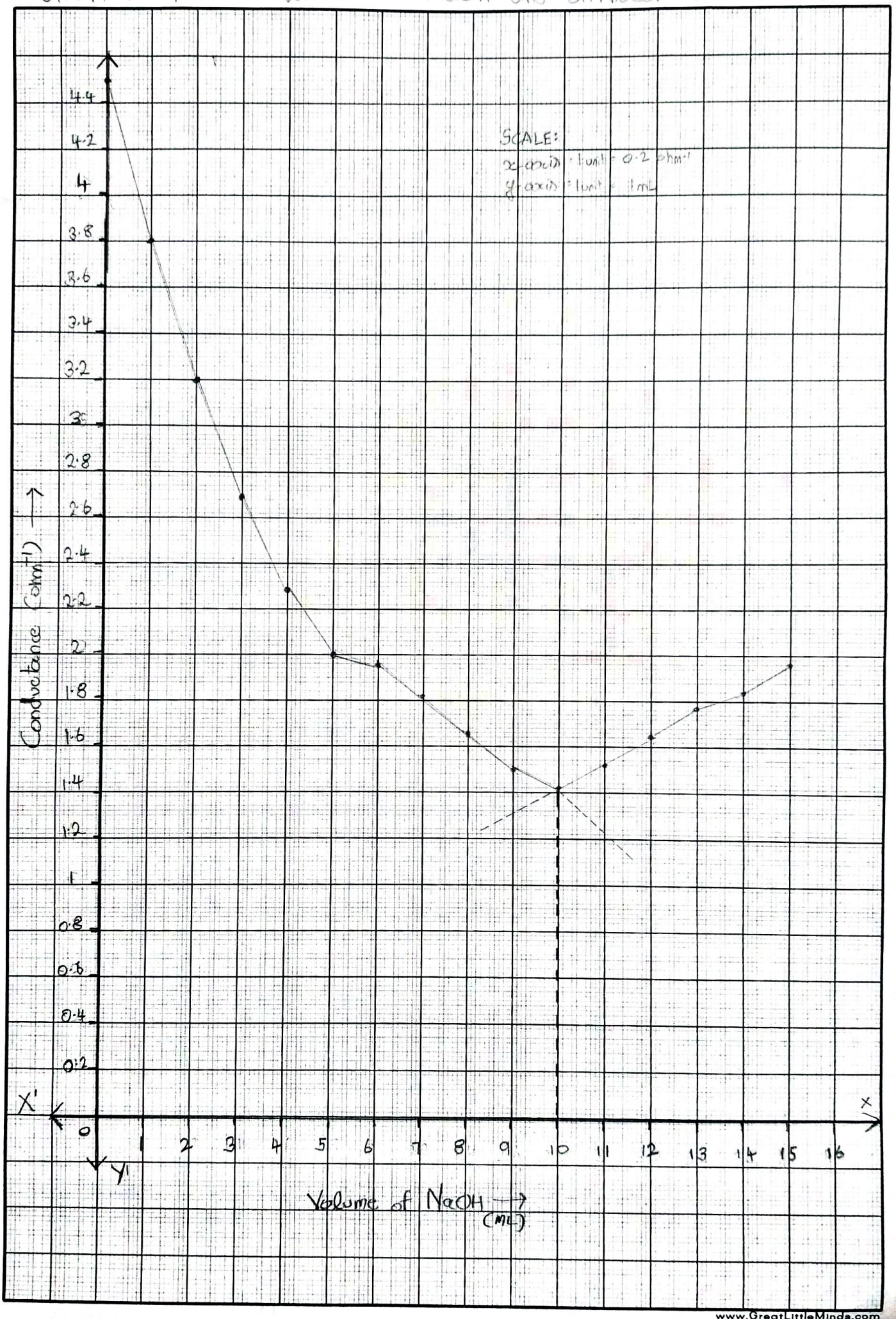
EXPERIMENT- III

DETERMINATION OF STRENGTH OF AN ACID BY CONDUCTOMETRY

Titration 1: Titration between Std. NaOH and unknown HCl (Pilot)

S.No	Volume of NaOH (mL)	Conductance ($m ohm^{-1}$)
1.	0	4.5
2.	1	3.8
3.	2	3.2
4.	3	2.7
5.	4	2.3
6.	5	2.0
7.	6	1.91
8.	7	1.83
9.	8	1.69
10.	9	1.52
11.	10	1.41
12.	11	1.56
13.	12	1.68
14.	13	1.79
15.	14	1.84
16.	15	1.92

GRAPH 1: Titration between Std. NaOH and unknown HCl (Pilot)



Titration 2: Titration between Std. NaOH and unknown HCl (Fair)

S.No	Volume of NaOH (mL)	Conductance (m ohm^{-1})
1.	8	1.72
2.	8.2	1.70
3.	8.4	1.69
4.	8.6	1.67
5.	8.8	1.63
6.	9	1.50
7.	9.2	1.48
8.	9.4	1.45
9.	9.6	1.42
10.	9.8	1.39
11.	10	1.35
12.	10.2	1.31
13.	10.4	1.28
14.	10.6	1.36
15.	10.8	1.45
16.	11	1.49
17.	11.2	1.54
18.	11.4	1.58
19.	11.6	1.63
20.	11.8	1.67
21.	12	1.70

Calculations:

Volume of HCl (V_1) = 10 mL

Normality of HCl (N_1) = ?

Volume of NaOH (V_2) = 10.4

Normality of NaOH (N_2) = 0.1 N

$$N_1 V_1 = N_2 V_2$$
(HCl) (NaOH)

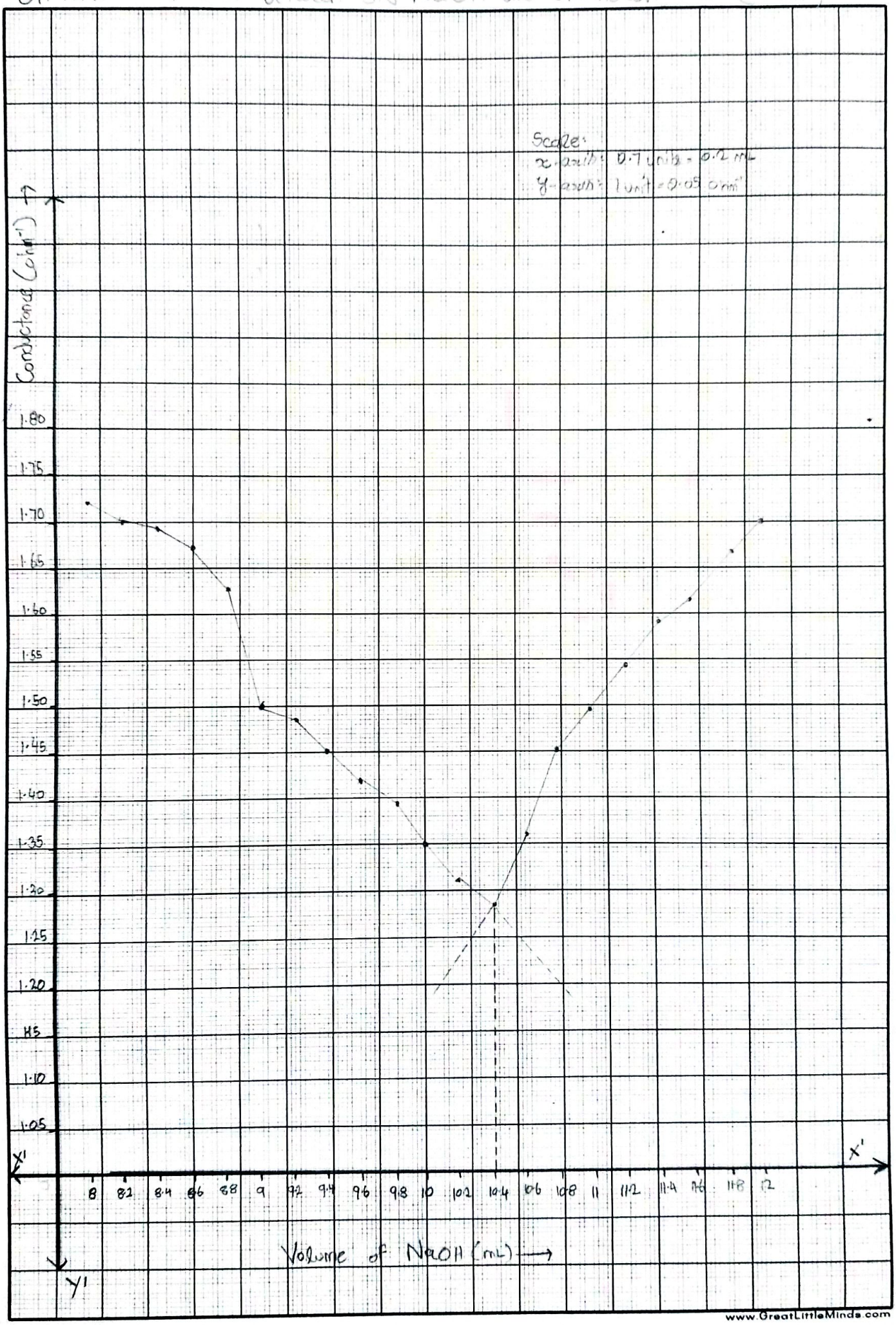
$$N_1 = \frac{N_2 V_2}{V_1} = \frac{0.1 \times 10.4}{10}$$

$N_1 = 0.104$ N

RESULT:

The strength of the given HCl solution = 0.104 N

GRAPH 2 Titration between Std. NaOH and unknown HCl (Fait)



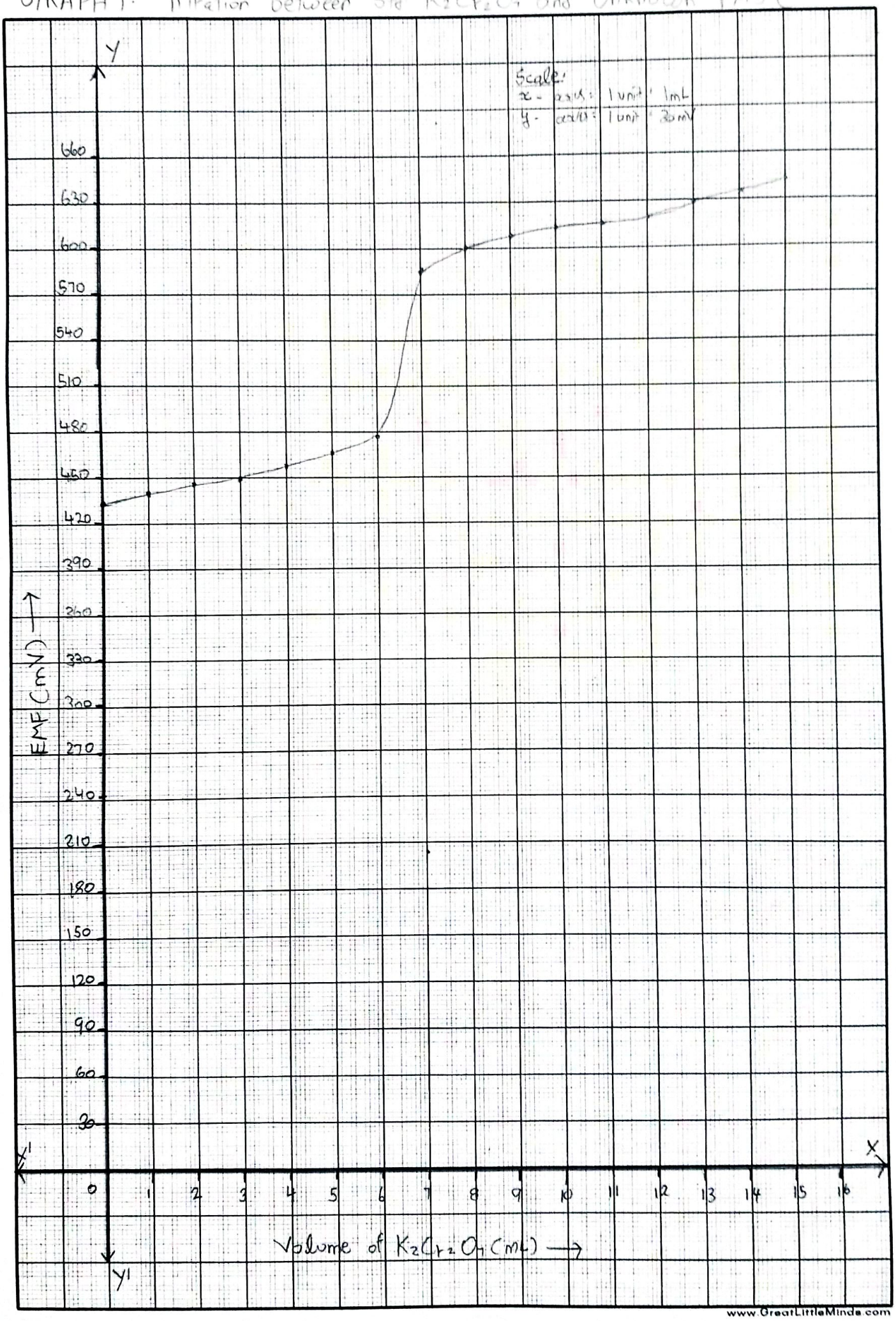
EXPERIMENT - IV

ESTIMATION OF THE AMOUNT OF Fe^{2+} ION USING $K_2Cr_2O_7$ BY POTENTIOMETRIC TITRATION

Titration 1: Titration between Std. $K_2Cr_2O_7$ and unknown FAS (Pilot)

S.No	Volume of $K_2Cr_2O_7$ (mL)	EMF (mV)
1.	0	430
2.	1	435
3.	2	442
4.	3	450
5.	4	458
6.	5	463
7.	6	470
8.	7	583
9.	8	600
10.	9	612
11.	10	618
12.	11	623
13.	12	627
14.	13	630
15.	14	634
16.	15	638

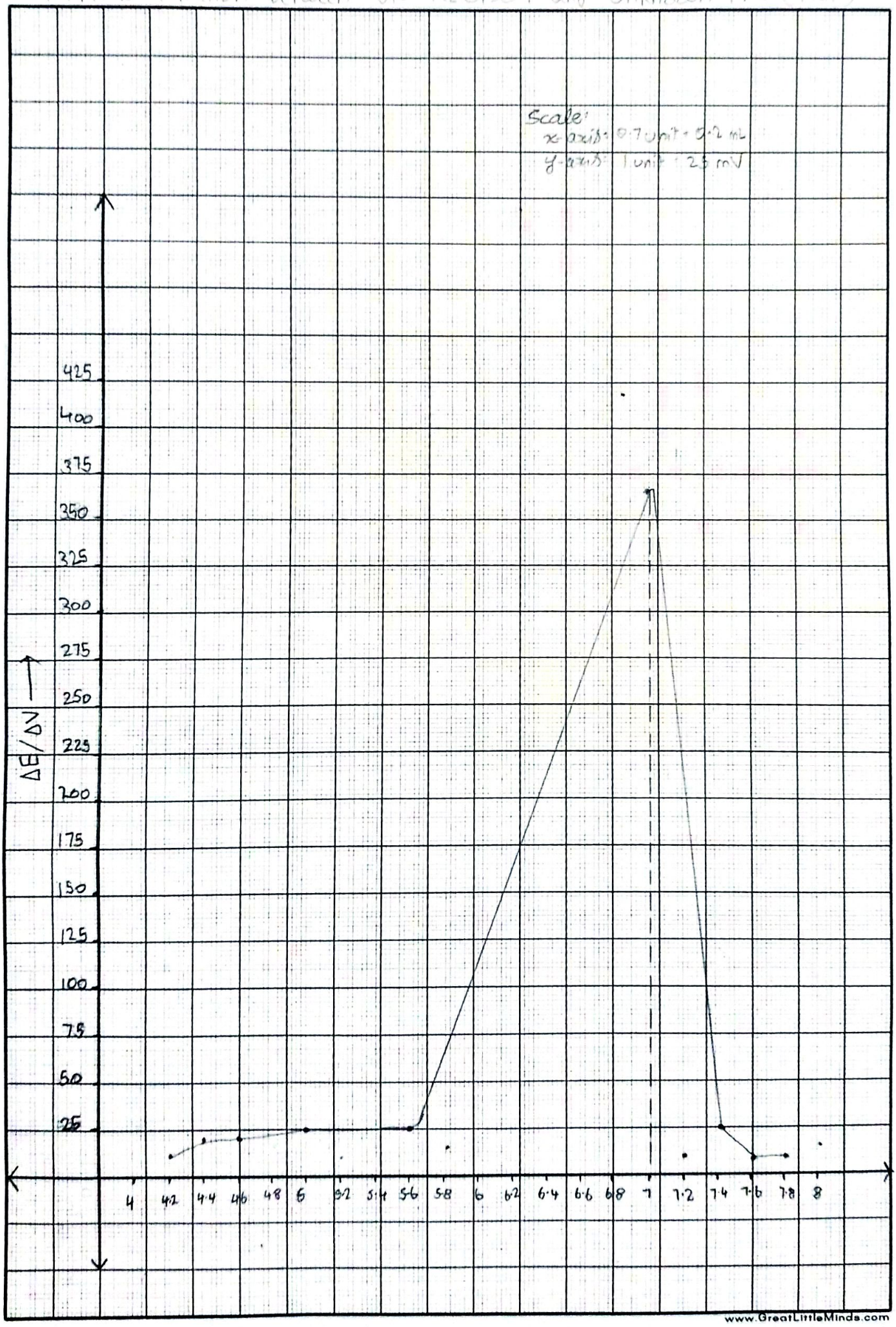
GRAPH 1: Titration between Std $K_2Cr_2O_7$ and Unknown FAS (Pico)



Titration 2: Titration between Std. $K_2Cr_2O_7$ and unknown FAS(Fair)

SN	Vol. of $K_2Cr_2O_7$ (mL)	EMF (mV)	ΔE	ΔV	$\Delta E / \Delta V$
1.	4	450	-	-	-
2.	4.2	452	2	0.2	10
3.	4.4	456	4	0.2	20
4.	4.6	460	4	0.2	20
5.	4.8	463	3	0.2	15
6.	5	468	5	0.2	25
7.	5.2	470	2	0.2	10
8.	5.4	473	3	0.2	15
9.	5.6	478	5	0.2	25
10.	5.8	481	3	0.2	15
11.	6.0	485	4	0.2	10
12.	6.2	489	4	0.2	10
13.	6.4	493	4	0.2	10
14.	6.6	497	4	0.2	10
15.	6.8	500	3	0.2	15
16.	7	573	73	0.2	365
17.	7.2	584	11	0.2	10.8
18.	7.4	589	5	0.2	25
19.	7.6	591	2	0.2	10
20.	7.8	593	2	0.2	10
21.	8	596	3	0.2	15

GRAPH 2: Titration between Std. $K_2Cr_2O_7$ and unknown FAS (Fair)



Calculations:

Volume of FAS (V_1) = 10 mL

Normality of FAS (N_1) = ? N

Volume of $K_2Cr_2O_7$ (V_2) =

Normality of $K_2Cr_2O_7$ (N_2) = 0.1 N

$$N_1 V_1 = N_2 V_2$$

$$N_1 = \frac{N_2 V_2}{V_1}$$

$$= \frac{0.1 \times 7}{10}$$

$$N_1 = 0.07$$

∴ Amount of Fe^{2+} present in the whole of the given solution $= \frac{\text{Normality of } Fe^{2+} \times \text{Eq weight of } Fe^{2+}}{10}$

$$= \frac{0.07 \times 55.85}{10}$$

$$= 0.03909 \text{ g/L}$$

RESULT:

The amount of Fe^{2+} present in the whole of the given solution = 0.03909 g/L.