

545/2
CHEMISTRY
Paper 2
2024



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

CHEMISTRY

Paper 2

New Lower Secondary Curriculum

SCORING GUIDE

545/2 - CHEMISTRY SAMPLE PAPER SCORING GUIDE

ITEM 1:

S/N	Basis of Assessment	Assessment Criteria	Scoring
(a) (i) A.	AIM OF THE EXPERIMENT	An experiment to determine the maximum heat produced during reaction of sodium hydroxide and hydrochloric acid or between BA2 and BA2 (student may start like this).	02
B.	VARIABLES OF THE EXPERIMENT	(DV) Dependent variable: Temperature of solution. (IV) Independent variable: Volume of acid added. (CV) Controlled variable: Volume of base fixed/volume of base measured.	03
C.	HYPOTHESIS	The reaction between sodium hydroxide and hydrochloric acid produces heat . Or Reaction between sodium hydroxide and hydrochloric acid is exothermic .	02
D.	PROCEDURE OF EXPERIMENT WITH RELEVANT MATERIALS	20/25cm ³ of BA2 is pipetted into a plastic beaker and its initial temperature noted and recorded. The initial temperature of BA1 is also noted and recorded and then filled into a burette and adjusted to the zero mark. BA1 is added to BA2 in the beaker at uniform intervals of 5cm ³ /10cm ³ each time stirring and noting the highest temperature of the mixture for seven readings upto 35cm ³ /40cm ³ /50cm ³ .	03

S/ N	Basis of Assessment	Assessment Criteria	Scoring
E.	RISKS AND MITIGATIONS	<p>– Swallowing of the base during pipetting. Mitigation: Use a pipette sucker or filler. Or stop sucking in as soon as solution goes past the mark.</p> <p>– Acid pouring on the skin or question paper. Mitigation Put on a lab coat, gloves, closed shoes. Dry the working table as soon as it is wetted by the chemical. Clean the thermometer before using in another solution to ensure no reaction occurs before mixing the two solutions. Handle glass ware with care to avoid accidents and breakages. Risk: Blockage of burette. Mitigation: Pipetting the base inside of acid to avoid blockages in the burette when the base reacts with carbon dioxide forming sodium carbonate. Risk: Breakage of thermometer Mitigation: Putting back the thermometer in its case/container after use. Risk: Spilling solutions on table Mitigation: Use a filter funnel for filling the funnel.</p>	02
F.	PRESENTATION OF DATA.	<p>The results are recorded in the table below.</p> <p><u>Table of Results:</u></p> <p>Initial Temperature of BA1- 25.0 °C Initial Temperature of BA2- 27.5/28.0°C Average Initial Temperature- 26.25/26.5°C Volume of BA2 used - 25.0 cm³</p>	04

	RECORDING OF DATA.	Initial Temperature of BA1- 25.0 °C Initial Temperature of BA2- 27.5/28.0°C Average Initial Temperature- 26.25/26.5°C Volume of BA2 used - 25.0 cm ³									04
		TABLE, T₁ Volume of pipette= 25.0cm ³ .									
G.	Volume of BA1 added / cm ³ .	0	5	10	15	20	25	30	35	40	
	Highest temp. of mixture/ °C.	28.0	31.0	33.5	33.5	36.5	35.0	34.0	33.0	32.0	04
	Temperature change.	0.0	3.0	5.0	7.0	8.0	7.0	6.0	5.0	4.0	04
		Trend: Increasing and decreasing temperatures.									

ALTERNATIVE METHODS

TABLE, T₂

Volume of BA1 added / cm ³ .	0	10	20	30	40	50
Highest temp. of mixture/ °C.	27.5	33.0	37.0	34.5	33.0	32.5
Temperature Change	0.0	5.5	9.5	7.0	5.5	5.0

Volume of BA2 used = 20.0cm³.

TABLE, T₃

Volume of BA1 added / cm ³ .	0	5	10	15	20	25	30	35
Highest temp. of mixture/ °C.	27.0	31.0	34.0	36.0	35.0	33.5	32.5	31.5
Temperature Change	0	4.0	7.0	9.0	8.0	6.5	5.5	4.5

TABLE, T₄

Volume of BA1 added / cm³.	0	10	20	30	40	50
Highest temp. of mixture/ °C.	26.0	34.0	35.5	33.0	32.0	30.5
Temperature Change	0	8.0	9.5	7.0	6.0	4.5

S/N	Basis of Assessment	Assessment Criteria	Scoring
(a) (ii) H.	DATA ANALYSIS AND INTERPRETATION/ CREATING MEANING	<p>A graph of highest temperature against volume of BA1 added was plotted as shown on graph paper.</p> <p>Heat evolved by reaction: =Heat gained by mixture. =$mC\theta$.</p> <p>Graph 1, (G1): Heat evolved =$(20 + 25) \times 4.2 \times (36.5 - 28.0)$ =$-1,606.5 \text{ J mol}^{-1}$.</p> <p>Graph 2, (G2): Heat evolved =$(20 + 25) \times 4.2 \times (37.0 - 27.5)$ =$-1,795.5 \text{ J mol}^{-1}$.</p> <p>Graph 3, (G3): Heat evolved =$(20 + 15) \times 4.2 \times (36.0 - 27.0)$ =$-1,323 \text{ J mol}^{-1}$.</p> <p>Graph 4, (G4): Heat evolved =$(20 + 20) \times 4.2 \times (35.5 - 26.0)$ =$-1,596 \text{ J mol}^{-1}$</p>	03

(b) I.	CONCLUSION	Heat is evolved when sodium hydroxide reacts with hydrochloric acid. The maximum heat evolved when 25cm^3 of sodium hydroxide is mixed with 20cm^3 of hydrochloric acid is 1606.5Jmol^{-1} .	01
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ALTERNATIVE METHOD:

S/N	Basis of Assessment	Assessment Criteria	Scoring
	PROCEDURE OF EXPERIMENT	<p>(VARIABLES INTERCHANGED)</p> <p>(a) All the BA1 provided (50cm^3) was diluted by adding an equal volume of water (50cm^3) to form 100cm^3 of solution. The resultant solution was labelled BA3. Its initial temperature is noted.</p> <p>(b) 20cm^3 of BA3 was measured using a measuring cylinder into a plastic beaker followed by 5cm^3 of BA2 and the mixture stirred. The highest temperature of the mixture is noted and recorded.</p> <p>(c) Procedure (b) is repeated for values of BA2 equal to 10, 15, 20 and 25cm^3. The results are then entered in the table below.</p>	03
	PRESENTATION OF DATA. RECORDING OF DATA.	<ul style="list-style-type: none"> – Initial temperature of BA3= $25.0\text{ }^\circ\text{C}$ – Initial temperature of BA2= $26.0\text{ }^\circ\text{C}$ – Average temperature= $25.5\text{ }^\circ\text{C}$ – Volume of BA3 used= 20.0 cm^3 	03

TABLE, T5

Volume of BA2 added / cm³.	0	5	10	15	20	25
Highest temp. of mixture / °C.	25.0	30.0	32.5	32.0	31.0	30.0

A graph of highest temperature against volume of **BA2** added is plotted.

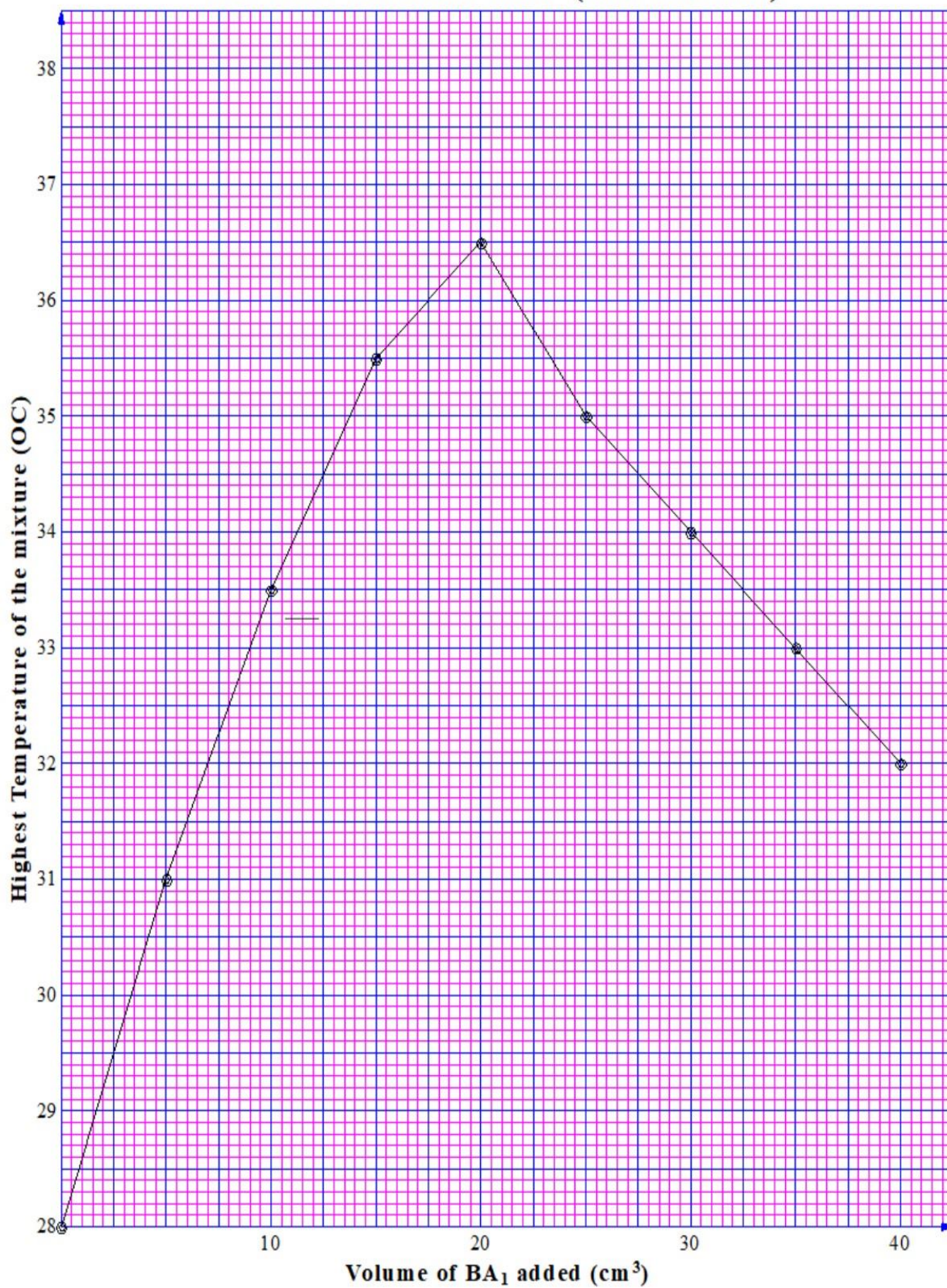
BOTH VARIABLES FIXED / CONTROLLED:

S/N	Basis of Assessment	Assessment Criteria	Scoring
		<p>(BOTH VARIABLES FIXED / CONTROLLED)</p> <p>25cm³ of BA1 is measured into a plastic beaker and its initial temperature noted and recorded. 25cm³ of BA2 is also measured and its initial temperature noted and recorded. The two volumes of BA1 and BA2 are mixed at once and the mixture stirred using a thermometer.</p> <p>The highest temperature of the mixture is noted and recorded.</p> <p>All the results are entered in the table below.</p>	03
		<p>Highest temperature of mixture= 37.0 °C Initial temperature of BA1= 25.0 °C Initial temperature of BA2= 26.0 °C Average temperature of mixture= 25.5 °C</p> <p>Volume of BA1 used = 25.0cm³. Volume of BA2 used = 25.0cm³. Total volume of solution= 50.0cm³.</p>	03
	DATA ANALYSIS	Heat evolved by reaction:	

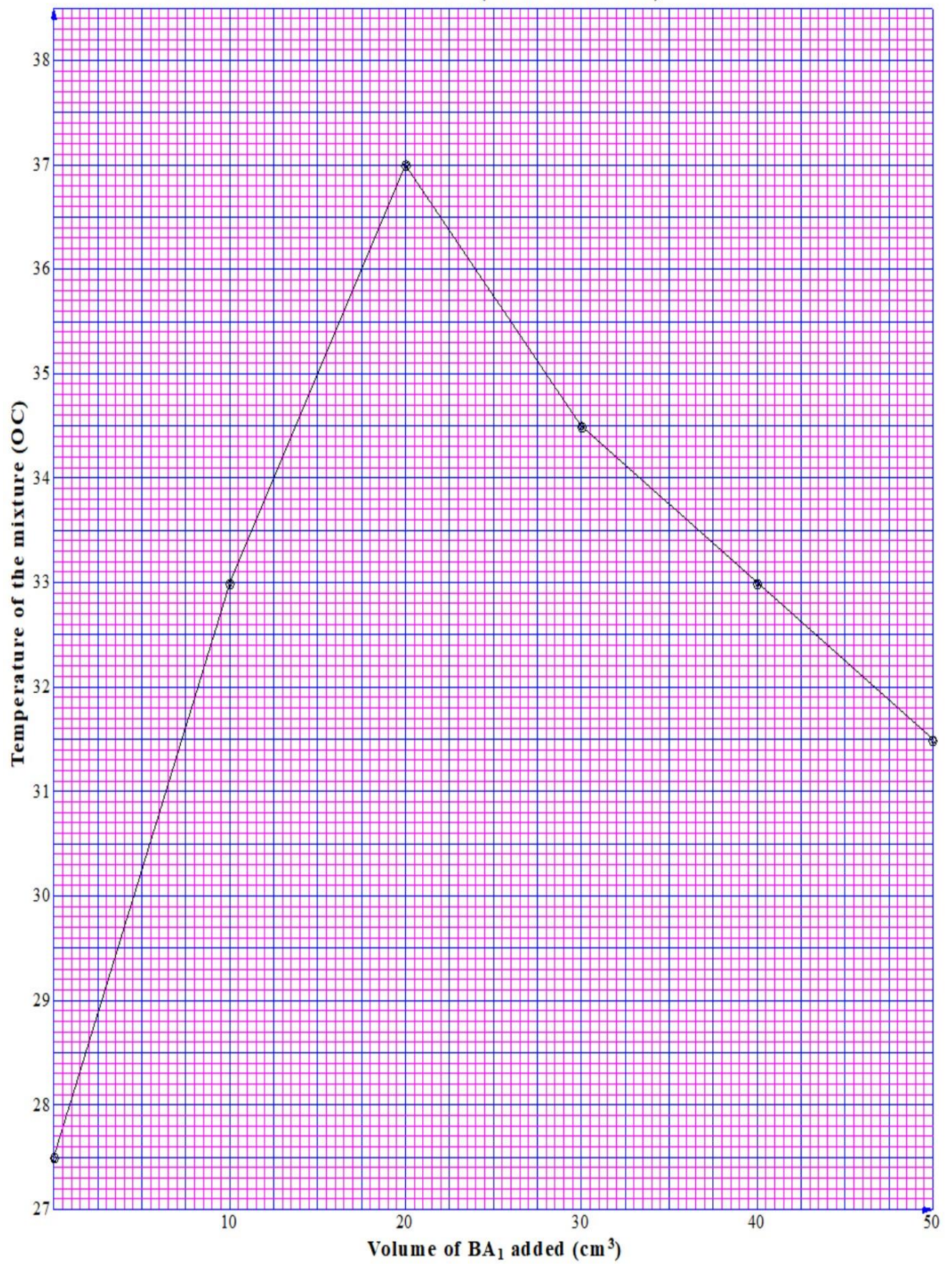
	AND INTERPRETATION / CREATING MEANING.	$\begin{aligned} &= \text{heat gained by mixture.} \\ &= mC\theta. \\ &= (50 \times 1 \times 4.2 \times (37 - 25.5)) \\ &= -2,415 \text{ Jmol}^{-1}. \end{aligned}$	
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SAMPLE

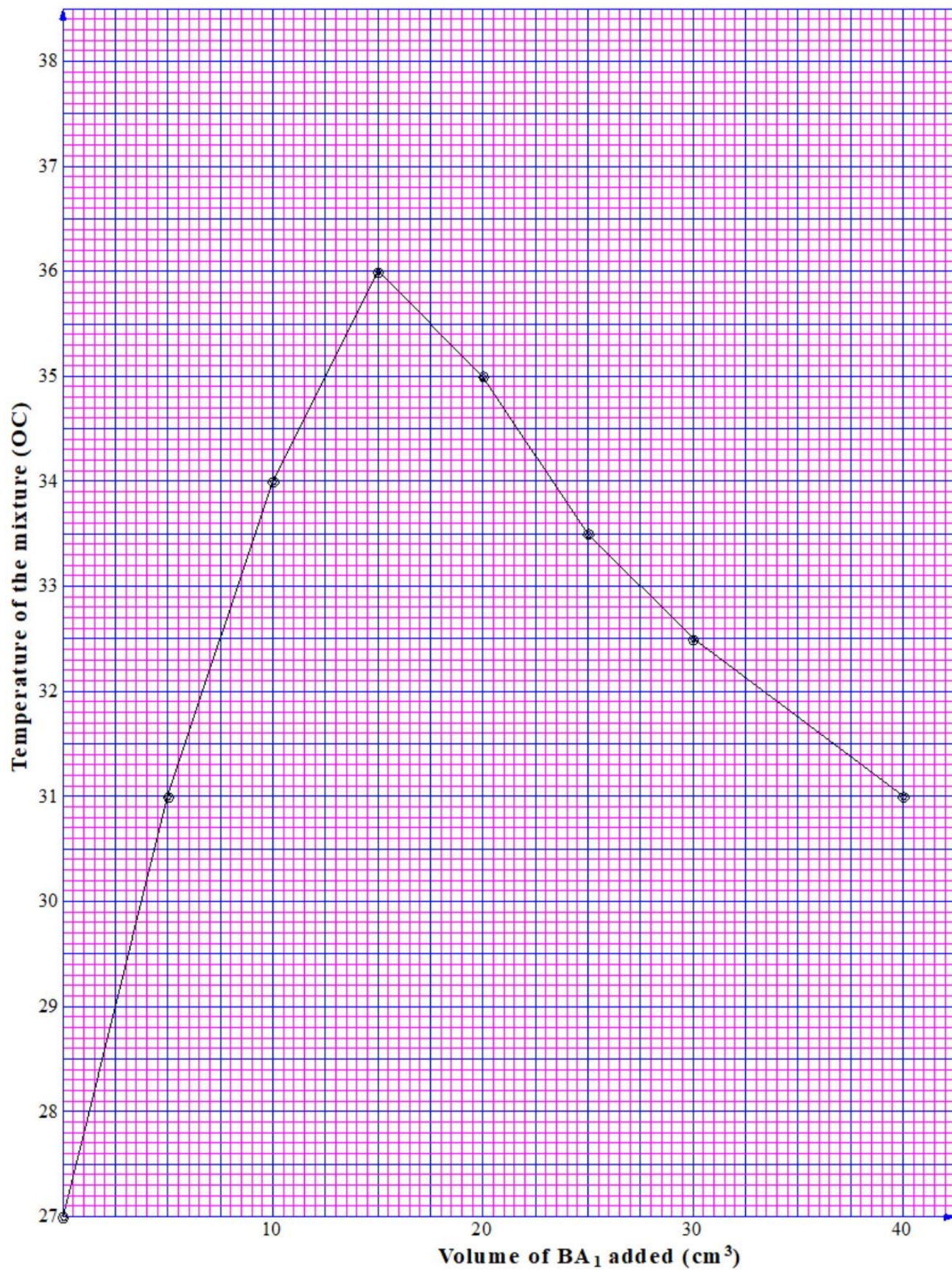
PIPETTE VOLUME 25cm^3 (5cm^3 Intervals)



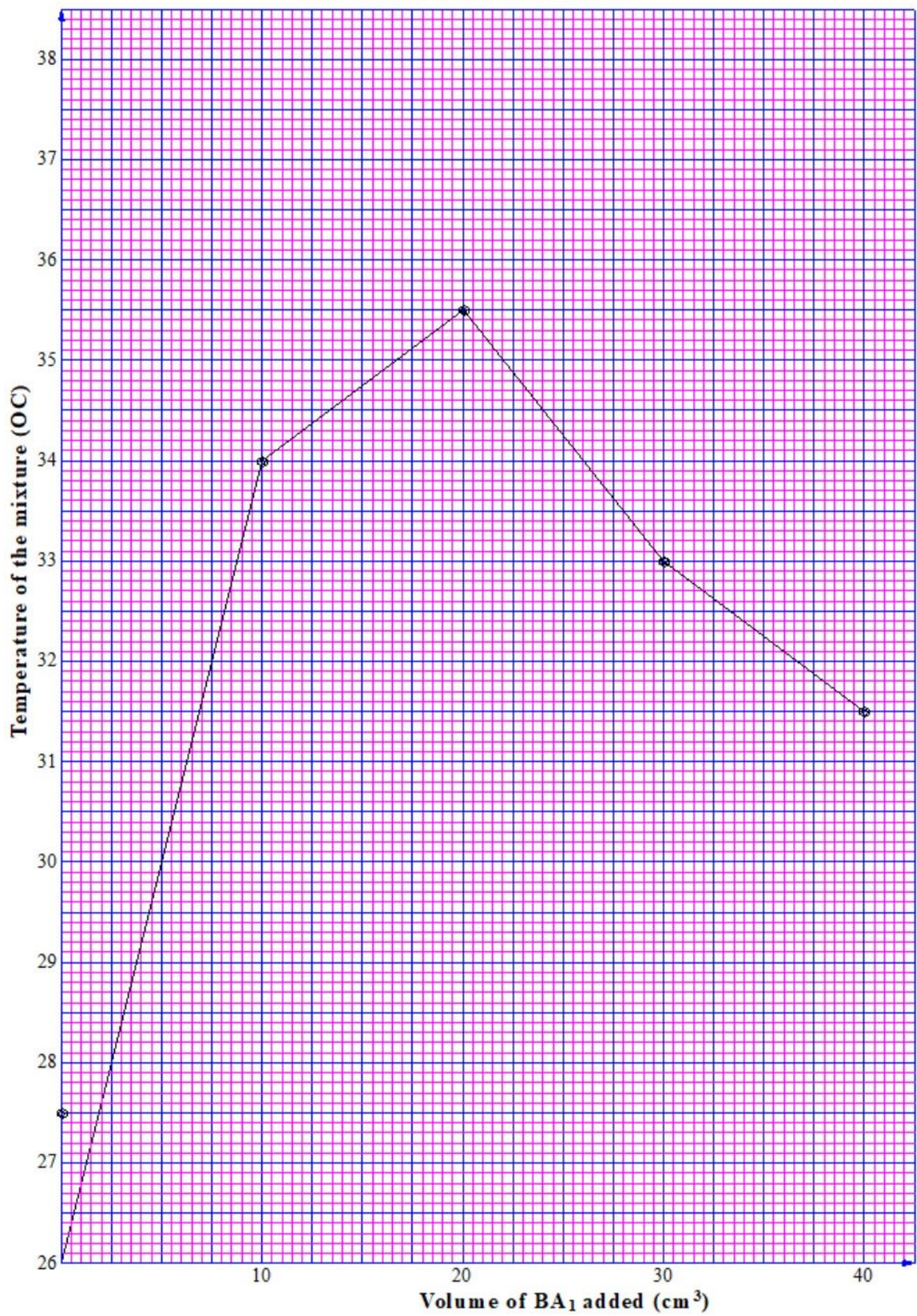
PIPETTE VOLUME 25cm³ (10cm³ Intervals)



PIPETTE VOLUME 20cm³



PIPETTE VOLUME 20cm³



PIPETTE VOLUME 25cm³ DILUTED ACID

