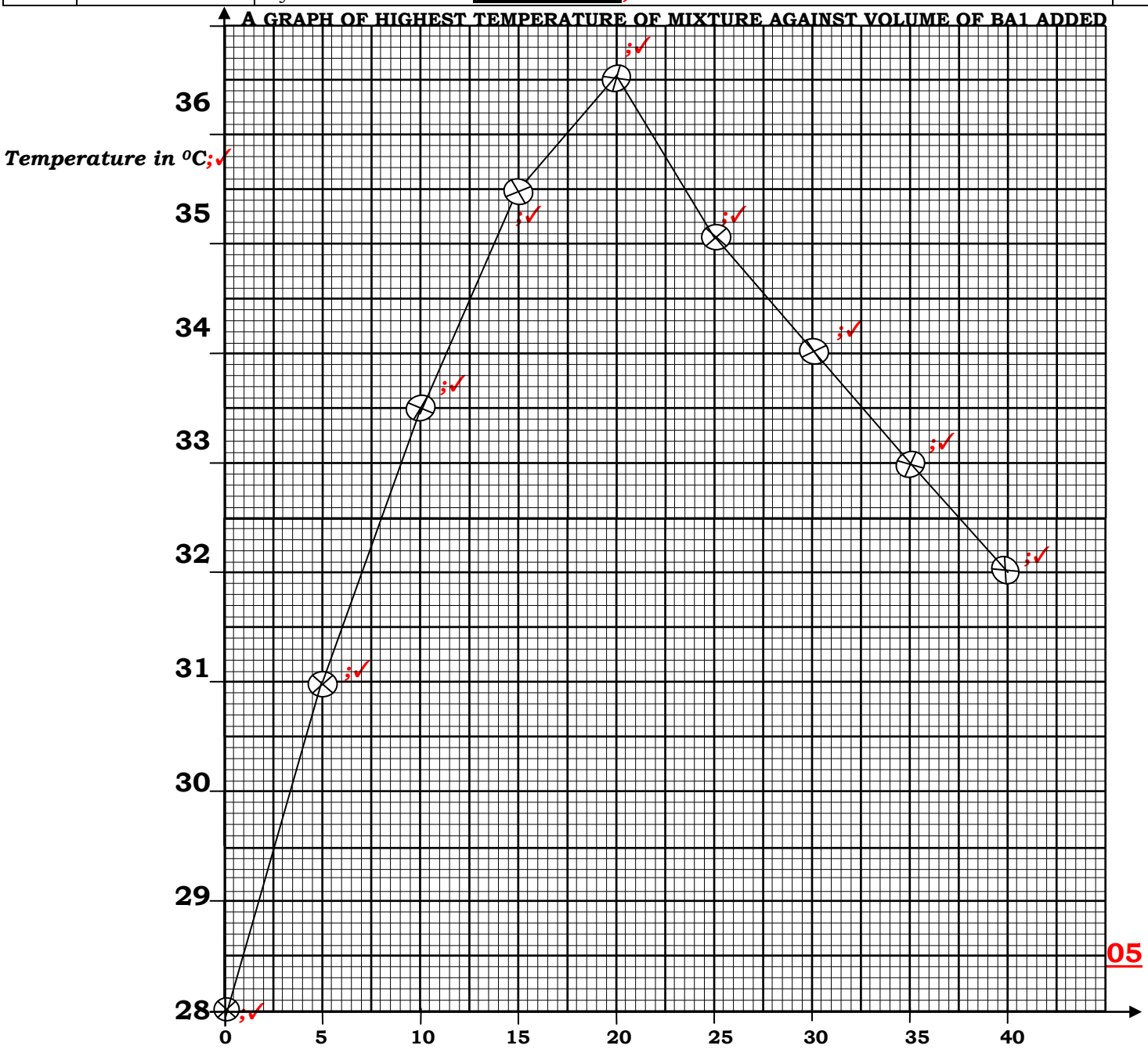
545/2-ITEM SCORING GUIDE

Uganda Certificate of Education

S3-CHEMISTRY-**Paper 2**

S/No	Basis of Assessment	Assessment Criteria	Scoring
(a) (i) **A.**	**AIM OF THE EXPERIMENT**	*An experiment to determine the maximum heat produced;✓ 1A during reaction of sodium hydroxide and hydrochloric acid or between **BA2** and **BA2** (student may start like this);✓ 1A*	**02**
B.	**VARIABLES OF THE EXPERIMENT**	(DV) Dependent variable: *Temperature of solution;✓ 1V* (IV) Independent variable: *Volume of acid added;✓ 1V* (CV) Controlled variable: *Volume of base fixed/volume of base measured;✓ 1V*	**03**
C.	**HYPOTHESIS**	The reaction between **sodium hydroxide** and **hydrochloric** acid;✓ 1H**produces heat**.;✓ 1H **Or** Reaction ***between BA1(NaOH) and BA2(HCl) acid*** is **exothermic**.	**02**
D. (b)	**PROCEDURE OF EXPERIMENT WITH RELEVANT MATERIALS**	(i) 20/25cm^3 of solution **BA2** is pipetted into a plastic beaker and its initial temperature noted and recorded using a thermometer,;✓ 1P and then the thermometer is washed with clean water. (ii) The initial temperature of solution **BA1** is also noted and recorded and then filled into a burette and adjusted to the zero mark.;✓ 1P (iii) 5cm^3 or 10cm^3 of solution **BA1** from burette is then added or run into solution **BA2** in the plastic beaker each time stirring using thermometer and noting the highest temperature of the mixture;✓ 1P (iv) The beaker is washed and procedure is repeated for five or six times each time adding varying solutions of **BA1** from burette at intervals of 10cm^3, 15cm^3, 20cm^3, 25cm^3 30cm^3 and 40cm^3;✓ 1P respectively with constant pipette values of solution **BA2** . ;✓ 1P **[*Stop* scoring when flow is disorganized]**	**05**
E	**RISKS AND MITIGATIONS**	**Risk–** 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. ;✓ 1Rm **Risk–** 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. ;✓ 1Rm **Risk**: Blockage of burette. ***(Award block @ 1 score for correct risk and mitigation).*** **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.	**02**
F.	**PRESENTATION OF DATA.**	The results are recorded in the table below. Initial Temperature of BA1-25.0 ^{0}C;✓ 1DA Initial Temperature of BA2-27.5/28.0^{o}C;✓ 1DA Average Initial Temperature-26.25/26.5^{o}C;✓ 1DA	**03**

G.	**RECORDING OF DATA.**	**TABLE, T_1** **Volume of pipette= 25.0cm³;✓ 1vp** **Volume of BA1 added (cm³)** 0;✓ | 5;✓ | 10;✓ | 15;✓ | 20;✓ | 25;✓ | 30;✓ | 35;✓ | 40;✓ **Highest temp. of mixture (^{0}C)** 28.0 ;✓ | 31.0 ;✓ | 33.5 ;✓ | 35.5 ;✓ | 36.5 ;✓ | 35.0 ;✓ | 34.0 ;✓ | 33.0 ;✓ | 32.0 ;✓ **Temperature change (^{0}C)** 0.0 | 3.0 | 5.0 | 7.0 | 8.0 | 7.0 | 6.0 | 5.0 | 4.0 Trend: Increasing and decreasing temperatures.	**06**
H.	**DATA ANALYSIS AND INTERPRETATION/ CREATING MEANING**	A graph of highest temperature against volume of **BA1** added was plotted as shown on graph paper. From Graph **1**, (**G1**): Heat evolved by reaction: *Heat gained by mixture. =mCθ* Heat evolved = (20 +25) X 4.2 X (36.5 – 28.0) = **¯1,606.5 J mol^{-1};✓** he	**01**
I. (c)	**CONCLUSION**	Heat is evolved when sodium hydroxide reacts with hydrochloric acid. The maximum heat evolved when 25cm³ of sodium hydroxide is mixed with 20cm of hydrochloric acid is 1606· 5 Jmol^{-1};✓ he	**01**



05

ALTERNATIVE METHODS (USING MEASURING CYLINDER INSTEAD OF PIPETTE)

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(a) (i) **A.**	**AIM OF THE EXPERIMENT**	*An experiment to determine the maximum heat produced;✓* 1A *during reaction of sodium hydroxide and hydrochloric acid or between **BA1** and **BA2** (student may start like this).;✓* 1A	**02**
B.	**VARIABLES OF THE EXPERIMENT**	(DV) Dependent variable: *Temperature of solution. ;✓* 1DV (IV) Independent variable: *Volume of base or BA1 added;✓* 1IV (CV) Controlled variable: *Volume of acid or BA2 fixed/volume of acid measured. ;✓* 1CV	**03**
C.	**HYPOTHESIS**	The reaction between **sodium hydroxide** and **hydrochloric** acid**;✓** 1H **produces heat**. **;✓** 1H **Or** Reaction between sodium hydroxide and hydrochloric acid is **exothermic**.	**02**
D.	**PROCEDURE OF EXPERIMENT WITH RELEVANT MATERIALS**	**MATERIALS AND PROCEDURE** Measuring cylinder(100cm³), filter funnel, retort stand, measuring cylinder(10cm³), Plastic beaker(250cm³), Thermometer, burette(50ml), solutions BA1 and BA2**;✓** 1M **(i)** The initial temperature of **BA1 (NaOH)** is measured using a thermometer and recorded.**;✓** 1p **(ii)** Thermometer is then washed with clean water, and initial temperature of solution **BA2 (HCl)** is also read and recorded**;✓** 1p **(iii) BA2 (HCl)** is then filled into a burette using a funnel and adjusted to the zero mark. **(iv)** 5cm³ of **BA2 (HCl)** is run from burette into plastic beaker**;✓** 1p **(v)** Also 5cm³ of **BA1 (NaOH)** is measured using a 100cm³ measuring cylinder and added/transferred into the 5cm³ of **BA2(HCl)** in a Plastic beaker, stirred and the highest temperature of the mixtu is measured using thermometer and recorded**;✓** 1p **(v)** The plastic beaker is then washed and Procedures **(iv)** and **(v)** are repeated for five or six times using uniform/constant volumes of 5cm³ of **BA2** from burette and varying volumes of 10cm³, 15cm³, 20cm³, 25cm³, 30cm³, and 40cm³ of **BA1**respectively.**;✓** 1A Results are recorded in a suitable table.	**06**
E	**RISKS AND MITIGATIONS**	**Risk–** Acid pouring on the skin or question paper, or working table. **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. **;✓** 1RM **Risk:** Breakage of thermometer ***[deny score if only risk /no mitigation given*** **Mitigation:** Putting back the thermometer in its case/container after use. **;✓** 1RM **Risk:** Spilling solutions on table **Mitigation:** Use a filter funnel for filling solution BA1 in the burette. **;✓** 1RM ***[Maximum score = 02 scores]***	**02**

<table>
<tr><td>F.</td><td>PRESENTATION OF DATA.</td><td>The results are recorded in the table below.
Initial Temperature of BA1-28.0 ^{o}C;✓DA
Initial Temperature of BA2-27.5/28.0^{o}C;✓DA
Average Initial Temperature-27.5/28.0^{o}C;✓DA
<u>Table of Results</u> [TABLE, T_2]</td><td>03</td></tr>
<tr><td>G</td><td>RECORDING OF DATA.</td><td>
<table>
<tr><td>Experiment number</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>Volume of BA1 added (cm^3)</td><td>0;✓</td><td>5;✓</td><td>10;✓</td><td>15;✓</td><td>20;✓</td><td>25;✓</td><td>30;✓</td></tr>
<tr><td>Volume of BA2 added (cm^3)</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td></tr>
<tr><td>Highest temp. of mixture (^{0}C)</td><td>28.0 ;✓</td><td>32.0 ;✓</td><td>36.0 ;✓</td><td>32.0 ;✓</td><td>31.0 ;✓</td><td>30.0 ;✓</td><td>28.0 ;✓</td></tr>
</table>
The above results in the table is plotted in a suitable graph [award 5 scores for any 5 correctly recorded values of thermometer to 1dp]; -1 if dp. Is not correct</td><td>05</td></tr>
<tr><td>H.</td><td>DATA ANALYSIS AND INTERPRETATION/ CREATING MEANING</td><td>A graph of highest temperature against volume of BA1 added was plotted as shown on graph paper.
Heat evolved by reaction: = Heat gained by mixture. ;✓DA
Heat evolved $=mC\theta$
Heat evolved =(10 +25) X 4.2 X (36.5 – 28.0) ;✓DA
= $^{-}$1,606.5 Jmol^{-1}. ;✓DA [deny score if no units]</td><td>03</td></tr>
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(c)</td><td>CONCLUSION</td><td>Heat is evolved when sodium hydroxide reacts with hydrochloric acid. The maximum heat evolved when 25cm^3 of sodium hydroxide is mixed with 20cm of hydrochloric acid is 1606· 5 Jmol^{-1};✓h</td><td>01</td></tr>
</table>