



TEST CODE **02112032**

FORM TP 2011154

MAY/JUNE 2011

CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

CHEMISTRY

UNIT 1 – Paper 03/2

ALTERNATIVE TO INTERNAL ASSESSMENT EXAMINATION

2 hours

**You are advised to use the first 10 minutes
for reading through the paper carefully.**

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. Answer ALL questions on this paper.
2. Use this answer booklet when responding to the questions. For EACH question, write your answer in the space indicated and return the answer booklet at the end of the examination.
3. The use of silent non-programmable calculators is allowed.
4. A data booklet is provided.

NOTHING HAS BEEN OMITTED.

1. You are provided with a saturated solution of calcium hydroxide, Ca(OH)_2 . Carry out the following experiment to determine the solubility product constant at room temperature for Ca(OH)_2 .

(a) Procedure:

- (i) Filter 100 cm^3 of a saturated solution of calcium hydroxide, Ca(OH)_2 .
- (ii) Transfer (using a pipette) 20 cm^3 of the filtered Ca(OH)_2 solution into a 250 cm^3 conical flask and add TWO drops of screened methyl orange indicator.
- (iii) Fill your burette with $0.0500 \text{ mol dm}^{-3}$ HCl.
- (iv) Titrate your calcium hydroxide solution against the HCl in the burette.
- (v) Record in Table 1, to two decimal places, both your initial burette reading and the reading at the end point.
- (vi) Repeat steps (ii) - (iv) until consistent results are obtained.

TABLE 1: DATA FOR EXPERIMENTAL PROCEDURE

Titration	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of HCl used (cm^3)			

[6 marks]

- (b) Calculate the volume of HCl used for the titration.

[1 mark]

- (c) Write a **balanced** equation for the reaction between Ca(OH)_2 and HCl.

[2 marks]

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(d) Calculate the number of moles of HCl used in the titration.

[1 mark]

(e) Calculate the number of moles of $\text{Ca}(\text{OH})_2$ used in the titration.

[1 mark]

(f) Write an equation for the dissociation of $\text{Ca}(\text{OH})_2$.

[1 mark]

(g) Calculate the number of moles of Ca^{2+} ions used in the titration.

[1 mark]

(h) Calculate the number of moles of OH^- ions used in the titration.

[1 mark]

- (i) Calculate the concentration in mol dm^{-3} of Ca^{2+} and OH^- ions present in the $\text{Ca}(\text{OH})_2$ solution.

[2 marks]

- (j) Write the K_{sp} expression for $\text{Ca}(\text{OH})_2$.

[1 mark]

- (k) Calculate K_{sp} at room temperature for $\text{Ca}(\text{OH})_2$.

[1 mark]

Total 18 marks

2. A student was asked to find the heat of neutralization for the reaction between 50 cm^3 of 2.0 mol dm^{-3} HCl and 50 cm^3 of an equimolar solution of NaOH. The student recorded the initial temperatures of the HCl and NaOH solutions and found them both to be $23.26 \text{ }^\circ\text{C}$. After mixing the solutions, the student recorded the temperature of the mixture every 20 seconds for 3 minutes. The recorded temperatures were 28.50 , 28.55 , 28.48 , 28.38 , 28.27 , 28.16 , 28.05 , 27.95 and $27.84 \text{ }^\circ\text{C}$.

- (a) Construct a table to record the observations of the student.

[3 marks]

- (b) On the axes provided in Figure 1 on page 7, and using a scale of 1 cm to represent 10 seconds on the horizontal axis and 2 cm to represent $0.1 \text{ }^\circ\text{C}$ on the vertical axis (beginning at $27.6 \text{ }^\circ\text{C}$), plot a graph of temperature vs time for the reaction.

[6 marks]

- (c) Explain the shape of the curve obtained from your graph.

[2 marks]

- (d) Write the equation for the neutralization reaction.

[1 mark]

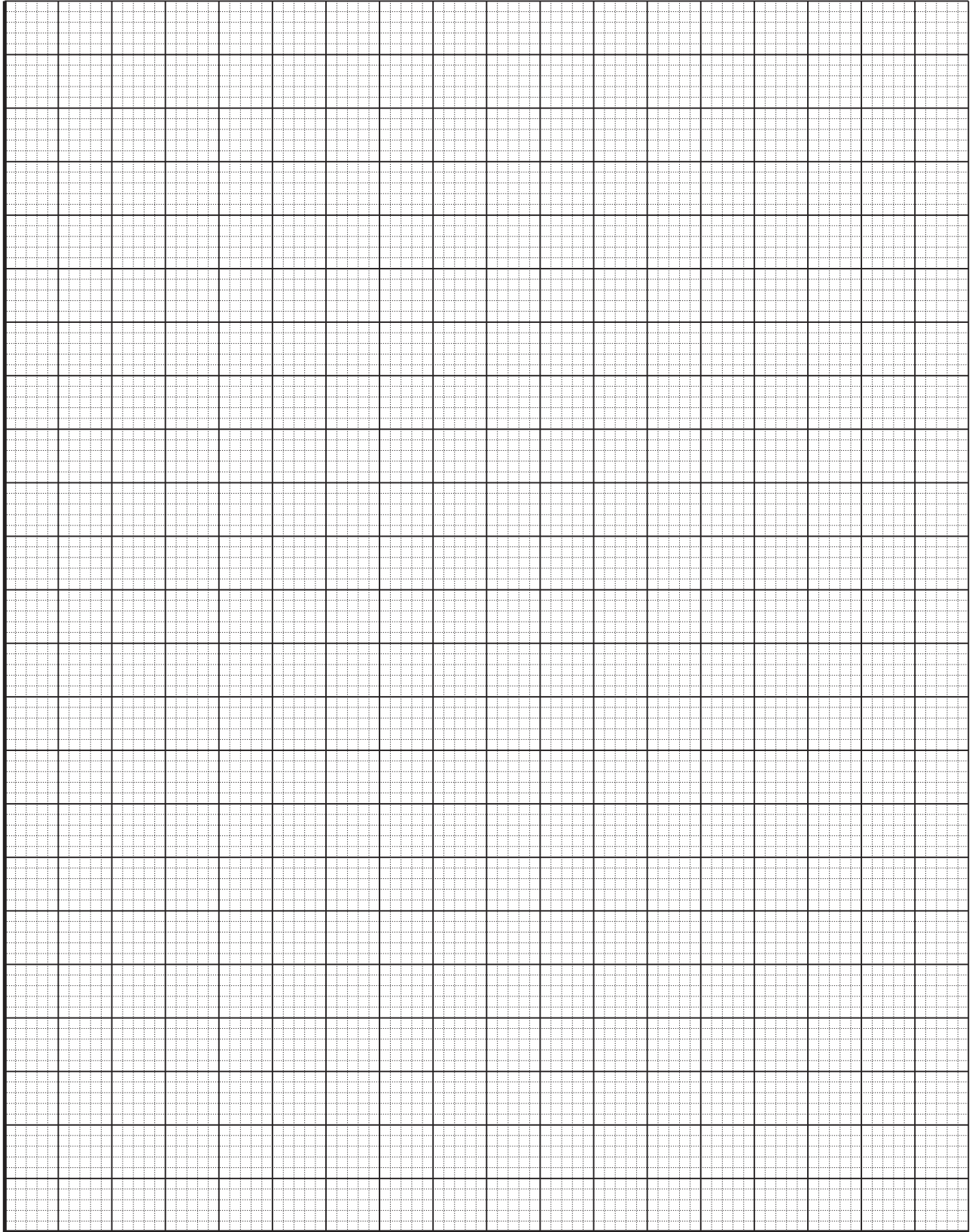


Figure 1

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- (e) Assuming the heat capacity of the calorimeter is negligible and can therefore be ignored, calculate the heat of the reaction in Joules.

(Density and heat capacity of all solutions are assumed to be 1.01 g cm^{-3} and $4.18 \text{ Jg}^{-1} \text{ }^\circ\text{C}^{-1}$ respectively).

[4 marks]

- (f) Calculate the enthalpy change of the reaction in kJ mol^{-1} .

[2 marks]

Total 18 marks

3. A chemistry student was taught that groups of elements in the Periodic Table exhibit variations in their chemical properties. The student was encouraged to investigate the variation in reactivities of the Group VII elements.

Plan and design an experiment that could be used by the student in his or her investigation.

Your answer should include:

- (a) Aim

[1 mark]

- (b) Hypothesis

[1 mark]

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(c) Apparatus and materials

[3 marks]

(d) Experimental procedure

(e) Variables

[3 marks]

(i) Manipulated

(ii) Responding

(iii) Controlled

[3 marks]

(f) Treatment of results

[1 mark]

Total 12 marks

END OF TEST