CARIBBEAN EXAMINATIONS COUNCIL

ADVANCED PROFICIENCY EXAMINATION

CHEMISTRY

UNIT 1 – PAPER 03/2

2 hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Answer ALL questions.

2. Write your answers in the spaces provided in this booklet.

3. ALL working MUST be shown.

4. The use of non-programmable calculators is permitted.

5. A data booklet is provided.

Answer ALL questions.

1.   You are provided with a popular brand of vinegar. Carry out the following experiment to determine the percentage of acetic acid in your vinegar sample.

(a)   Procedure

A.   Pipette 10 cm^3 of vinegar into a 100 cm^3 volumetric flask and make up to the mark with distilled water.

B.   Transfer (using a pipette) 20 cm^3 of the diluted vinegar solution into a 250 cm^3 conical flask and add two drops of phenolphthalein indicator.

C.   Fill your burette with 0.10 mol dm^{-3} sodium hydroxide.

D.   Titrate your vinegar solution against the NaOH in the burette.

E.   Record both your initial burette reading and the reading at the end point in Table 1, to two decimal places.

F.   Repeat steps B – E until consistent results are obtained.

TABLE 1: DATA FOR EXPERIMENTAL PROCEDURE

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

[6 marks]

(b)   Suggest a reason for using phenolphthalein as the indicator.

_____

_____

[1 mark]

(c)   Calculate the volume of NaOH used for the titration.

[1 mark]

(d)   Write an equation for the reaction of sodium hydroxide and acetic acid.

_____

[1 mark]

(e)   Calculate the number of moles of sodium hydroxide used in the titration.

[1 mark]

(f)   Calculate the number of moles of acetic acid present in your pipetted 20 cm^3 of vinegar solution (Step B).

[2 marks]

GO ON TO THE NEXT PAGE

(g) Calculate the concentration of the 100 cm³ vinegar solution (Step A).

[2 marks]

(h) Calculate the concentration of acetic acid in your original vinegar sample.

[1 mark]

(i) Calculate the percentage of acetic acid in your brand of vinegar if the density of the vinegar solution is 1.01 g cm⁻³.

[3 marks]

Total 18 marks

GO ON TO THE NEXT PAGE

2. An experiment is carried out to investigate the rate of reaction between an excess of dolomite chips (magnesium carbonate) and 50 cm^3 of dilute hydrochloric acid. The volume of carbon dioxide is measured at regular intervals using a gas syringe. Figure 1 shows six readings of the volume of carbon dioxide as given by the gas syringe, and the corresponding time taken.
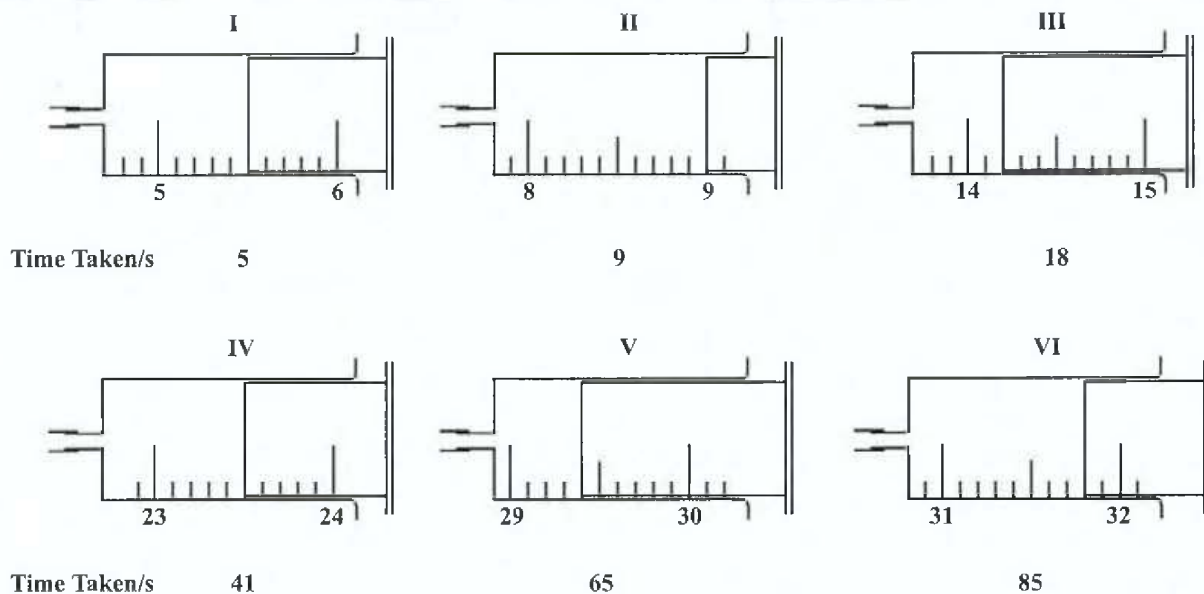

| Time Taken/s | 5 | 9 | 18 |

| Time Taken/s | 41 | 65 | 85 |

Figure 1. Volume of CO_2 measured by the gas syringe

(a) (i) From the results shown in Figure 1, construct a table to show number of readings, volume of CO_2 evolved, the time taken and the inverse of the time taken (l/t).

[5 marks]

(ii) On the grid on page 7, plot a graph of volume of CO_2 evolved against time taken.

[4 marks]

(iii) Explain the shape of the graph.

_____

_____

_____

[2 marks]

(iv) From the graph, determine the rate of reaction at 20 and 40 seconds. Show all your working.

20 s _____

_____

40 s _____

_____

[4 marks]

(v) State what can be deduced about the rate of reaction from your answer in (a) (iv) above.

_____

[1 mark]

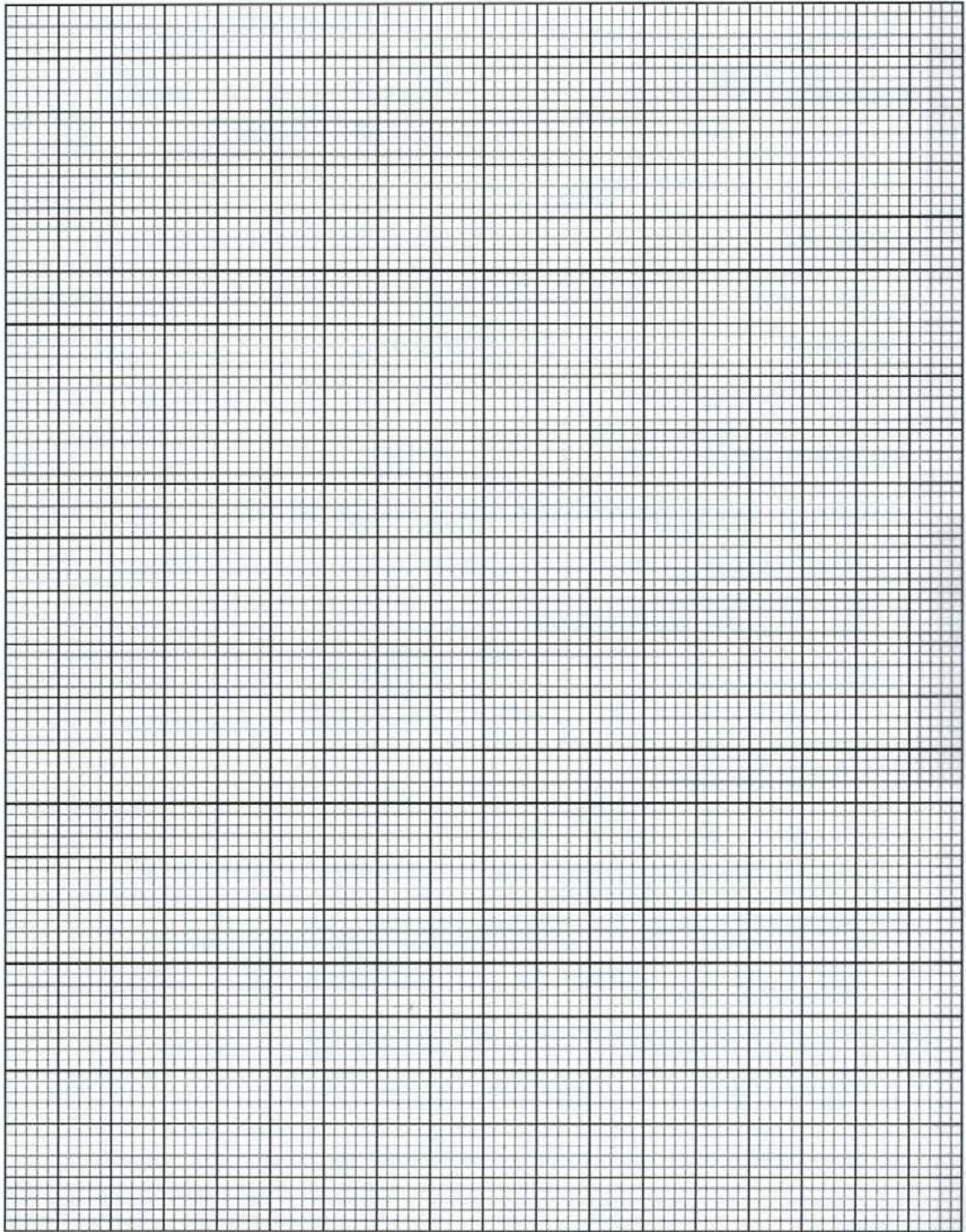(vi) Suggest the property of the reaction measured by the value, l/t (the inverse of the time).

_____

[1 mark]

(vii) Suggest a reason for the use of excess dolomite (magnesium carbonate).

_____

[1 mark]

Total 18 marks

GO ON TO THE NEXT PAGE

3. Dieticians refer to the energy content of foods consumed in terms of their calorie value, expressed as cal g^{-1} of food. The calorie and joule are both units of energy. Some persons believe that sweet potato contains more energy than yam.

Plan and design an experiment to test the truth of the claim above.

Your answer should include:

(a) Hypothesis

_____

_____

[1 mark]

(b) Aim

_____

_____

[1 mark]

(c) Apparatus and materials

_____

_____

_____

_____

[2 marks]

(d) Experimental procedure

_____

_____

_____

_____

[2 marks]

(e)   Variables

    (i)   Manipulated

_____

    (ii)   Responding

_____

    (iii)   Controlled

_____

[3 marks]

(f)   Expected results

_____

_____

_____

_____

[1 mark]

(g)   Treatment of results

_____

_____

_____

_____

[1 mark]

(h)   State ONE source of error in the experiment.

_____

[1 mark]

Total 12 marks

END OF TEST