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# Chemistry Standard level Paper 1B

15 May 2026

Zone A afternoon | Zone B afternoon | Zone C afternoon

Session number

1 hour 30 minutes [Paper 1A and Paper 1B]

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## Instructions to students

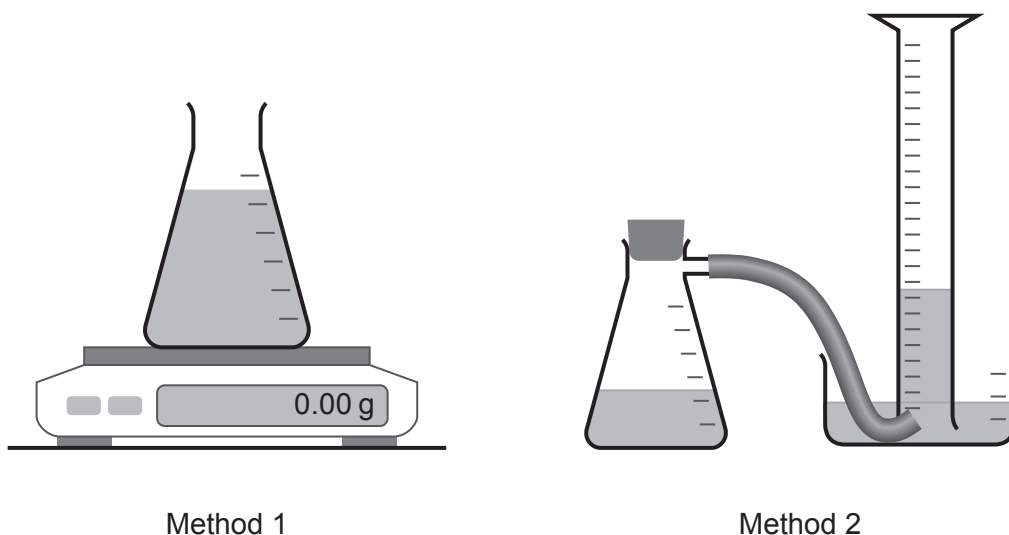
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **chemistry data booklet** is required for this paper.
- The maximum mark for paper 1B is **[25 marks]**.
- The maximum mark for paper 1A and paper 1B is **[55 marks]**.



## Section B

Answer **all** questions. Answers must be written within the answer boxes provided.

1. A student studied the reaction of hydrochloric acid,  $\text{HCl}$ , with solid calcium carbonate,  $\text{CaCO}_3$ , using two different methods.



- (a) (i) Write an equation, including state symbols, for the reaction. [2]

.....

- (ii) Deduce the feature of the reaction that allows the rate to be measured with both methods. [1]

.....

- (iii) The experimental design required calcium carbonate,  $\text{CaCO}_3$ , to be in excess.

Calculate the minimum mass of  $\text{CaCO}_3$ , in g, required when  $50.0 \text{ cm}^3$  of  $0.15 \text{ mol dm}^{-3}$   $\text{HCl}$  are used. Use section 7 of the data booklet. [2]

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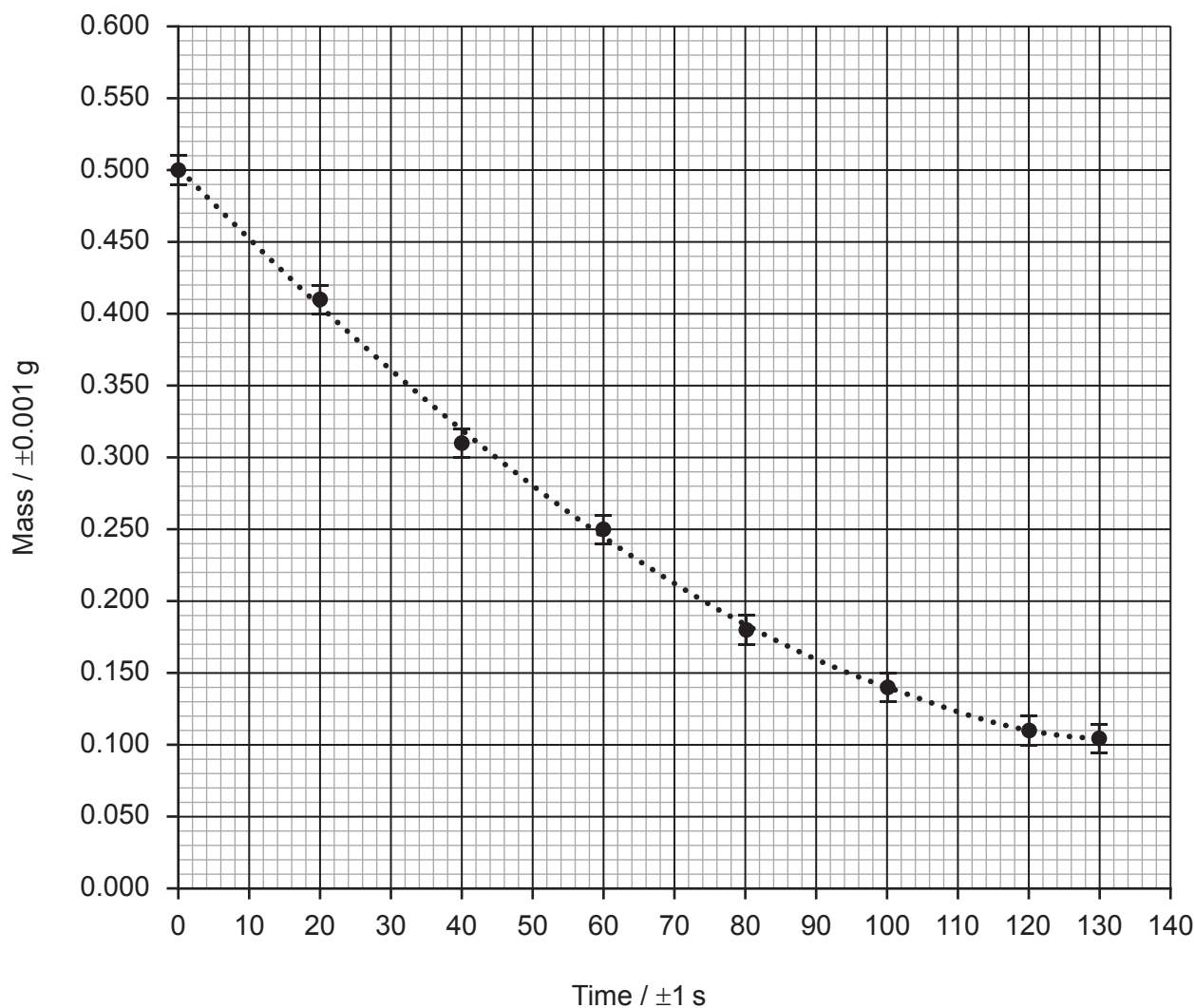
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**(Question 1 continued)**

- (b) Using method 1, the student placed the flask with the aqueous HCl on the balance and zeroed the balance before adding 0.500 g of  $\text{CaCO}_3$ . The mass was recorded every 20 seconds until the end of the reaction.

The student plotted the results of the average of three trials with uncertainties obtaining a graph.



Determine the initial rate of reaction, showing your working on the graph.

[2]

.....  
 .....

**(This question continues on the following page)**



12EP03

Turn over

**(Question 1 continued)**

- (c) The student repeated the experiment using method 2.
- (i) Calculate the volume of gas collected in the measuring cylinder when the reaction goes to completion at  $T = 20^{\circ}\text{C}$  and  $P = 1.00 \times 10^5 \text{ Pa}$ . Use section 1 of the data booklet and your answer to part (a)(iii).

If you did not get an answer in part (a)(iii), use 0.250 g, although this is not the correct answer.

[2]

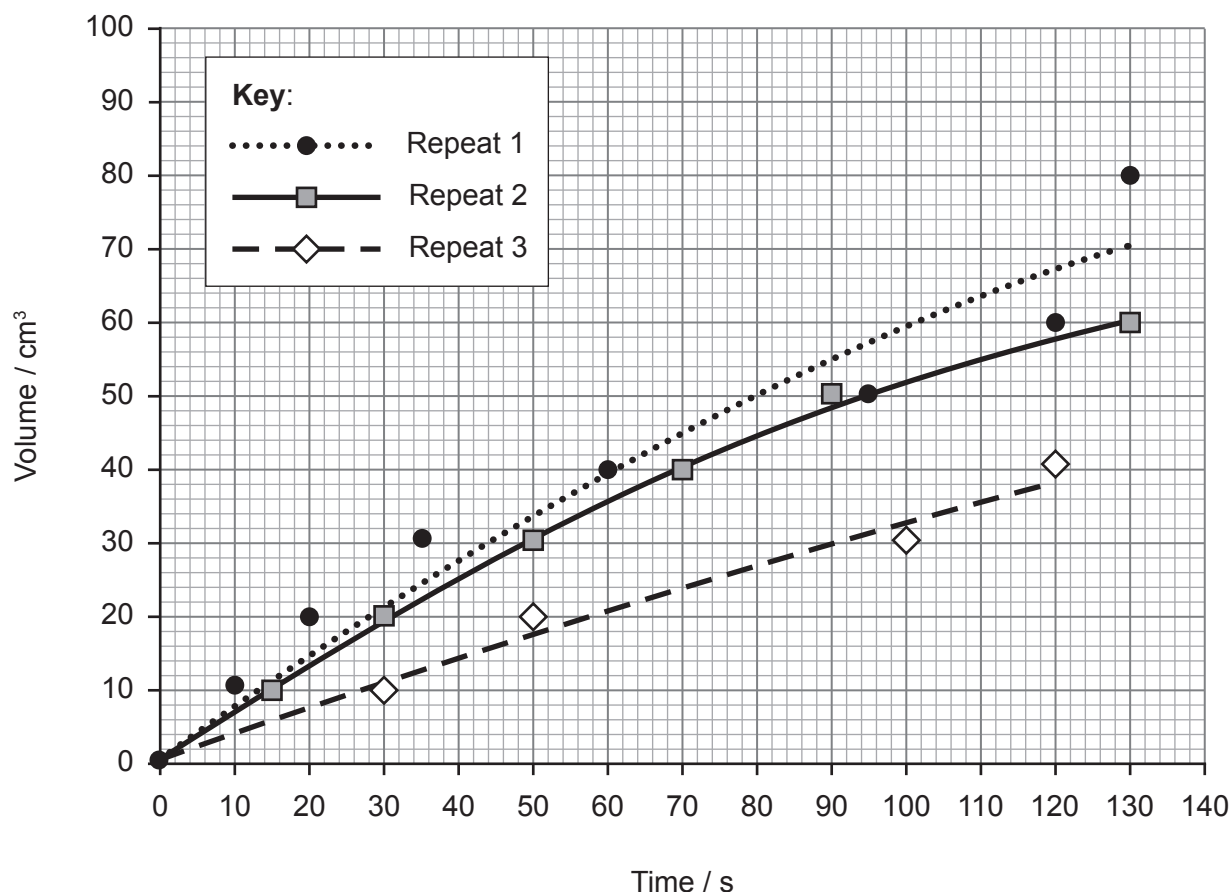
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(Question 1 continued)

- (ii) Using method 2, the student transferred the aqueous HCl solution to the flask, added the  $\text{CaCO}_3$  powder, and immediately sealed the flask. The time taken to collect each  $10\text{ cm}^3$  of gas was recorded until no further gas was collected. The experiment was repeated three times and raw data was plotted.



Suggest, with a reason, which method is more precise. Consider the data in part (b) and part (c)(ii).

[1]

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- (iii) State the type of error responsible for the lower precision in the selected method in part (c)(ii), indicating a possible reason for this error.

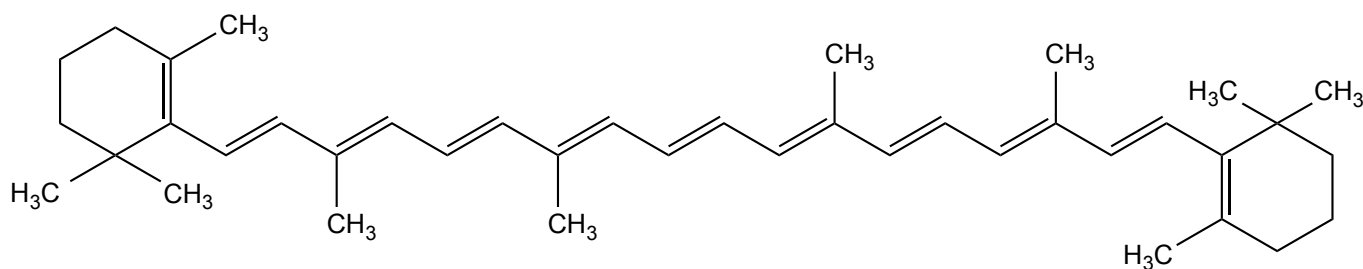
[1]

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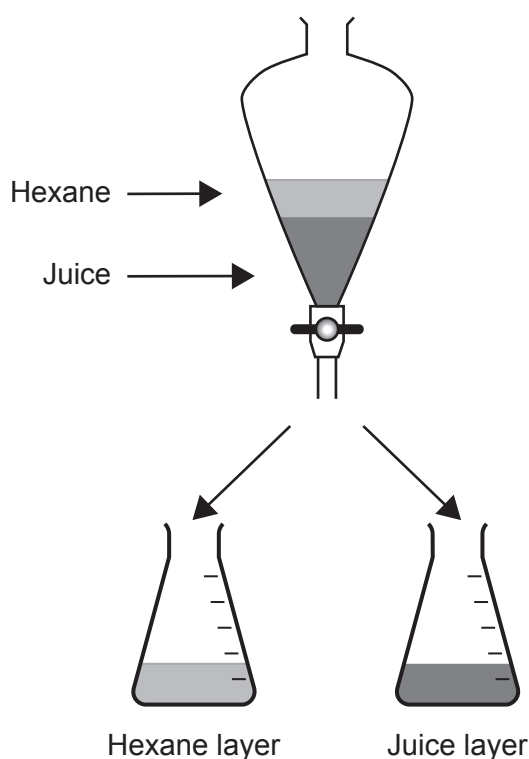
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2. The carotenoid content of fresh tomato juice was studied using colorimetry. The structure of one of the carotenoids in a tomato,  $\beta$ -carotene, is shown.



- (a) To separate the carotenoids, the filtered tomato juice was placed in a separating funnel with hexane,  $C_6H_{14}$ . After swirling the contents, the two immiscible solutions were collected in separate flasks.



Predict, in terms of intermolecular forces, in which solution the carotenoids will be found.

[1]

.....  
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**(Question 2 continued)**

(b) An absorption spectrum was used to select the wavelength at which the samples were to be analysed.

(i) Describe the contents of the required solutions. [2]

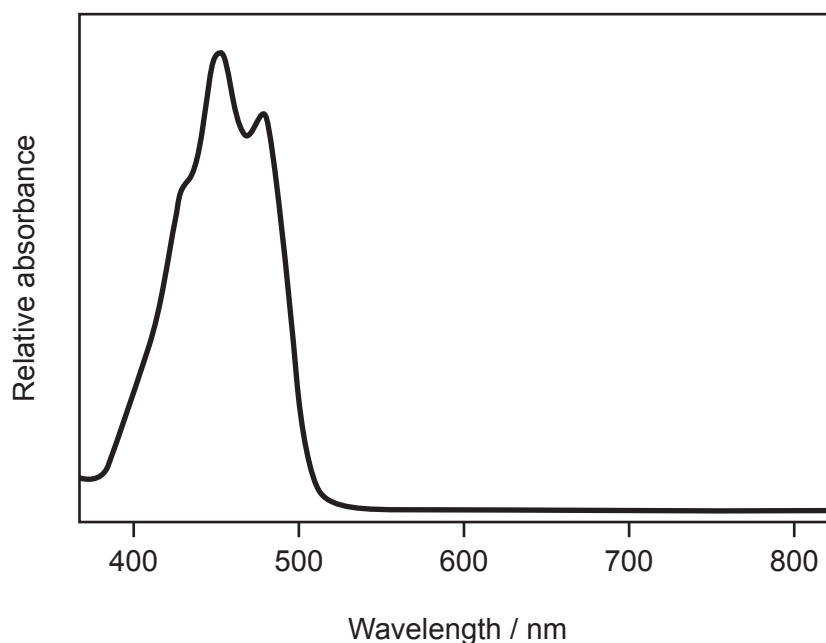
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(ii) The obtained absorption spectrum is shown.



Suggest, with a reason, the most suitable wavelength for the determination of  $\beta$ -carotene. [2]

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12EP07

**Turn over**

(Question 2 continued)

- (iii) The quantitative determination of the carotenoids required the construction of a calibration curve. Suggest **two** requirements for a reliable calibration curve. [2]

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- (c) Tomatoes also contain ascorbic acid,  $C_6H_8O_6$ .

- (i) The student determined the content of ascorbic acid by titration with iodine,  $I_2$ . This method is based on the following redox reaction:



Deduce which species acts as an oxidizing agent writing a half-equation to justify your conclusion. [1]

.....

- (ii) Starch is added towards the end of the titration.

Explain, with a reason, the use of starch in this titration. [2]

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(This question continues on the following page)



**(Question 2 continued)**

- (iii) For the titration, 10.000 g ( $\pm 0.010\%$ ) of tomato juice were placed in a conical flask and diluted with 50 cm<sup>3</sup> of water. The titration was performed using a standardized 0.500 mol dm<sup>-3</sup> ( $\pm 0.30\%$ ) solution of iodine, I<sub>2</sub>(aq), and a 25.00 cm<sup>3</sup> burette ( $\pm 0.05$  cm<sup>3</sup>). The average volume of titrant was 1.20 cm<sup>3</sup>.

Calculate the percentage uncertainty of the volume of the titrant showing your working.

[1]

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.....

- (iv) Suggest **one** change in the method to reduce the major source of uncertainty.

[1]

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- (d) Experimental results could be compared to those in a database. Suggest **two** factors that must be considered when comparing **these** experimental results to data from a given source.

[2]

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**References:**

2.(b)(ii) With permission from Harvard Forest.



12EP10

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12EP11

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12EP12