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Physics
Standard level
Paper 1B

28 April 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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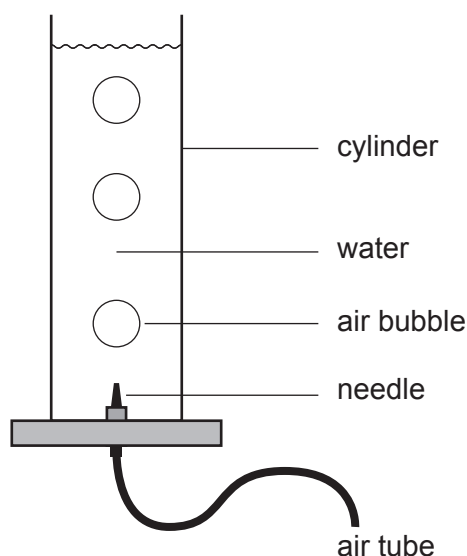
Instructions to students

- 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 **physics data booklet** is required for this paper.
- The maximum mark for paper 1B is **[20 marks]**.
- The maximum mark for paper 1A and paper 1B is **[45 marks]**.



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

1. A student designs an experiment to determine the relationship between the diameter of an air bubble and its terminal speed in water. A needle is used to inject air bubbles one at a time into the bottom of a tall cylinder filled with water. The motion of the bubbles is captured by a video camera as they rise upwards.



- (a) State why the temperature of the water needs to be controlled during the investigation. [1]

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- (b) The student used the formula for viscous drag force to derive the following formula for the terminal speed v_t of a bubble as a function of its diameter d :

$$v_t = \frac{\rho g d^2}{18\eta}$$

- (i) Identify the quantities ρ , g , and η . [1]

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(Question 1 continued)

- (ii) Suggest how the student will know that the terminal speed has been reached. [2]

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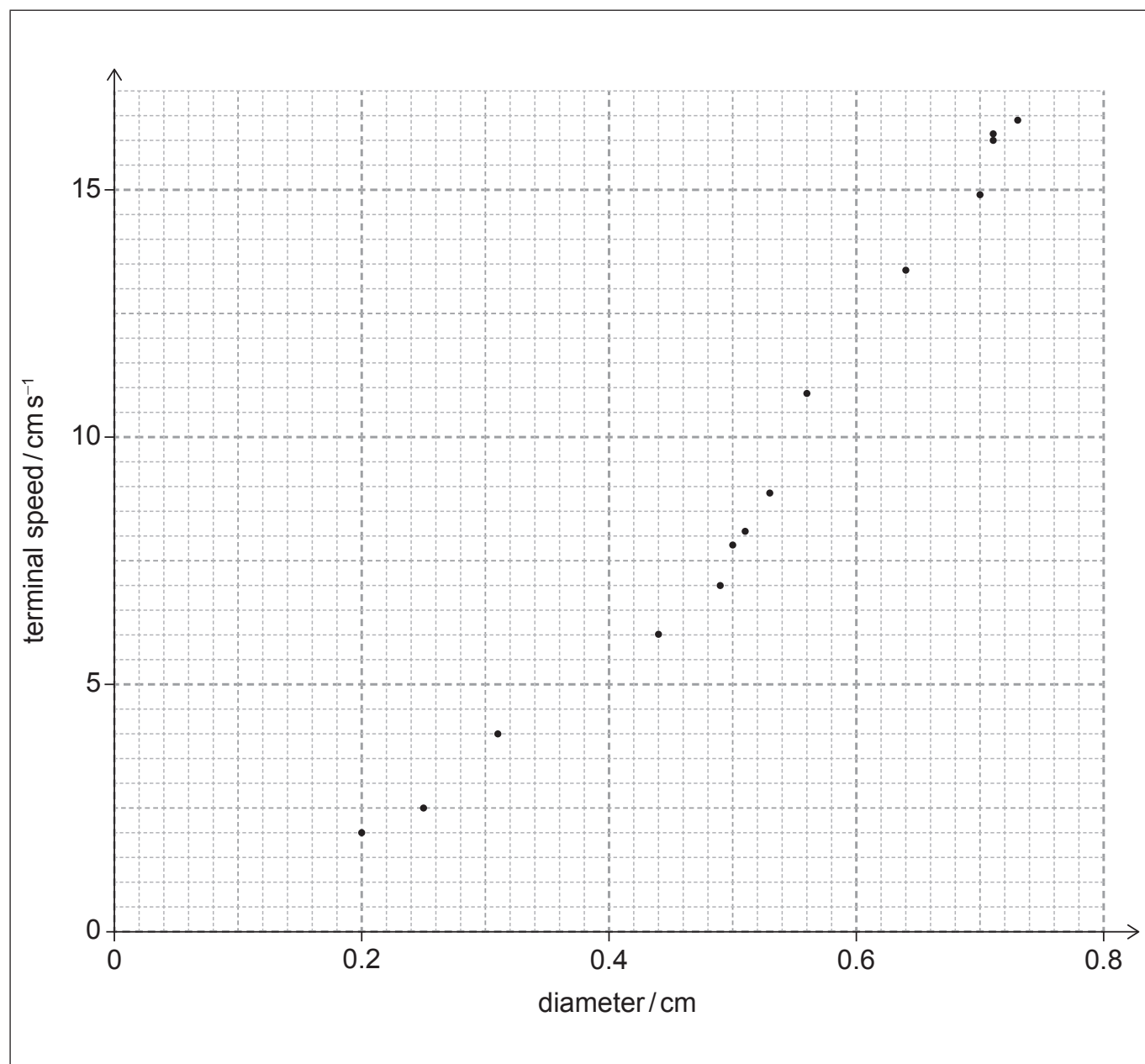
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(Question 1 continued)

The graph shows the variation of a bubble's terminal speed compared to its diameter.



(c) On the graph, draw a suitable line of best fit for the data. [1]

(d) Suggest how the variables shown on the axes of the graph could be manipulated to obtain a straight line of best fit. [1]

(This question continues on the following page)



(Question 1 continued)

- (e) A 0.30 cm bubble moved (1.7 ± 0.1) cm in 10 frames as it moved at terminal speed. The frame rate of the video was (24 ± 1) frames per second.

- (i) Calculate the terminal speed of the 0.30 cm bubble. [1]

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- (ii) Calculate the percentage uncertainty of your answer to (e)(i). [2]

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- (iii) Draw the data point for $d = 0.30$ cm on the graph, including an error bar, to show the absolute uncertainty in the terminal speed. [2]



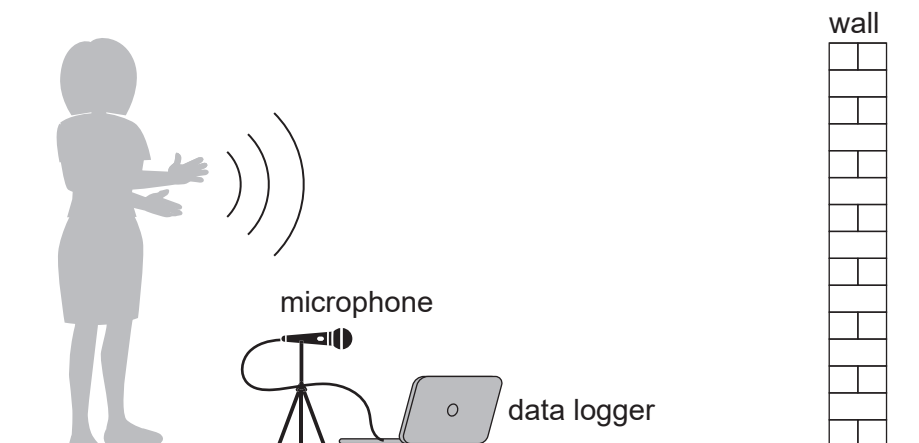
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2. A group of students conduct an experiment to measure the speed of sound using echoes.

One of the students stands beside a data logger that is a measured distance from a wall and makes an audio recording of clapping two blocks together along with its echo. They then move to a new distance and repeat the experiment.



- (a) One of the students suggested taking measurements at 0.2 m and 30 m from the wall. Suggest why these distances were not suitable.

[2]

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- (b) Describe one condition of the experimental space needed to take accurate readings.

[1]

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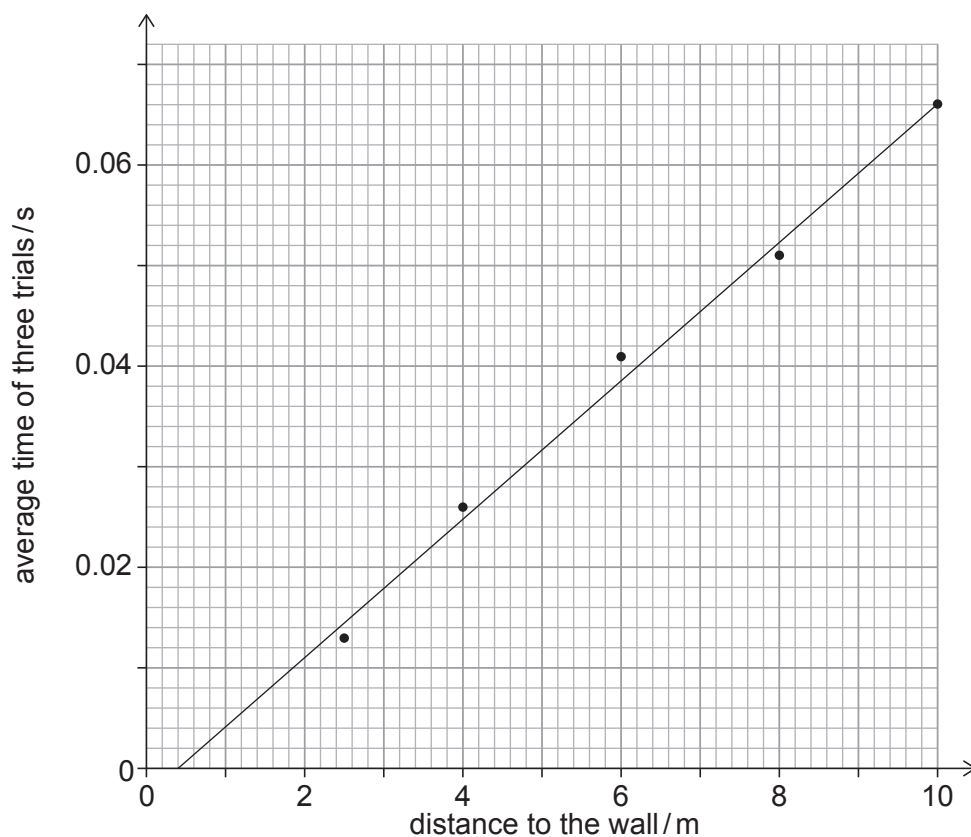
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(Question 2 continued)

The graph shows the relationship between the distance from the person to the wall and the time of the sound arriving at the microphone between the initial clap and its echo.



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(Question 2 continued)

- (c) (i) From the graph, identify the evidence for a systematic error in the data. [1]

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- (ii) Outline the most probable cause of the systematic error. [2]

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- (d) Using the graph, determine the speed of sound. [3]

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12EP10

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12EP12