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Physics
Higher level
Paper 1B

28 April 2026

Zone A afternoon | **Zone B** afternoon | **Zone C** afternoon

Session number

2 hours [Paper 1A and Paper 1B]

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Instructions to students

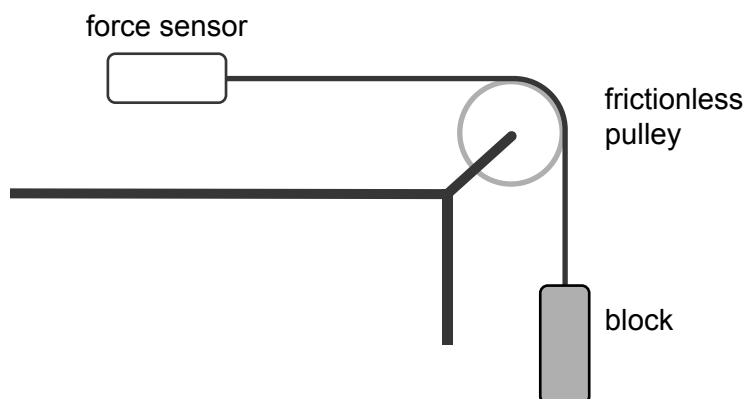
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- A clean copy of the **physics data booklet** is required for this paper.
- The maximum mark for paper 1B is **[20 marks]**.
- The maximum mark for paper 1A and paper 1B is **[60 marks]**.



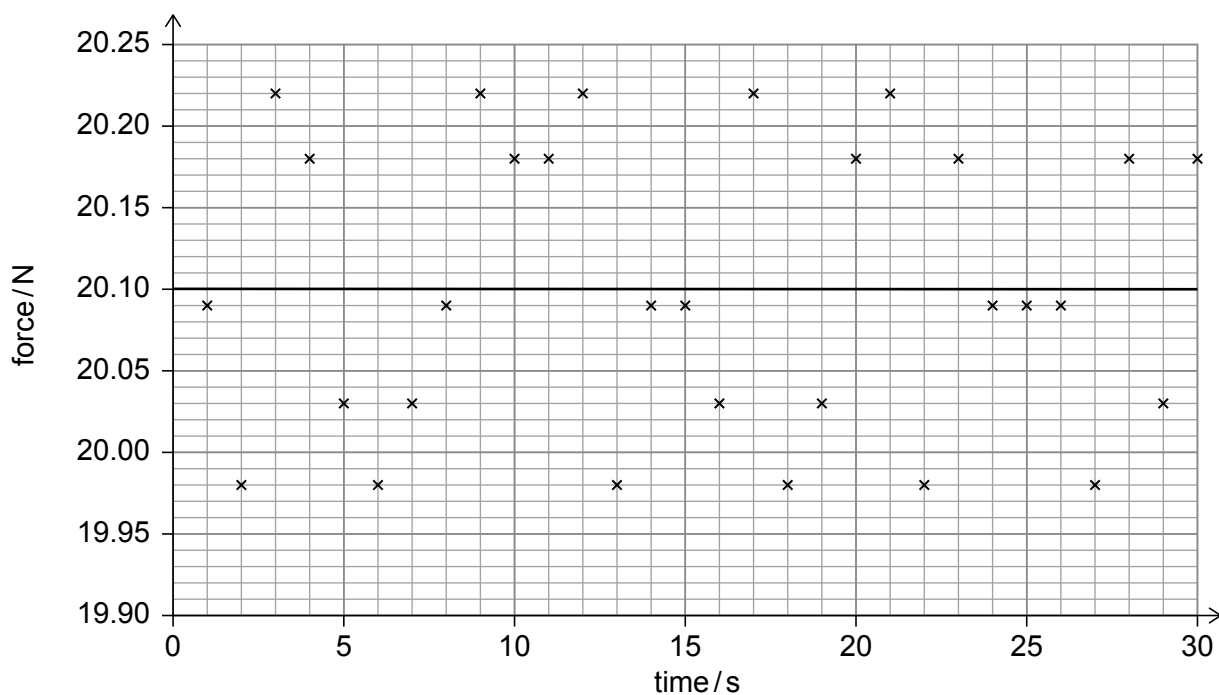
Answer **all** questions. Answers must be written within the answer boxes provided.

- Two students measure the force needed to keep a block at rest.

Student A uses a frictionless pulley. The block is attached to one end of a string. The other end passes over the frictionless pulley to a force sensor.



Data are collected for 30 seconds. The graph shows the data and the line of best fit.



(This question continues on the following page)



(Question 1 continued)

- (a) (i) State the average measured force. [1]

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- (ii) Estimate the percentage uncertainty in the measured force. [2]

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- (b) The students use a value of $g = 9.81 \text{ m s}^{-2}$ in their calculation. This value has percentage uncertainty of 0.4 %. Determine the mass of the block and its absolute uncertainty. State your answer to the appropriate number of significant figures. [3]

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(This question continues on page 5)



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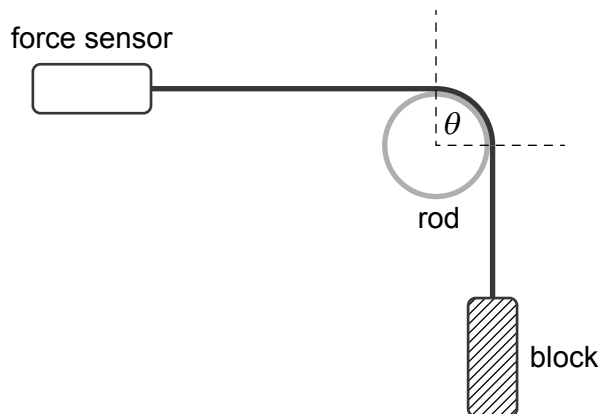
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(Question 1 continued)

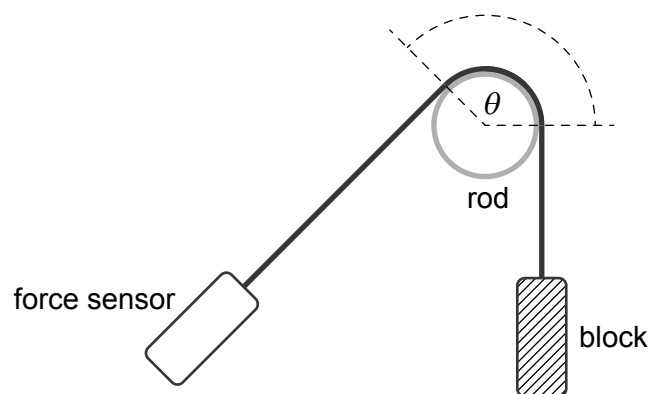
Student B designs an experiment using a fixed rod. In the experiment, the minimum force F needed to keep the block at rest is measured. The angle θ , subtended by the string in contact with the rod, is increased.

The position of the force sensor for $\theta = \frac{\pi}{2}$ rad is shown.



Angle θ is increased by moving the force sensor.

(c) Draw, on the diagram below, the position of the force sensor for the value $\theta = \pi$ rad. [1]



(This question continues on the following page)



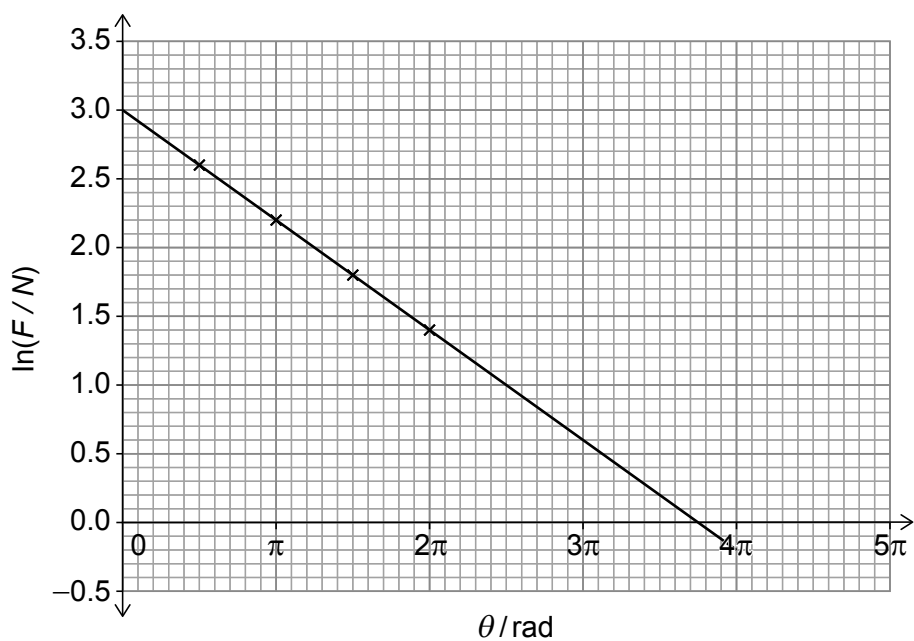
(Question 1 continued)

F and θ are related by

$$\ln(F) = \ln(mg) - k\theta$$

where m is the mass of the block and k is a constant.

Data were taken for four positions of the force sensor. The graph shows the variation of $\ln(F)$ with θ , and the line of best fit.



(This question continues on the following page)



(Question 1 continued)

- (d) (i) State how the value of $\ln(mg)$ can be obtained from the graph. [1]

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- (ii) Determine the value of k . [3]

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- (e) Identify **two** control variables in this experiment. [2]

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will not be marked.



2. A group of students conducts an experiment to confirm the relationship between pressure P and volume V , for a constant mass M of air at a constant absolute temperature T . They use the equation $PV = \frac{M}{m_A} k_B T$ where m_A is the average mass of a molecule of the air.

(a) Outline why the equation suggests a directly proportional relationship between $\frac{1}{P}$ and V . [2]

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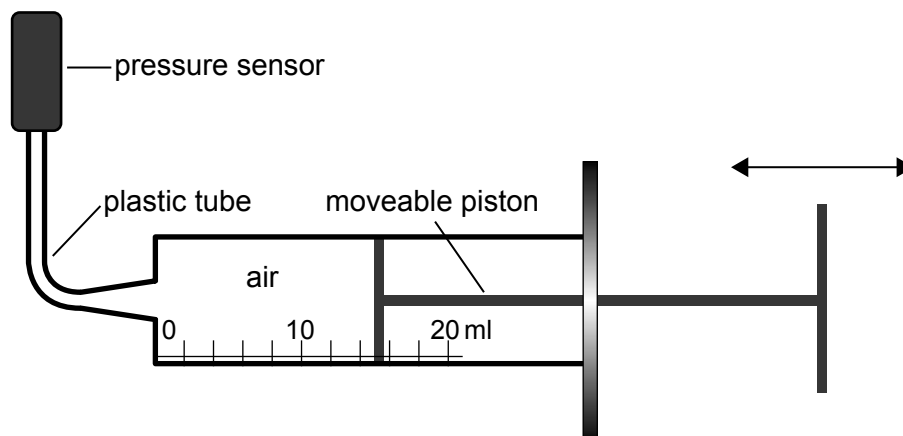
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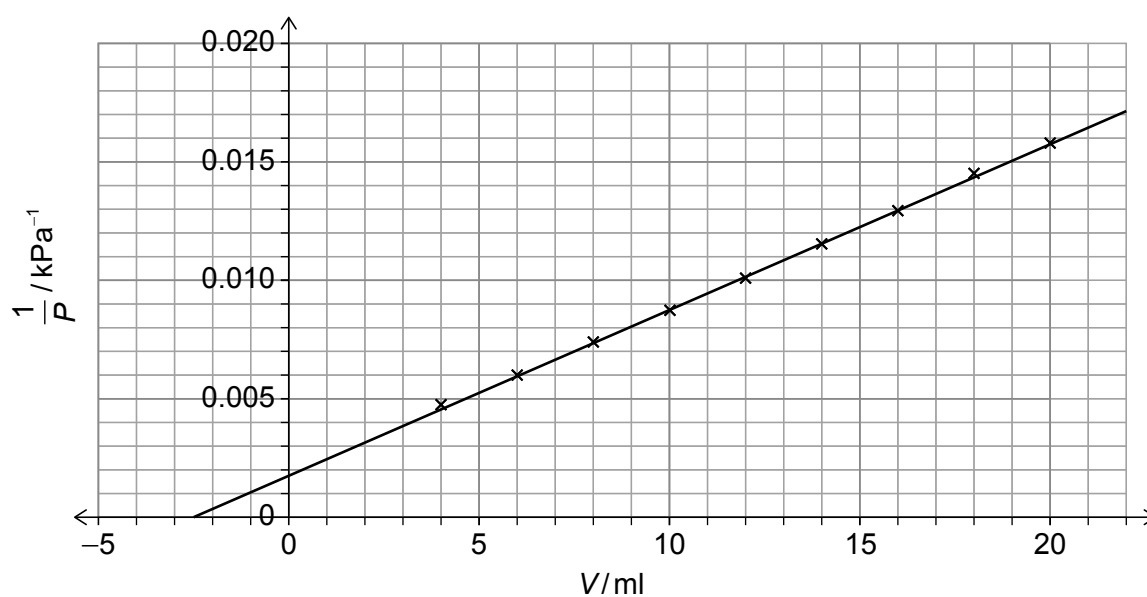
(Question 2 continued)

The students constructed an apparatus containing a plastic syringe and a pressure sensor, connected by a plastic tube.



The temperature inside the syringe is kept at room temperature. V is measured using the scale on the syringe.

The graph shows the variation with V of $\frac{1}{P}$ and the line of best fit.



(This question continues on the following page)



(Question 2 continued)

- (b) The unit of the slope of the graph can be written as $\text{kg}^X \times \text{m}^Y \times \text{s}^2$

Determine the value of X and the value of Y .

[2]

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- (c) For $V = 20 \text{ ml}$, show that the pressure measured is about 60 kPa .

[1]

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The graph shows a systematic error.

- (d) Identify

- (i) the feature of the graph that shows a systematic error.

[1]

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- (ii) the source of the error in part (i).

[1]

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