

Name

Index Number

Anglo-Chinese School
(Independent)



END-OF-YEAR EXAMINATION 2024
YEAR 5 IB DIPLOMA PROGRAMME

PHYSICS (HIGHER LEVEL)

PAPER 1B

Monday

23 September 2024

2 hours

INSTRUCTIONS TO STUDENTS

Write your index number in the box above.

Do not open this booklet until you are told to do so.

Answer all the questions.

Answers must be written within the answer boxes provided.

The maximum mark for paper 1B is [20 marks].

The maximum mark for paper 1A and paper 1B is [60 marks]

The combined time for both Paper 1A and Paper 1B is 2 hours.

INFORMATION FOR STUDENTS

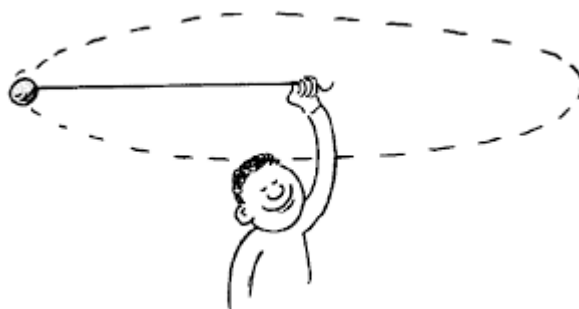
Data booklet will be provided.

Calculators are allowed for this paper.

This paper consists of 6 printed pages (including cover page).



1. In an experiment to determine the period T of oscillation of a mass m revolving in a uniform circular motion, a student held one end of the string and swirled the mass above head as shown.



- (a) The student recorded the time taken for 20 oscillations with a digital stopwatch, as $20T = 11.50 \pm 0.05$ s.

- (i) Explain why it is a good experimental technique to determine the period T of oscillation from the time taken for 20 oscillations rather than from one oscillation.

[2]

- (ii) State the reason why it is unlikely that the uncertainty in the time taken is as precise as ± 0.05 s. Hence, give a better estimate of the uncertainty of the stopwatch.

[2]

- (iii) **Based on the data provided**, determine the square of the period (T^2) and its uncertainty ΔT^2 . [3]

- (iv) The student pulls the string with a constant force F of 0.85 ± 0.05 N. The mass m of the object is $200 \text{ g} \pm 0.5\%$. Given that $F = \frac{4\pi^2 L m}{T^2}$. Show that the uncertainty in the length L of the string is about 7%. [2]

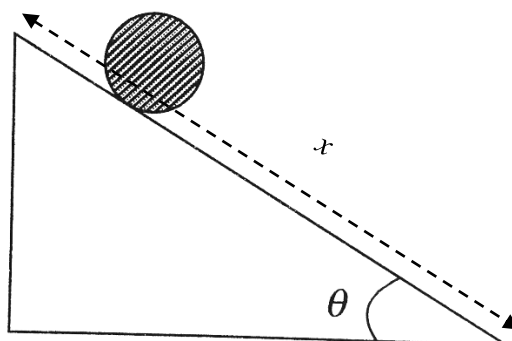
- (b) (i) Another student wants to test the equation in (iv) by varying the mass m and then determine the new period T . State the axes the student could plot to get a linear graph. [1]

- (ii) A data set the student has obtained for the investigation in (b)(i) is shown below. There are 6 repeats of the same measurement of mass m .

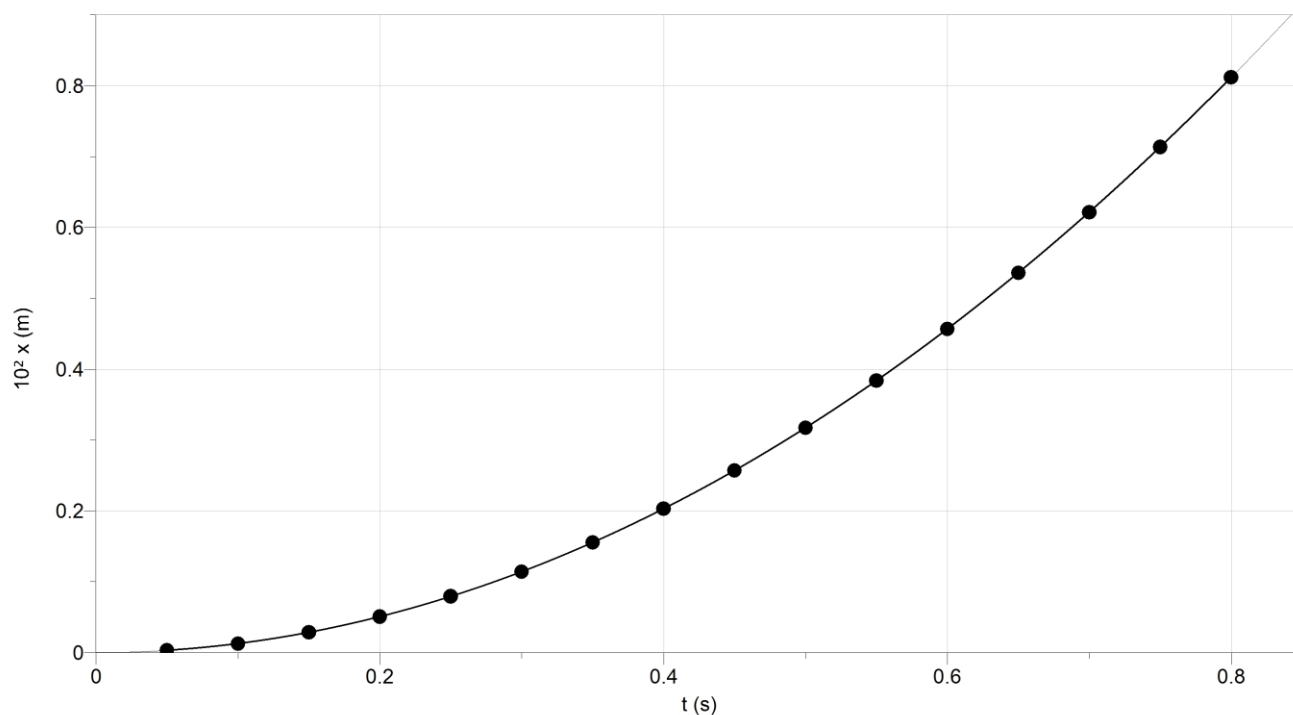
$m \text{ (g)}$	210	195	200	198	205	201
$T \text{ (s)}$	2.55	2.45	2.89	2.70	2.65	2.55

Calculate the mean value of m and its associated uncertainty Δm . [2]

2. A student plans an investigation to determine the acceleration due to gravity g . The student measures the time taken t in seconds, of a ball to roll down an incline plane where $\theta = 15^\circ$. He also varies the slope displacement x in centimetres. The graph shows the data analysed using Logger Pro. The equation of motion in this investigation is given by $x = \frac{1}{2} at^2$, where a is the acceleration of the ball on the incline plane. You may assume that the slope is frictionless.



- (a) (i) Write down an expression for g in terms of a and $\sin \theta$. [1]



(ii) By choosing a **suitable** pair of data of x and t , determine a value for g . [3]

(iii) State **one** possible source of random error in this investigation and explain how this error can be reduced. [2]

- (b) Another student modified the set-up by decreasing the angle of slope θ .
Explain **one** advantage of using an incline plane with a smaller θ .

[2]
