

Instructions to Supervisors for the Practical Examination (Units 5-9)
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CONFIDENTIAL

OPEN ON RECEIPT

The examination will be held on Thursday 23 May 2002 9.00am to 10.45am

- These *Instructions* are provided to enable centres to make appropriate arrangements for the examination. Copies of the *Instructions* are to be kept at the centre under lock and key when not in use; they are not to be removed from the centre. The question paper packets must not be opened prior to the examination.
- These instructions explain how to set up the equipment for Question 2.
- Question 2 is printed on pages 5 to 6 of this instruction booklet.
- Centres are at liberty to make any reasonable modifications to the apparatus which may be required for the successful working of the experiment but a note of all such modifications must be forwarded to the Examiner with the scripts. However, any such modifications must permit the experiment to be carried out in the specified manner.

Candidates are to measure the time period of a simple pendulum with an interrupted swing.

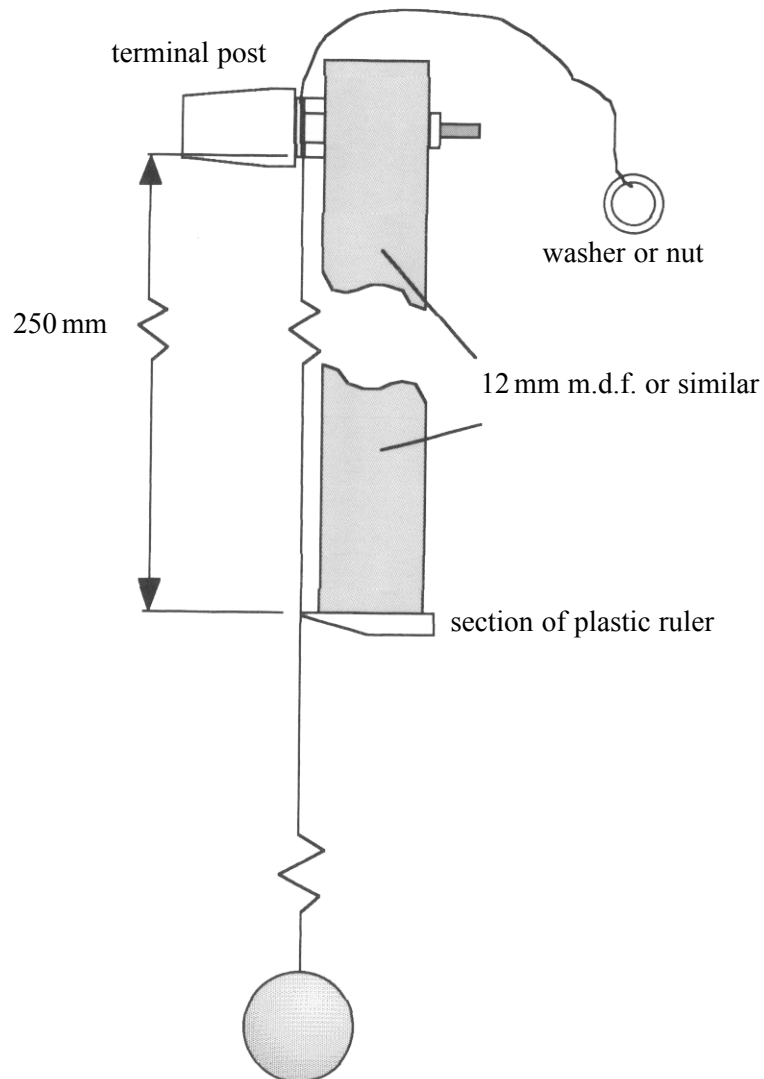
Apparatus required for each candidate:

- pendulum bob fastened to about 1 metre of strong thread
- retort stand fitted with boss and clamp
- metre ruler
- stopwatch capable of reading to 0.1 s or better
- suitable fiducial mark to assist candidates to measure the period of the pendulum
- materials to construct assembly to support the interrupted pendulum:
strip of thin sheet material, e.g. 12 mm m.d.f., dimension 300 mm × 40 mm,
between 30 mm and 40 mm of a plastic ruler (cut along median line), one
4 mm terminal post (e.g. RS423-201, Maplin FD69A), small washer or nut

The apparatus is to consist of a simple pendulum of length 0.90 m suspended so that the thread overhangs the edge of the bench. The thread is to pass through a hole in the terminal post, so by unscrewing the terminal the thread is released and candidates can change the effective length of the pendulum. At a point 250 mm below the shoulder of the terminal, a section of plastic ruler is mounted horizontally to interrupt the pendulum at the mid-point of its swing. The motion of the pendulum in a plane perpendicular to the edge of the bench will therefore consist of half cycles of different duration.

The suggested arrangement for the apparatus is described below and illustrated in the diagram on page 3.

Drill a suitable hole through the median line of the m.d.f. to accommodate the threaded stem of the terminal post. Fit the terminal post in place then trim the m.d.f. so the distance between the shoulder of the terminal post and the end of the m.d.f. is 250 mm. Glue the section of ruler in place so that approximately 4 mm protrudes. Assemble the pendulum by passing the thread through the hole in the terminal post and tie on the bob. Fasten a small washer or nut to the (upper) free end of the thread to prevent the thread becoming detached from the terminal post when the terminal is unscrewed.



Clamp the m.d.f. so that the pendulum overhangs the edge of the bench. The terminal post should be about 100 mm above the top of the bench. Adjust the length of the pendulum so that the bob hangs freely about 100 mm above the floor and when the thread is at rest and hanging vertically it just touches the protruding edge of the ruler.

The metre ruler, stopwatch and fiducial mark should be placed on the bench alongside the apparatus.

Examiners require no information for this question.

Turn over ►

Question 2 is printed on pages 5 to 6.

Space is provided in the examination paper for the answer to each part-question. The spaces for candidates' answers have been omitted in this version. The graph paper grid for part (c) has been similarly omitted.

Apparatus

General equipment for the examination may be obtained from:

Philip Harris Education
Novara House
Excelsior Road
Ashby Park
Ashby-de-la-Zouch
LE65 1NG

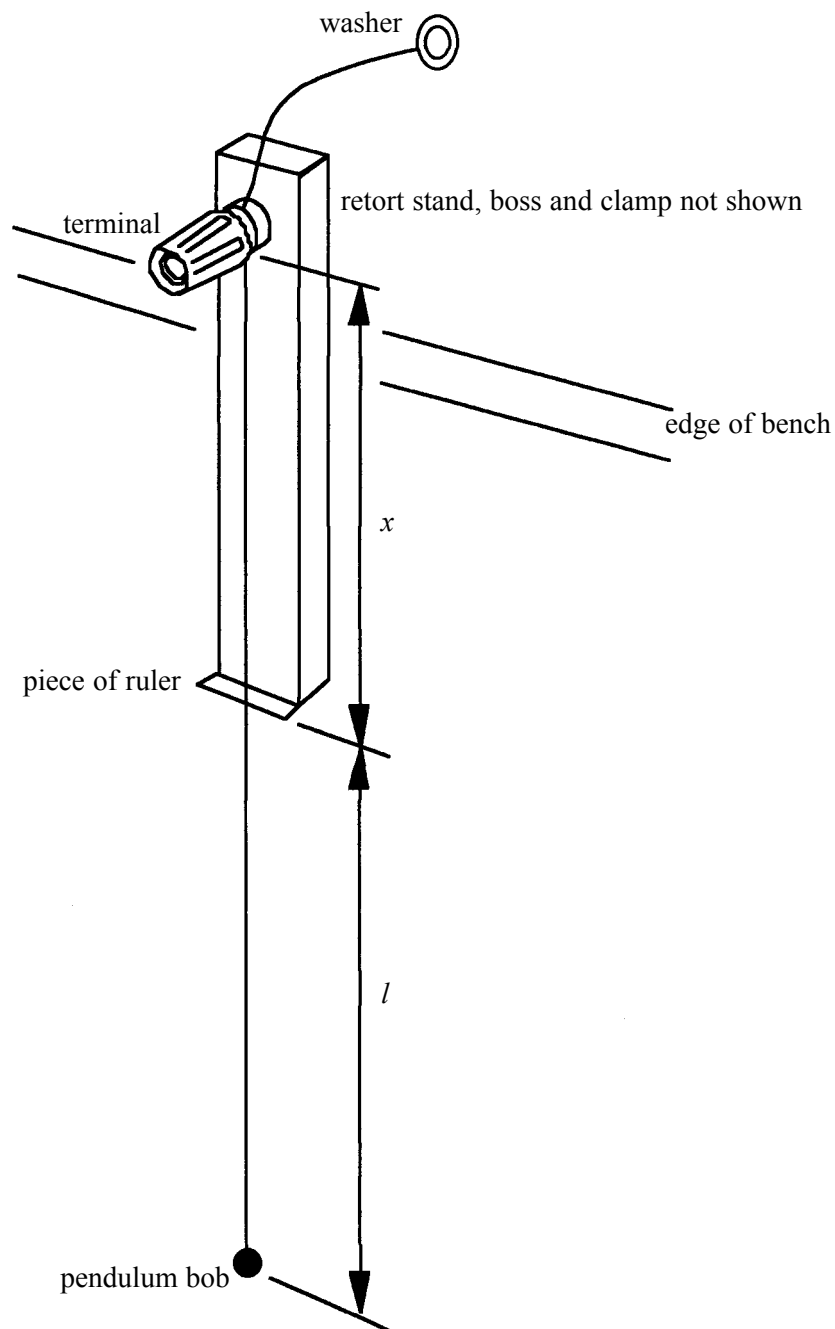
Griffin Education
Griffin & George
Bishop Meadow Road
Loughborough
Leicestershire
LE11 5RG

2 This question is divided into parts (a) to (e), printed on pages 9 to 12.

In this experiment you are required to measure the time period of a pendulum with an interrupted swing.

No description of the experiment is required.

You are provided with the apparatus shown in the diagram.



Turn over ►

- (a) Measure and record, x , the length of thread between the terminal and the piece of ruler.
- (b) Holding the washer in one hand, unscrew the terminal and then adjust the length of the pendulum until l is about 0.55m. Secure the thread in this position by tightening the terminal. Ensure that all the thread supported by the terminal is vertical. Measure and record the length, l , of the vertical thread between the piece of ruler and the centre of the pendulum bob.

Displace the pendulum bob from its equilibrium position in a plane perpendicular to the edge of the bench. Release the bob from rest so that the pendulum oscillates with small amplitude and its swing is interrupted by the edge of the piece of ruler.

Measure and record the period, T , of these oscillations.

Repeat this procedure and find T for **four smaller** values of l .

Record all your observations below.

(5 marks)

- (c) Using the grid **on page 11** of this booklet, plot a graph of your results with $(\sqrt{l+x} - \sqrt{l})$ on the vertical axis and $\frac{1}{T}$ on the horizontal axis.

Tabulate below the data you intend to plot on your graph.

(8 marks)

- (d) (i) Measure and record the gradient, G , of your graph.

(ii) Evaluate $\frac{G}{x}$.

(3 marks)

- (e) (i) Make a labelled sketch to show your view of the apparatus when measuring T . Show the position of the fiducial mark in the sketch.

- (ii) A student misunderstands the ‘count-down’ technique and counts ‘one’ instead of ‘zero’ as the oscillations begin. The student thinks that 20 oscillations are being timed when in actual fact the time recorded is for only 19 oscillations.

Explain what effect this has on the graph that the student plots.

- (iii) Systematic errors can arise from zero errors in measuring instruments. In such cases the error can easily be detected once the results are transferred to a graph. The error committed by the student in part (ii) is a *percentage systematic error*. Explain why a *percentage systematic error* is harder to detect from a graph than a *zero systematic error*.

(6 marks)

END OF QUESTION

THERE ARE NO INSTRUCTIONS PRINTED ON THIS PAGE

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