

Surname						Other Names					
Centre Number						Candidate Number					
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General Certificate of Education  
 June 2002  
 Advanced Level Examination



**PHYSICS (SPECIFICATION A)  
 Practical (Units 5-9)**

**PHAP**

Thursday 23 May 2002      9.00am to 10.45am

**In addition to this paper you will require:**

- a calculator,
- a pencil and a ruler.

Time allowed: 1 hour 45 minutes

**Instructions**

- Use a blue or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **both** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 30.
- Mark allocations are shown in brackets.
- The paper carries 5% of the total marks for Physics Advanced.
- A *Data Sheet* is provided on pages 3 and 4. You may wish to detach this perforated sheet at the start of the examination.
- You are expected to use a calculator where appropriate.
- You are advised to spend no more than 30 minutes on Question 1.

For Examiner's Use			
Number	Mark	Nmber	Mark
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2			
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**Data Sheet**

- A perforated Data Sheet is provided as pages 3 and 4 of this question paper.
- This sheet may be useful for answering some of the questions in the examination.
- You may wish to detach this sheet before you begin work.

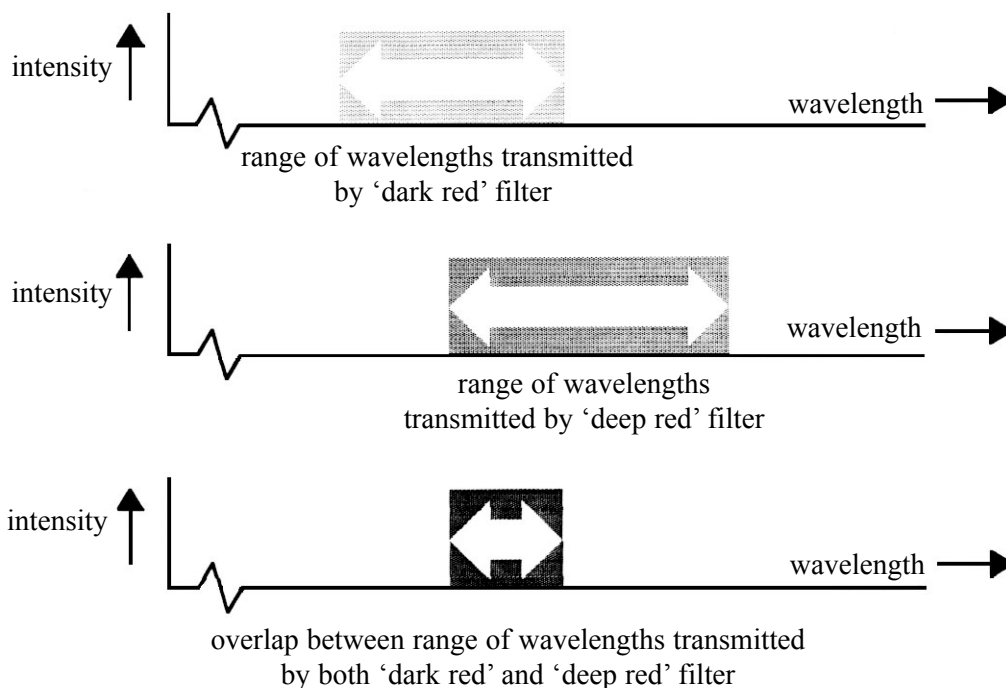
**The data sheet replaces this page**

**The data sheet replaces this page**

Answer **both** questions.

You are advised to spend no more than 30 minutes on Question 1.

- 1 A student finds a box of coloured filters and selects two at random. One is marked “dark red” and the other “deep red”. Knowing that each filter transmits a certain (continuous) range of light wavelengths, the student decides to investigate the characteristics of these two filters. Although a preliminary investigation does reveal that the filters have different characteristics, there appears to be some overlap between the range of wavelengths that each transmits, as the diagram illustrates.



Design an experiment that would enable the student to determine the **overlap** between the range of the light wavelengths that both filters are able to transmit.

You should assume that the normal laboratory apparatus used for measuring the wavelength of light is available to you.

You are advised to draw a suitable diagram of the arrangement you intend to use as part of your answer.

You should also include the following in your answer:

- The quantities you intend to measure and how you will measure them.
- How you propose to use your measurements to determine the **overlap** between the range of light wavelengths that the filters are able to transmit.
- The factors you will need to control and how you will do this.
- How you could overcome any difficulties in obtaining reliable results.

Write your answers to Question 1 on **pages 6 and 7** of this booklet.

(8 marks)



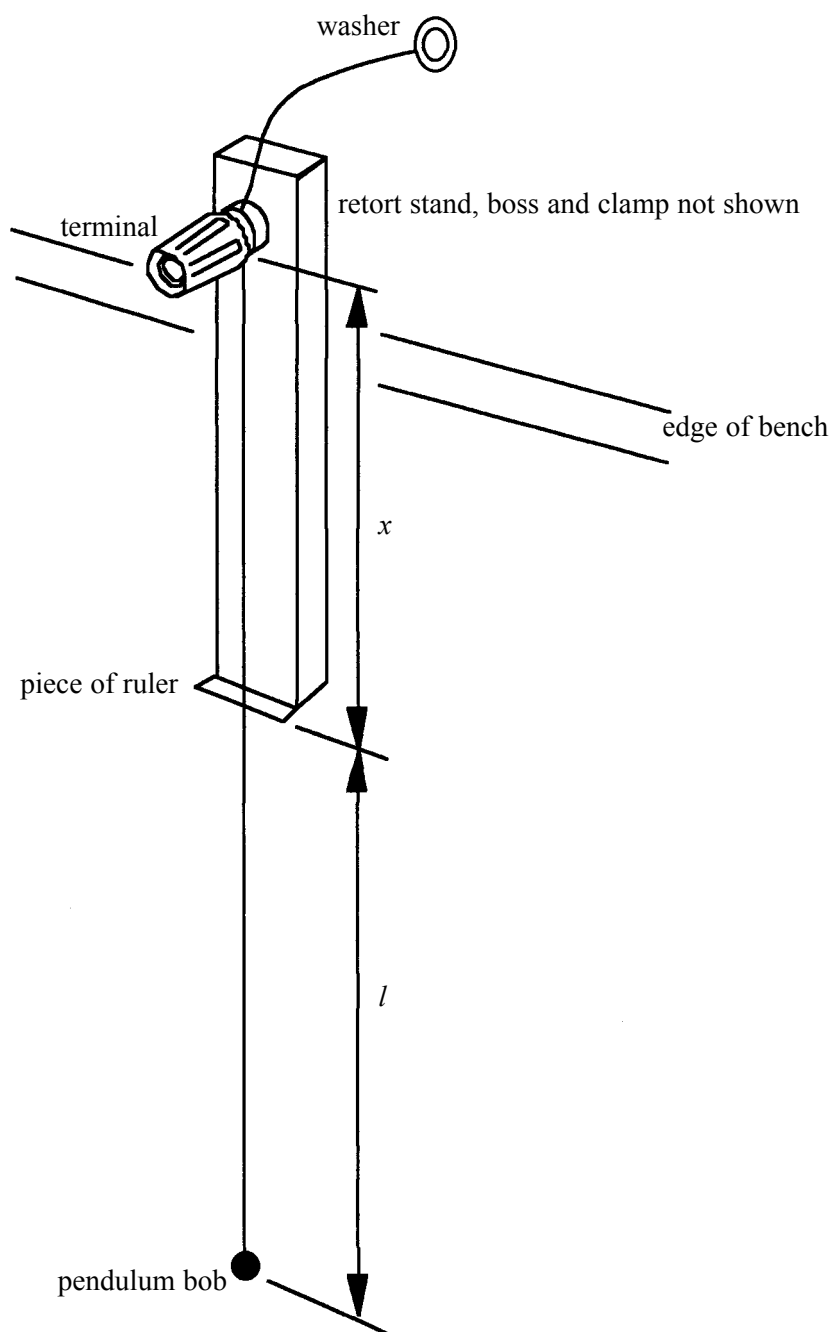


**2 This question is divided into parts (a) to (e), printed on pages 9 to 12.**

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.





- (a) Measure and record,  $x$ , the length of thread between the terminal and the piece of ruler.

$x =$  .....

- (b) Holding the washer in one hand, unscrew the terminal and then adjust the length of the pendulum until  $l$  is about 0.55 m. 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.

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(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.

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(8 marks)

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

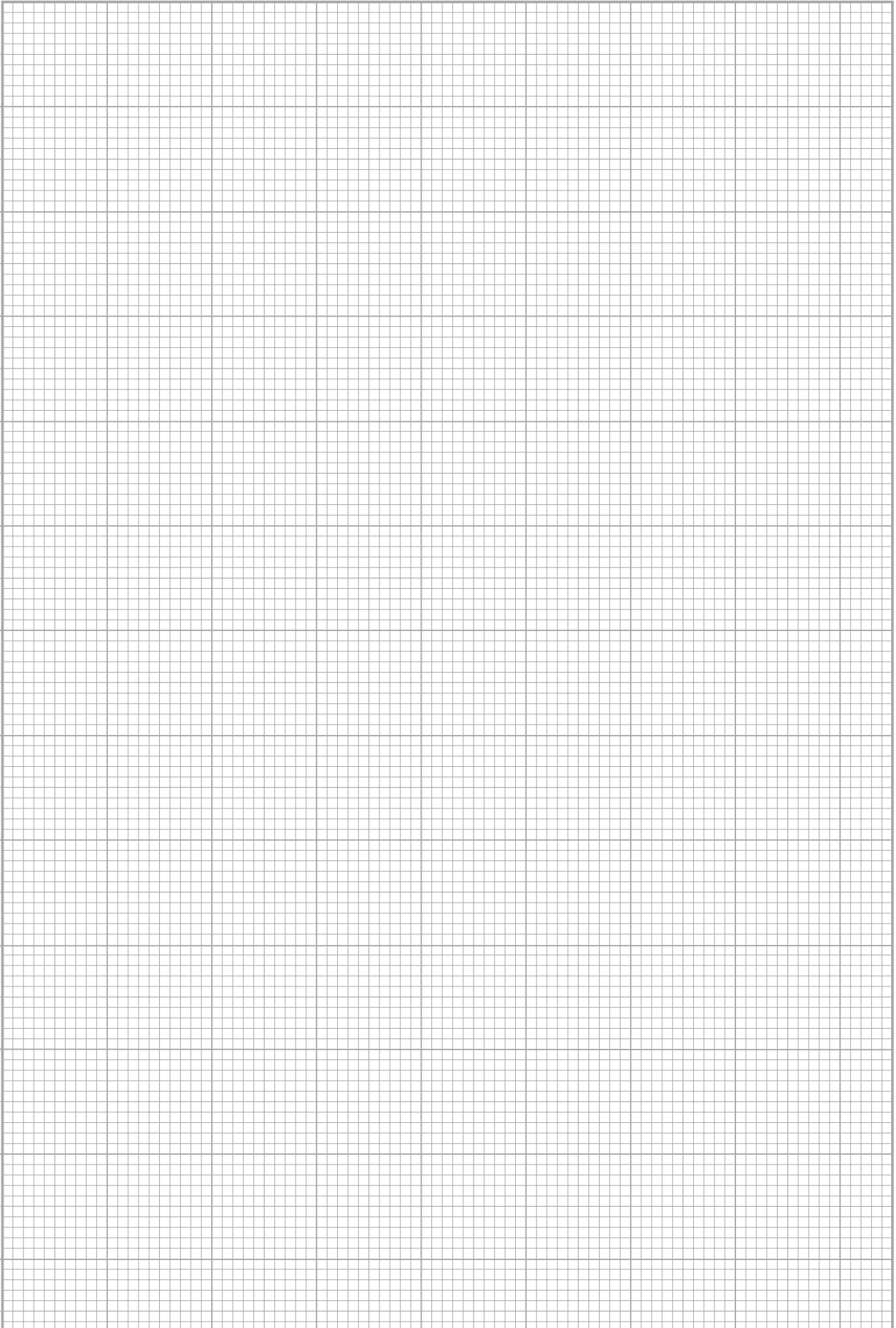
$$G = \dots\dots\dots$$

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

$$\frac{G}{x} = \dots\dots\dots$$

(3 marks)

**QUESTION 2 CONTINUES ON PAGE 12**



- (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.

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- (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*.

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(6 marks)