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General Certificate of Education
June 2001
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS (SPECIFICATION A) PHA3/P
Unit 3 Practical

Wednesday 23 May 2001 Afternoon Session

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.
- A *Data Sheet* is provided on pages 3 and 4. Detach this perforated sheet at the start of the examination.

Information
- The maximum mark for this paper is 30.
- Mark allocations are shown in brackets.
- The paper carries 15% of the total marks for Physics Advanced Subsidiary and carries 7½% of the total marks for Physics Advanced.
- You are expected to use a calculator where appropriate.
- In questions requiring description and explanation you will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary where appropriate. The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.
- 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			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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.
- Detach this sheet before you begin work.

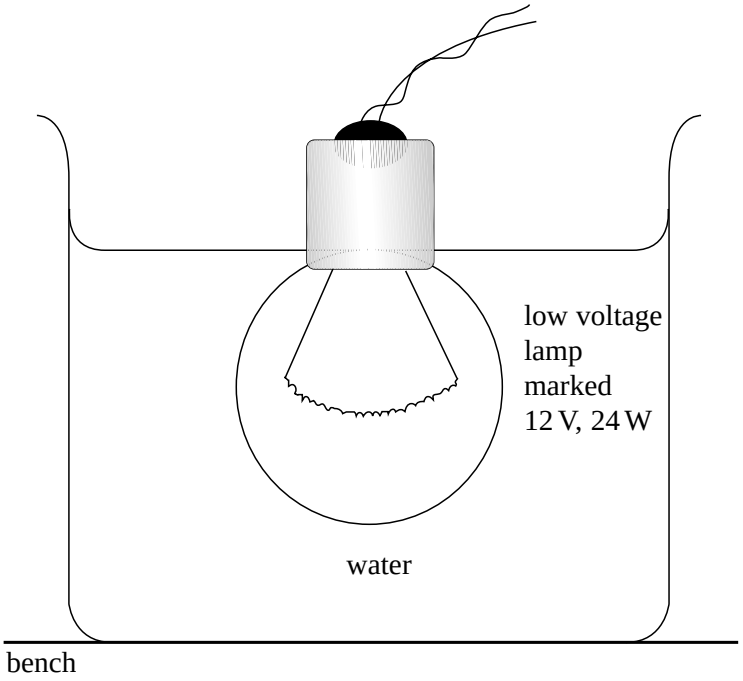
The data sheet replaces this page

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 reads that only a small proportion of the electrical energy supplied to a typical filament light bulb is transformed into light energy. He assumes that the electrical energy not usefully transformed is converted to heat energy.
He is told that, providing certain safety precautions are taken, a low voltage lamp marked 12 V, 24 W can be inverted with the bulb placed in a beaker containing water, as shown below.



Design an experiment that would enable the student to determine the proportion of electrical energy supplied to the lamp that is transformed into heat energy.
You should assume that the normal laboratory apparatus used for measuring electrical energy and heat energy would be available.
You are advised to draw a suitable circuit diagram 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 proportion of the electrical energy that is transformed into heat-energy.
- The factors you will need to control and how you will do this.
- How any difficulties in obtaining a reliable result could be overcome.

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

(8 marks)

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2 This question is divided into parts (a) to (e) printed on pages 8 to 14.

In this experiment you will investigate the bending of a plastic metre ruler under different horizontal loads.
No description of the experiment is required.

(a) (i) Hook the mass hanger on to the loop at the free end of the thread.
Support the mass hanger so that the thread goes slack and the free end of the metre ruler returns to its undeflected position, as shown in the end view of the apparatus, **Figure 1**.
Place block B against the ruler so that when the mass hanger is allowed to hang freely and the thread becomes taut, the free end of the ruler remains in the undeflected position. This arrangement is shown in end view in **Figure 2** and in plan view in **Figure 3**.

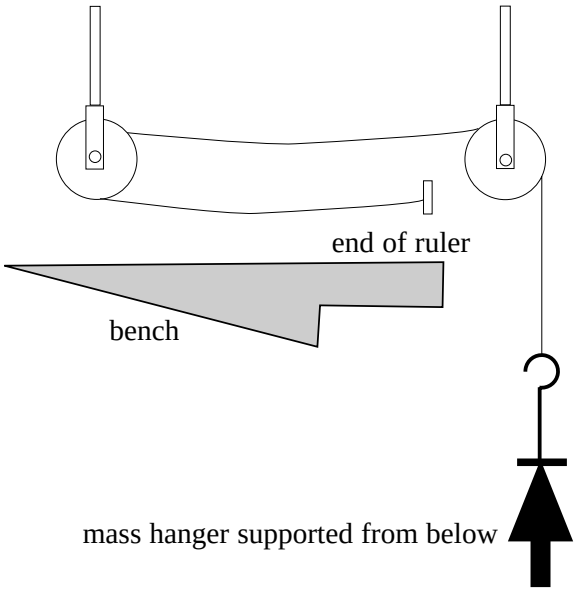

Figure 1 free end of ruler in undeflected position, string slack

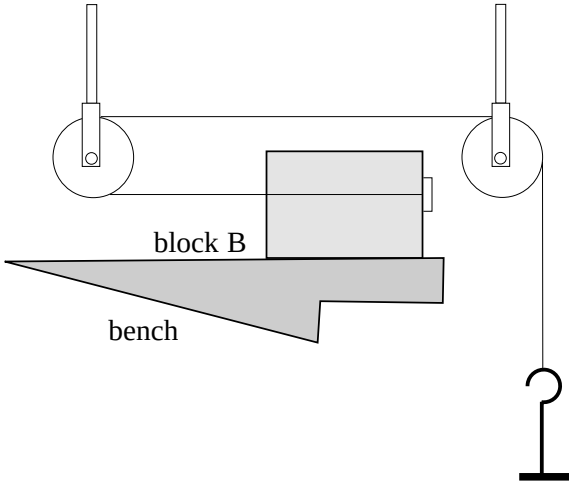

Figure 2 free end of ruler held in undeflected position by block B, mass hanger freely suspended

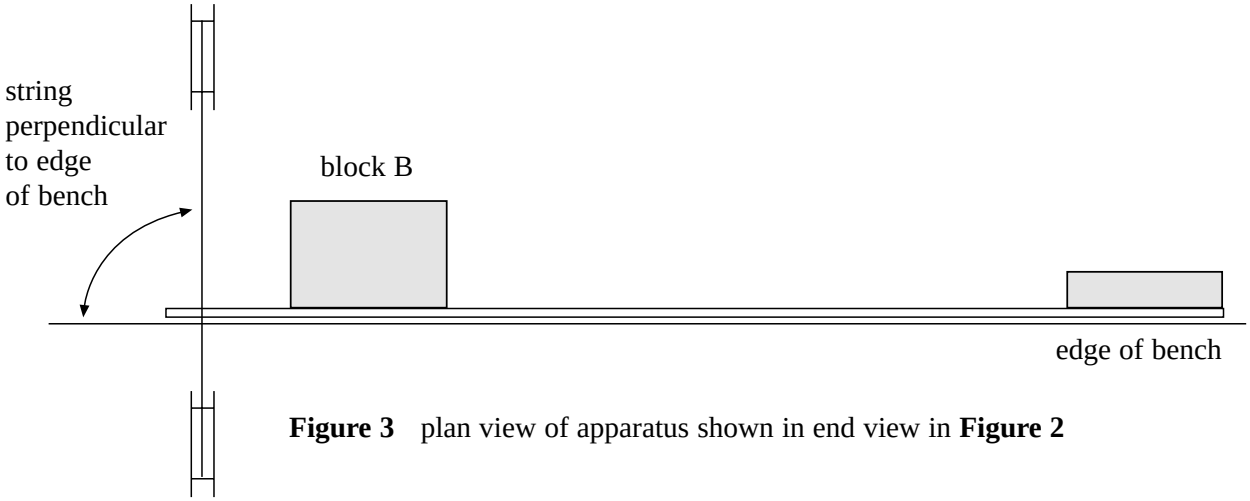

Figure 3 plan view of apparatus shown in end view in **Figure 2**

(ii) Measure and record the vertical height, h_0, between the mass hanger and the floor.

h_0 = ...

(iii) Remove block B so that the ruler bends as shown in the plan view in **Figure 4**.
Adjust the position of the stand so that the pulleys move **parallel to the edge of the bench** until all sections of the thread lie in the same vertical plane. Check that the section of thread joined to the ruler is **perpendicular** to the edge of the bench.
Do not adjust the clamping of the ruler or of the pulleys.

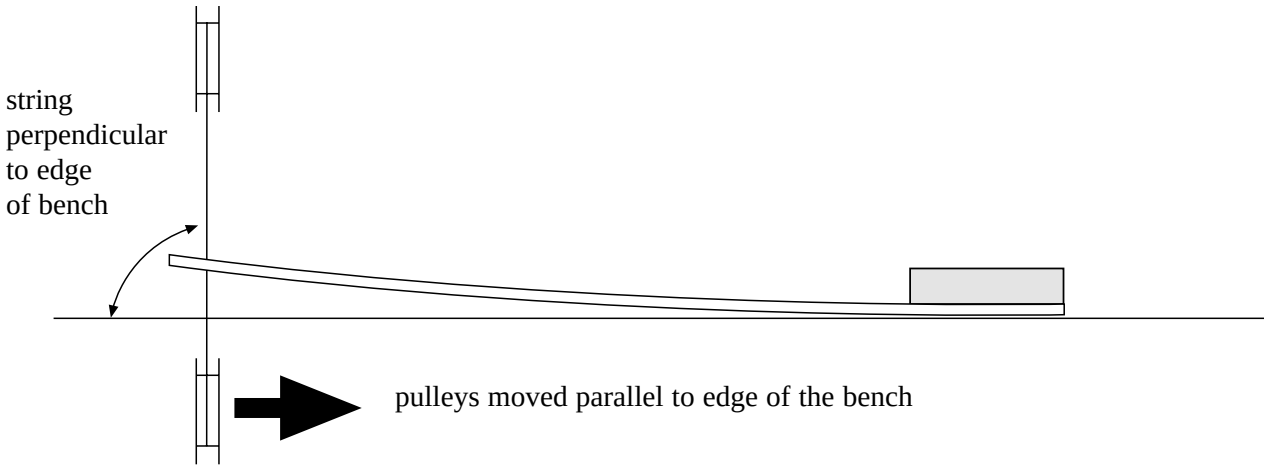

Figure 4

QUESTION 2 CONTINUES ON THE NEXT PAGE

(b) (i) Measure and record the new vertical height, *h*, between the mass hanger and the floor.

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Record the total mass, *M*, supported by the thread.
Note: the mass of the mass hanger is provided for your use.

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(ii) You are provided with additional masses which can be slotted on to the hanger.
Using the same procedure as before, investigate how the vertical distance, *h*, varies as the total mass, *M*, supported by the thread is changed.
Ensure that any movement of the stand you make is **parallel to the edge of the bench**.
Before each new measurement of *h* is made, check that all sections of the thread lie in the **same vertical plane** and the section of thread joined to the ruler is **perpendicular** to the edge of the bench.

Record your measurements and observations in the space below.

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(7 marks)

QUESTION 2 CONTINUES ON THE NEXT PAGE

(c) It is suggested that the horizontal deflection of the end of the ruler is directly proportional to the total mass, *M*, supported by the thread.
Plot a suitable graph using the grid on **page 13** of this booklet to confirm whether this suggestion is true or not.

Use the space below to organise the data that you intend to plot in the form of a table.

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(7 marks)

(d) (i) Explain whether you think your results show that the deflection of the end of the ruler is directly proportional to *M*.

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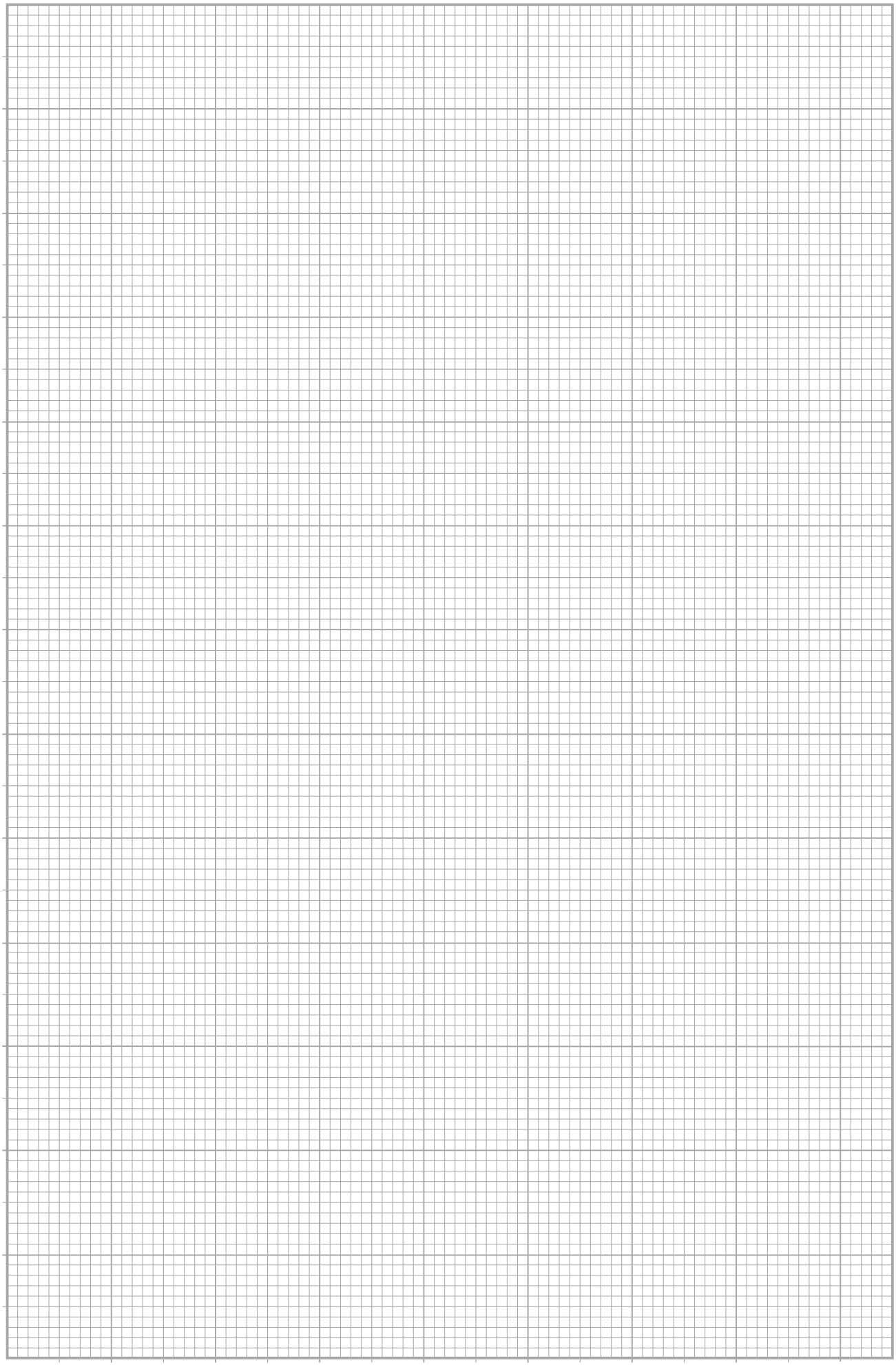
(ii) Use your graph to read and record the deflection, *p*, of the end of the ruler when the total mass supported by the thread is 100 g.

p = ...

(2 marks)

QUESTION 2 CONTINUES ON PAGE 14



(e) (i) Explain, with the aid of a diagram, how you ensured that your measurements of h were accurate.

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(ii) Suppose that, as M is increased, the pulleys exert a constant frictional force on the thread. State and explain what effect, if any, this would have on your value of p.

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(iii) Suggest how you could check if the ruler had become permanently bent as a result of the experiment.

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(6 marks)

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END OF QUESTIONS

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