OCR
RECOGNISING ACHIEVEMENT

ADVANCED GCE **2826/03/TEST**

PHYSICS A

Practical Examination 2 (Part B – Practical Test)

THURSDAY 31 JANUARY 2008 Afternoon

Time: 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials: Candidate's Plan (Part A of the Practical Examination)
Electronic Calculator

CUP/T34913

Candidate Forename | | Candidate Surname | |

Centre Number | | Candidate Number | |

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- In the Practical Test you will be assessed on the Experimental and Investigative Skills:
  Skill I Implementing
  Skill A Analysing evidence and drawing conclusions
  Skill E Evaluating evidence and procedures.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- The total number of marks for this paper is **60**.

For Examiner's Use		
Qu.	**Max.**	**Mark**
Planning	**16**	
1	**28**	
2	**16**	
Total	**60**	

This document consists of **12** printed pages.

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Answer **all** the questions.

It is recommended that you spend about one hour on question 1.

1 In this experiment you will be investigating the oscillations of a compound pendulum. A compound pendulum is a solid body which swings about an axis.

In this case the compound pendulum is a metre rule loaded with a 100 g mass taped to one end. It has small holes drilled in it every 2 cm, through which a thin rod can be passed as an axis of rotation.

(a) **(i)** Suspend the loaded metre rule horizontally from a clamp stand, using the loop of string provided. Adjust the position of the string until the rule is balanced. The string will then be at **G**, the centre of gravity of the metre rule and attached mass. Record the length **OG**, where **O** is the **end** of the rule as shown in Fig. 1.1.

OG = ... cm [1]

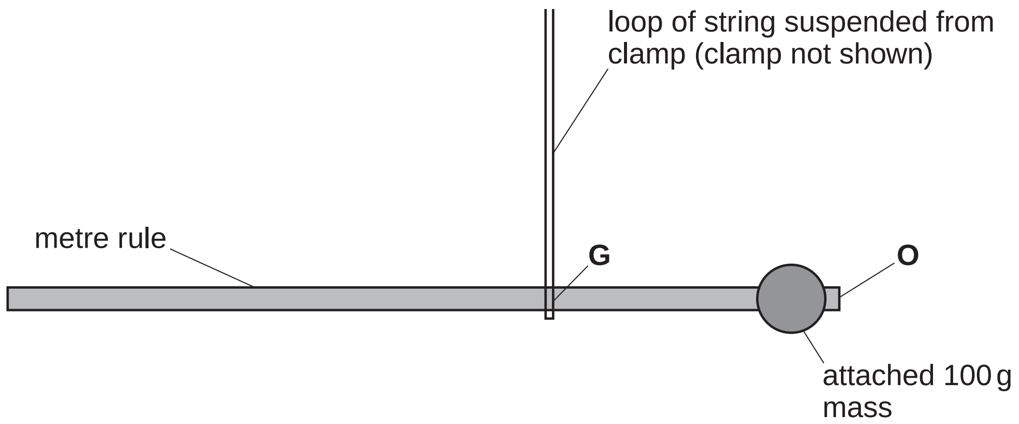

Fig. 1.1 (not to scale)

(ii) Safety spectacles must be worn for sections (a)(ii) and (b).

Select a position for the pivot **X** towards the other end of the rule so that *h* (distance **XG**) is about 50 cm (see Fig. 1.2). Insert the thin rod through the nearest suitable hole in the rule, and support the rod in the clamp so that the rule can oscillate as a pendulum. The rod is mounted so that one end can be gripped in the clamp.

Record the length **OX** on the rule.

OX = ... cm

Hence calculate *h*.

h = ... cm [1]

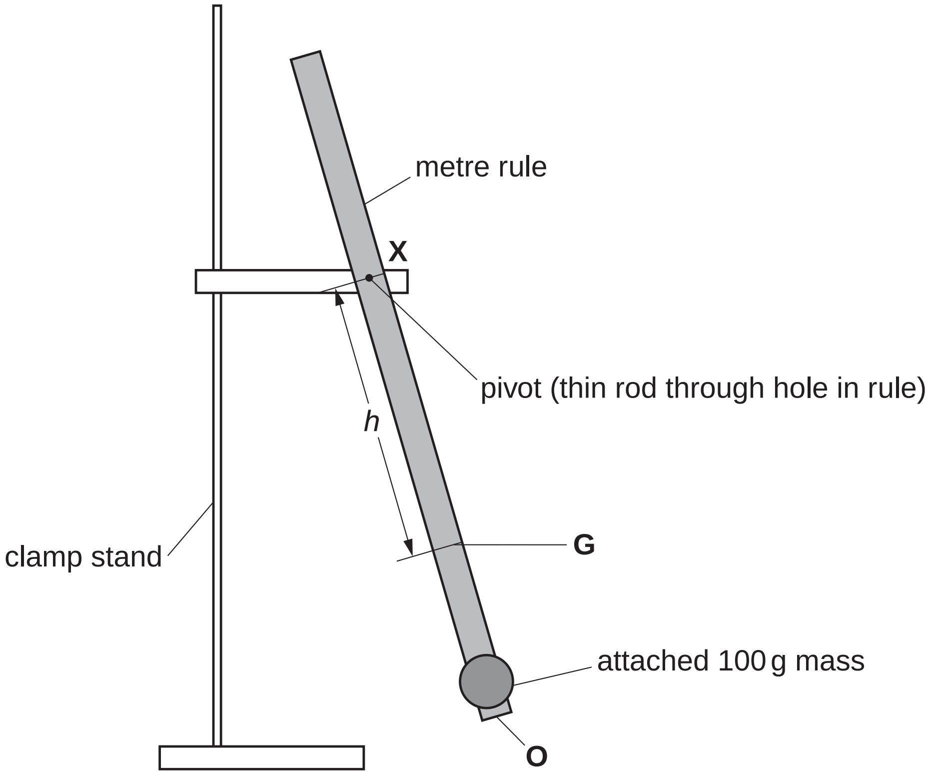

Fig. 1.2 (not to scale)

(b) (i) Displace the mass a few centimetres from its rest position and release it so that it performs <u>small</u> oscillations. Make and record measurements to determine the period *T* of these oscillations.

period *T* = ... s [1]

(ii) Repeat **(a)(ii)** and **(b)(i)** for different values of *h*, so that you have 6 sets of values for *T* and *h* in your table, which will include a minimum value for *T*. Values of *h* should be in the range $15 \leqslant h \leqslant 50$ cm.

[9]

(c) (i) Plot a graph of *T* /s (y-axis) against *h* /cm (x-axis). Care should be taken that the scale on the y-axis starts close to your minimum value for *T*.

(ii) Draw a smooth curve through the points.

(iii) Determine the gradient when *h* = 25 cm. You need not be concerned with the units of this quantity.

gradient = ... [7]

(d) The period T of a compound pendulum is given by

$$T = 2\pi\sqrt{\frac{k^2+h^2}{hg}}$$

where k is a constant and g is the gravitational field strength.
When $h = k$, the period T has its minimum value T_{min}, given by

$$T_{min} = 2\pi\sqrt{\frac{2h}{g}}.$$

Using your graph, write down the value of T_{min}, and the corresponding value of h.

T_{min} = ... s

h = ... cm

Using these results, and the formula given above, calculate a value for g.
State the unit for g.

g = …………….. unit .... [5]

(e) The formula given in **(d)** for the period T may be rearranged to give

$$T^2h = \frac{4\pi^2 h^2}{g} + \frac{4\pi^2 k^2}{g}.$$

Which quantities should be plotted to give a straight-line graph? How may g be obtained from the gradient?

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....[2]

(f) Which of the two methods for obtaining a value for g given in **(d)** and **(e)** would give the most reliable result? Give your reasoning.

....

....

....[2]

[Total: 28]

It is recommended that you spend about 30 minutes on question 2.

Approximately half of this time should be spent on the evaluation exercise in part (g).

2 In this question you will investigate the formation of an image of a bright object using a converging lens. The object is the filament of a light bulb, distance u from the centre of the lens. The image of the filament is formed on a screen. When focussed, it is distance v from the centre of the lens, as in Fig. 2.1.

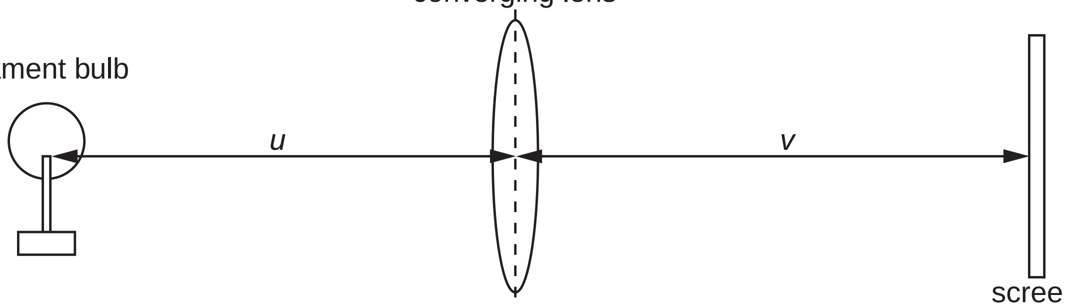

Fig. 2.1

(a) Set up the apparatus as shown in Fig. 2.1, with the lens about 12 cm from the bulb. Connect the bulb to the power supply. Move the screen until a focussed image is formed. You may adjust the height of the lens with the flat wooden blocks provided.

(b) Measure and record the object and image distances u_1 and v_1 from the centre of the lens.

object distance u_1 = ... cm

image distance v_1 = ... cm [1]

(c) Estimate the percentage uncertainty in your value of v_1. Show your working.

percentage uncertainty = ...% [2]

(d) Increase the object distance by about 3 cm. Adjust the position of the screen to obtain a new focussed image. Measure the new object and image distances u_2 and v_2.

object distance u_2 = ... cm

image distance v_2 = ... cm [1]

(e) Theory suggests that $uv \propto (u + v)$. Do the results of your experiment support this suggestion? Justify your answer.

[2]

(f) You are provided with a stop, which is a sheet of card with a hole cut in the centre. This card is designed to stop light which passes near the edges of the lens from reaching the screen. Place the card so that the hole is over the centre of the lens as in Fig. 2.2. Refocus the image and observe it closely with and without the stop. You may note your observations for later use.

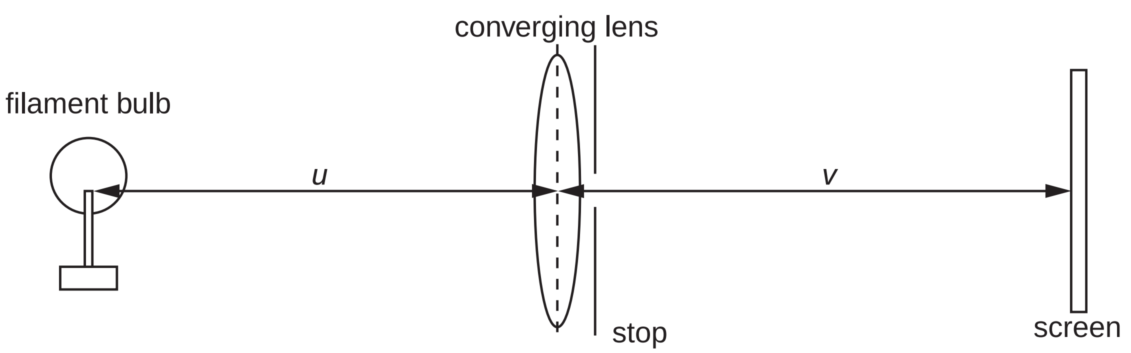

Fig. 2.2

(g) In this question, two marks are available for the quality of written communication.

Write an evaluation of the procedure you have followed. You should include

- some of the limitations of the procedure
- ways in which the experiment may be improved, giving reasons for your ideas
- comments on the advantages and disadvantages of using a stop, based on your observations in **(f).**

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Quality of Written Communication [2]

[Total: 16]

END OF QUESTION PAPER

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