Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
January 2002
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

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

Friday 1 February 2002 Morning 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.

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 expeeted 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
1			
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.
- You may wish to detach this sheet before you begin work.

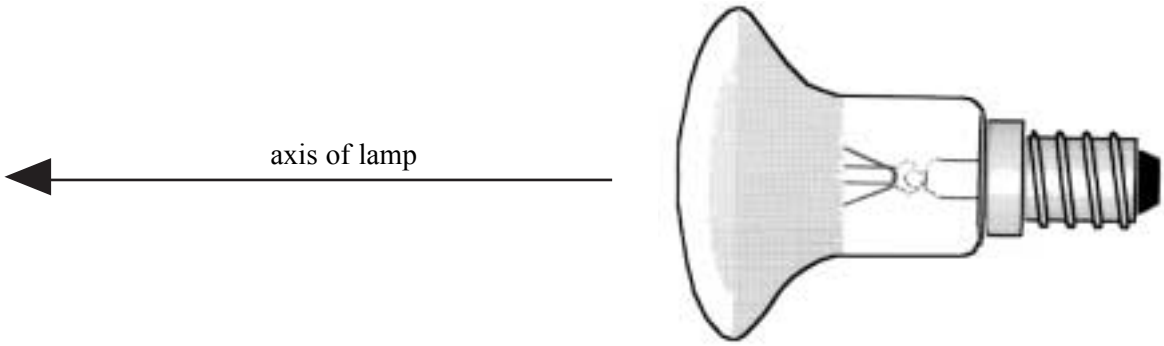
The data sheet replaces this page

The data sheet replaces this page

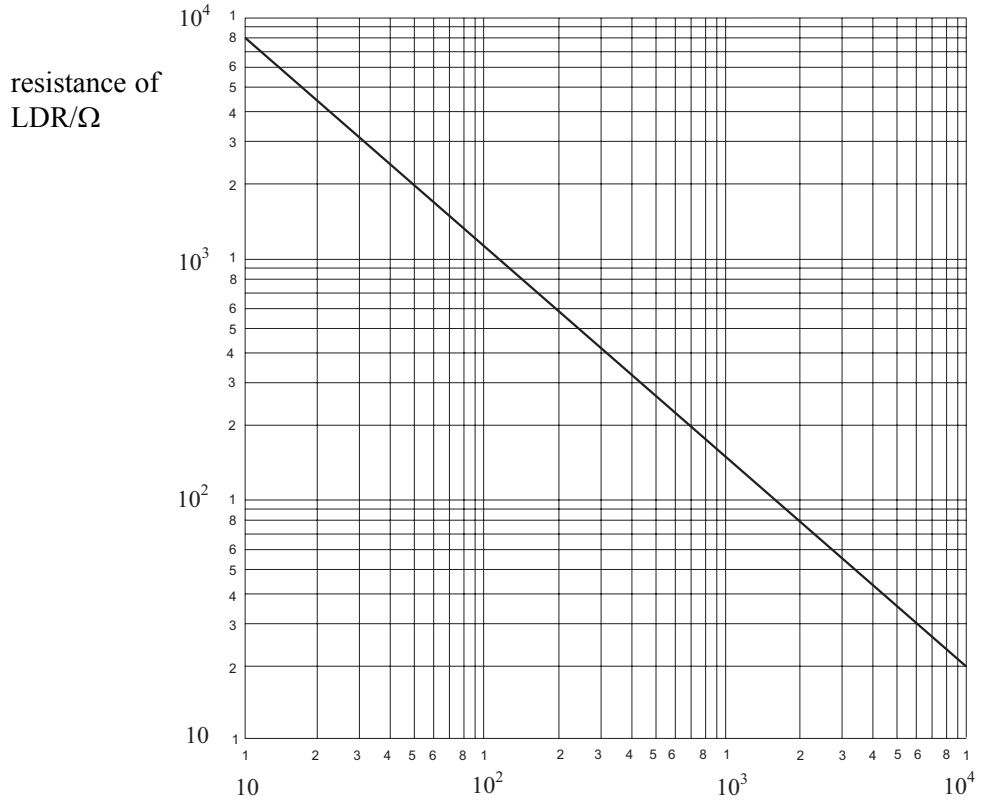
Answer **both** questions.

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

1 Two students discuss how the intensity of the illumination provided by a spotlight varies with the distance along the axis of the lamp.



Student A argues that the lamp should be regarded as a point source so the intensity of illumination should vary as the inverse-square of the distance along the axis from the lamp.
Student B disagrees, pointing out that the lamp incorporates a reflector that produces a narrow concentrated beam. Therefore, he reasons, the intensity must decrease exponentially with the distance along the axis from the lamp. Researching the problem, the students discover the calibration graph, shown below, that shows how the resistance of a light dependent resistor (LDR) varies with the intensity of the illumination falling on it.



Turn over ▶

Design an experiment that the students could perform to test their theories.

You should assume that a well-equipped physics laboratory 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 settle the argument between the students.
- 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 in the space provided on **pages 6 and 7** of this booklet.

(8 marks)

LEAVE MARGIN BLANK

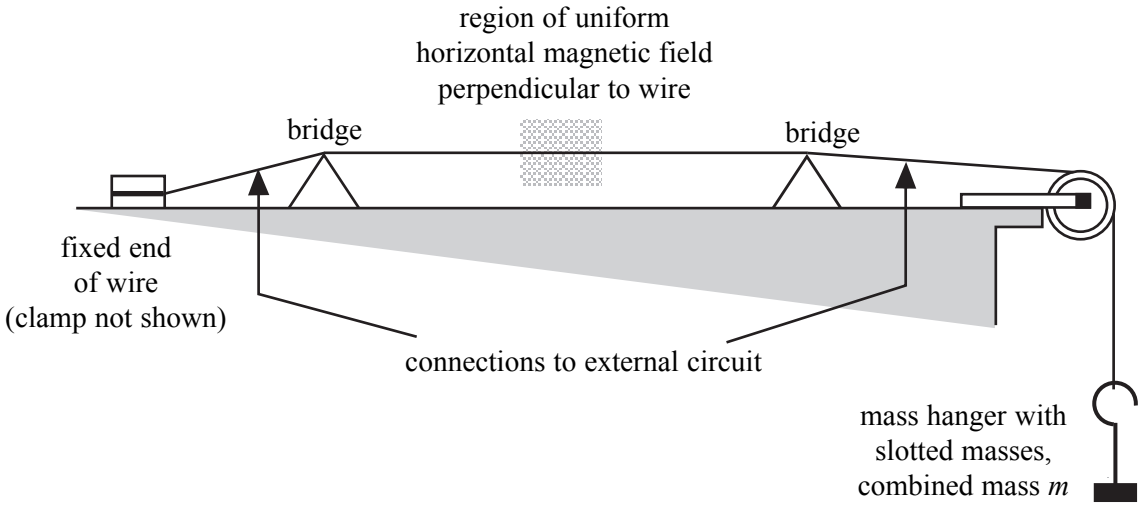
8

TURN OVER FOR THE NEXT QUESTION

2 This question is divided into parts (a) to (e) printed on pages 8 to 12.

In this experiment you are required to investigate transverse stationary waves on a wire undergoing forced vibration at the fundamental frequency.
No description of the experiment is required.

You are provided with the arrangement shown below.



(a) (i) Use the micrometer screw gauge to determine the diameter, *d*, of the wire.

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(ii) Wire is manufactured in certain diameters that are identified by SWG (standard wire gauge) numbers. With reference to the table below, identify the SWG number of the wire you are provided with.

diameter/mm	0.711	0.559	0.457	0.376	0.315	0.274	0.234	0.193
SWG number	22	24	26	28	30	32	34	36

SWG number = ...

QUESTION 2 CONTINUES ON THE NEXT PAGE

(b) Place sufficient slotted masses on the hanger so the total mass, m, supported by the wire is equal to 100 g.
Adjust the separation of the bridges so that the length of the wire, l, between them is approximately 0.20 m then turn on the ac power supply.
With the horizontal magnetic field at the centre of the vibrating section of the wire, **increase** l until the wire is seen to vibrate at the fundamental frequency.
Record below your measurements of m and l then repeat the procedure for **five larger** values of m.
When you have completed your measurements, **turn off** the ac power supply.

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(7 marks)

(c) Plot a graph with l on the vertical axis and $\sqrt{m}$ on the horizontal axis.
Tabulate your data for $\sqrt{m}$ in the space above.

(6 marks)

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

$G =$ .....

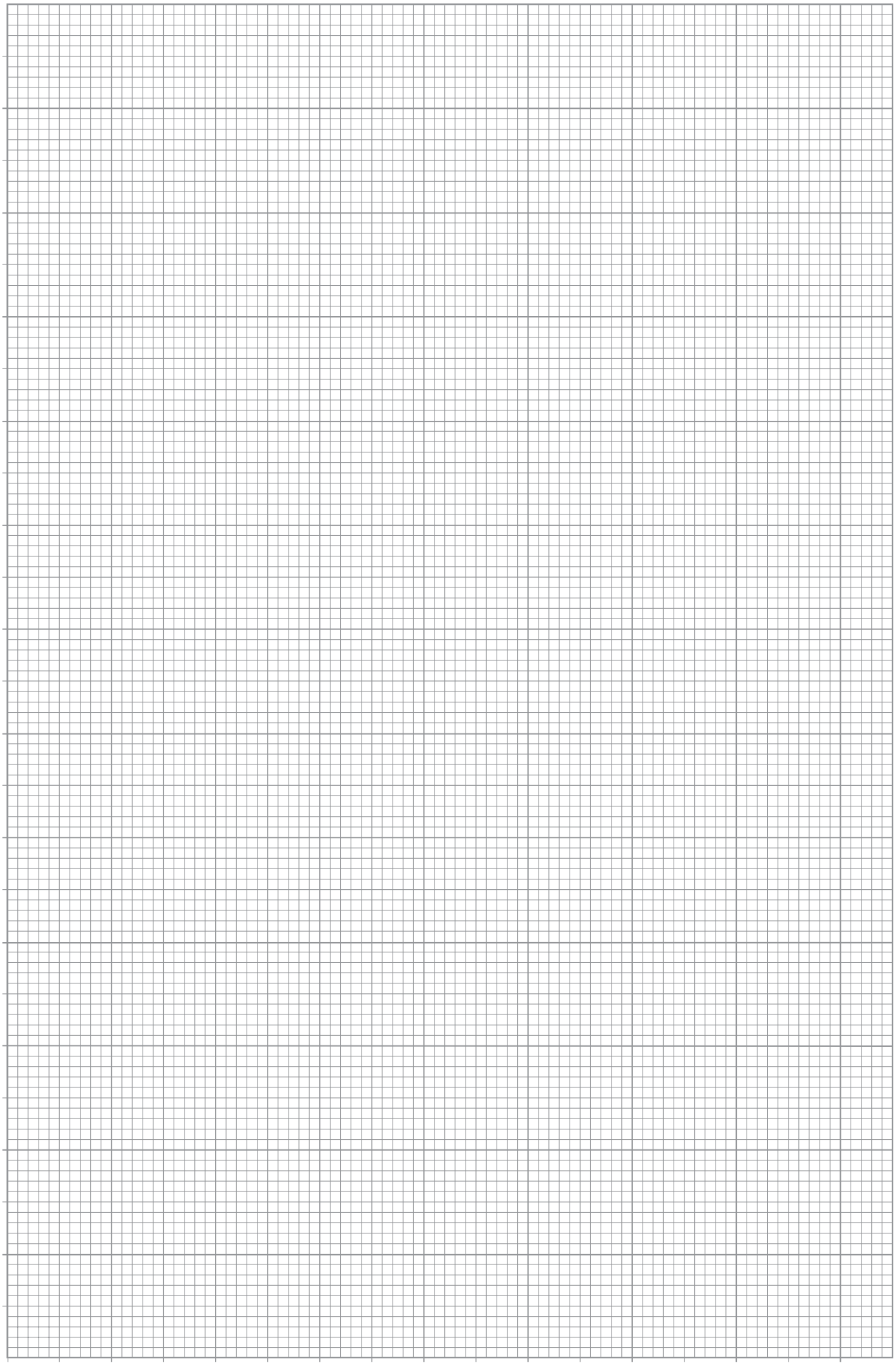
(ii) Calculate the mass per unit length of the wire, μ, given by

$$\mu = \frac{g}{(2fG)^2}$$, where $g = 9.81\ \text{m s}^{-2}$ and $f = 50\ \text{Hz}$.

$\mu =$ .....

(3 marks)

QUESTION 2 CONTINUES ON PAGE 12



Turn over ▶

(e) (i) Describe any precautions you took to ensure that your result for d was accurate.

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(ii) State and explain the effect, if any, on your graph, if the experiment were repeated with a wire made of the same material but with a higher SWG number.

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(iii) Use your data to deduce l if a stationary wave with **two** loops (i.e. the second harmonic) is to be produced when $m = 100\,\text{g}$.

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(6 marks)

22

END OF QUESTIONS