OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

PHYSICS A 2823/03/TEST

Practical Examination 1 (Part B – Practical Test)

Thursday **15 JANUARY 2004** Afternoon 1 hour 30 minutes

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

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read the questions carefully.

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
- 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.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
Planning	**16**	
1	**28**	
2	**16**	
TOTAL	**60**	

This question paper consists of 11 printed pages and 1 blank page.

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For Examiner's Use

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

1 In this question, you will investigate how the horizontal displacement of a ball that has rolled off the edge of a bench is related to the vertical displacement of the ball.

A ramp has been positioned on the bench so that the distance **AB** is 40 cm. A plumb-line is attached at **B**. The arrangement is shown in Fig. 1.1.

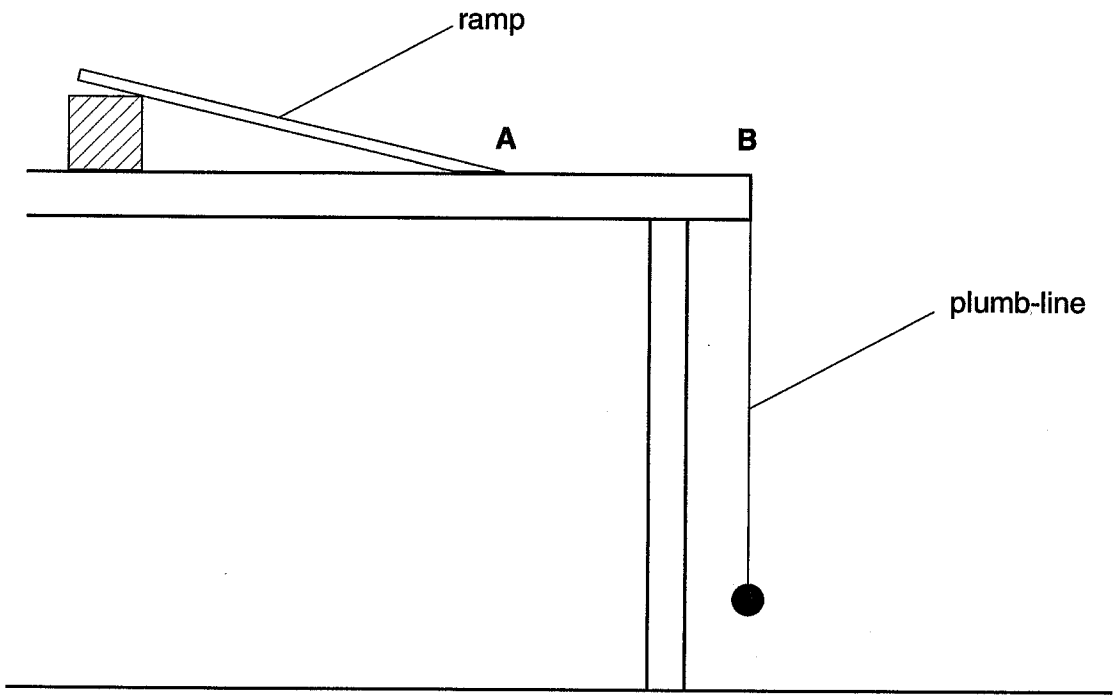

Fig. 1.1

(a) (i) Place the ball at the top of the ramp and release it so that it rolls down the ramp and across the bench from **A** to **B**. Measure and record the time t taken for the ball to move from **A** to **B**, and hence determine the average speed v of the ball in the region **AB**.

t = ... s

v = ... m s^{-1}

(ii) State **one** difficulty in obtaining an accurate measurement of the time t.

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(iii) For the purposes of this experiment, you may assume that v is constant. In practice, v changes as the ball rolls across the bench.
State **one** reason for this.

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(b) (i) A wooden board has been mounted so that it is approximately horizontal.
Attach a sheet of white paper to this board using Sellotape.

(ii) Place a sheet of carbon paper on top of the white paper. The carbon surface should be facing down.

(c) (i) Place the ball at the top of the ramp. Release the ball and allow it to roll down the ramp, across the bench and onto the board below as shown in Fig. 1.2. A tray has been provided to catch the ball after it rolls off the board.

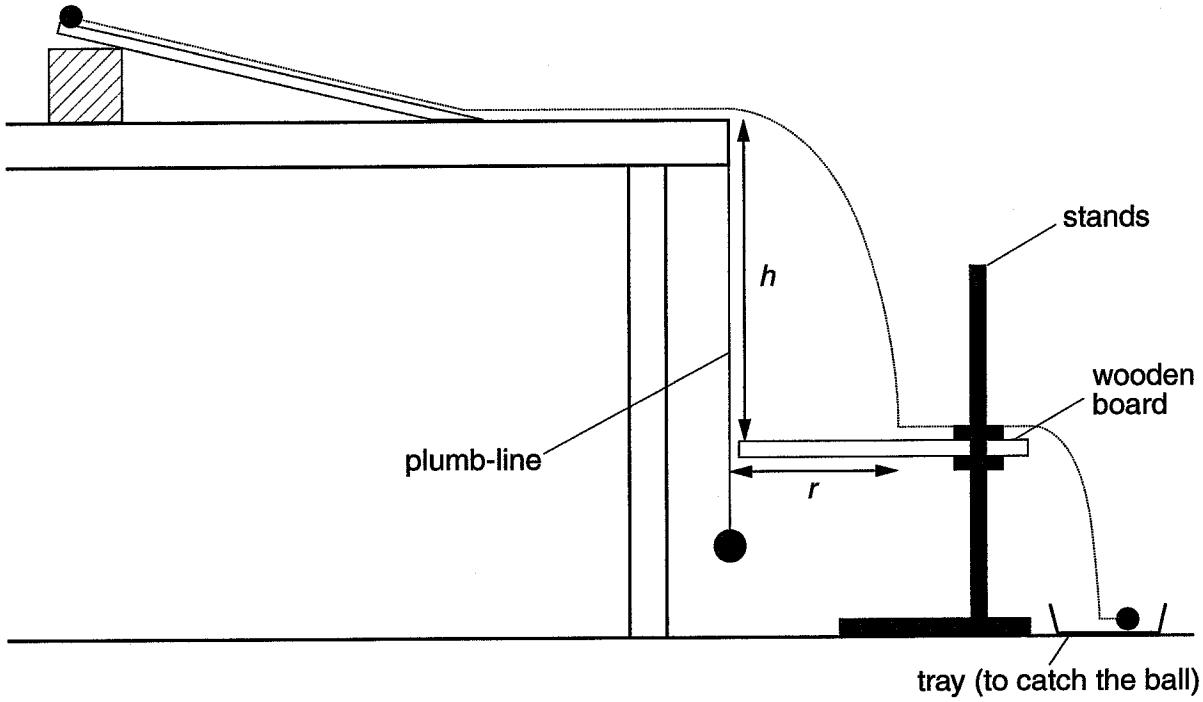

Fig. 1.2

(ii) Remove the carbon paper and observe that the ball has made a small ink dot on the white paper.

For Examiner's Use

(d) Measure and record the vertical displacement h of the board below the top surface of the bench and the horizontal displacement r of the ink dot from the plumb-line. Change the value of h by adjusting the height of the board and repeat **(c)** until you have six sets of readings for r and h. Values of h should not be less than 20 cm.
Include values of r^2 in your table of results.

(e) Justify the number of significant figures that you have given for r^2.

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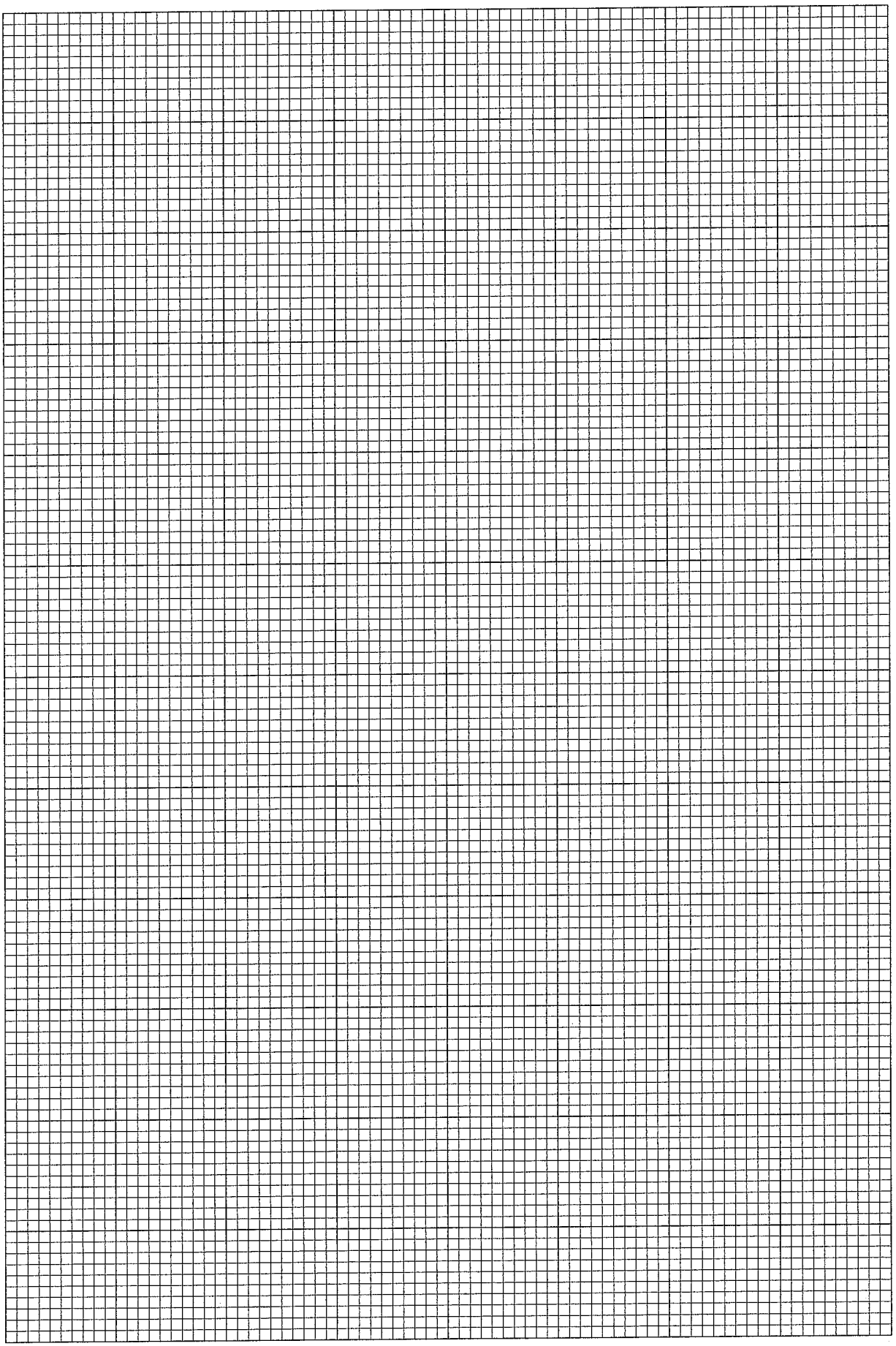
(f) Plot a graph of r^2 (y-axis) against h (x-axis) and draw the best straight line through the points.

(g) Determine the gradient of this line.

gradient = ...

For Examiner's Use



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For Examiner's Use

(h) Theory shows that the relation between r and h is

$$r^2 = \frac{2v^2h}{g}$$

where $g = 9.8\ \text{m s}^{-2}$, and v is the speed of the ball as it leaves the top surface of the bench.

Use your answer from **(g)** to determine a second value for v.

$v =$ ..... m s^{-1}

(i) Discuss briefly **two** of the limitations of your experiment in determining this second value of v.

1 .....

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2 .....

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

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

2 A photovoltaic cell is a device for converting light energy into electrical energy. In this question, you will investigate how the output voltage of a cell depends on the distance of the cell from a light source.

(a) (i) Connect the photovoltaic cell to a voltmeter.

(ii) Place the cell below the bulb as shown in Fig. 2.1 and measure the distance *d* between the filament and the surface of the cell.

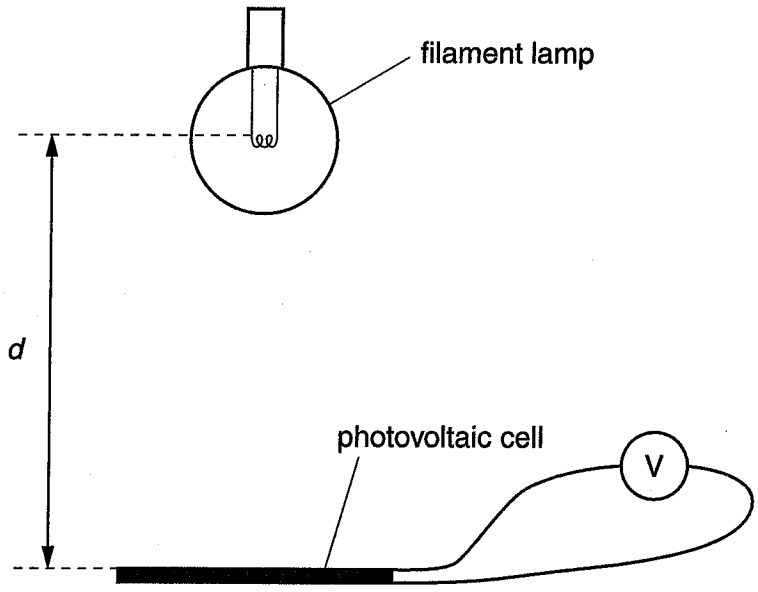

Fig. 2.1

(iii) Record this value of *d*.

d = ... cm

(iv) Determine the percentage uncertainty in this value of *d*.

% uncertainty in *d* = ...

For Examiner's Use

(b) Connect the filament lamp to the power supply. Turn on the power supply to the lamp and measure and record the value of the voltage V from the photocell.

$V =$ V

(c) Change the value of d so that it is twice as large as before. Measure and record the new values of d and V.

$V =$ V

$d =$ ..... cm

(d) For this cell, it is suggested that V is inversely proportional to d^2. Suggest whether the results of your experiment would support this suggestion. You should explain your reasoning clearly.

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Question 2 continued over the page

For Examiner's Use

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

Write an evaluation of the procedure that you have followed to investigate the relation between V and d. You should include some of the limitations of the procedure and suggest ways in which the experiment may be improved, giving reasons for your suggestions.

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Quality of Written Communication

END OF QUESTION PAPER