UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

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PHYSICS **9702/31**

Paper 31 Advanced Practical Skills 1 **May/June 2008**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.
You will be allowed to work with the apparatus for a maximum of one hour for each question.
You are expected to record all your observations as soon as these observations are made, and to plan the presentation of the records so that it is not necessary to make a fair copy of them. The working of the answers is to be handed in.
Additional answer paper and graph paper should be submitted only if it becomes necessary to do so.
You are reminded of the need for good English and clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
All questions in this paper carry equal marks.

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1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

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1 In this experiment you will investigate how the angles of the strings in a pulley system are affected by the mass suspended from the mid-point of the string. From these results you will determine the mass.

(a) Set up the apparatus as shown in Fig. 1.1. Clamp the pulleys so that they are 50 cm above the bench and 30 cm from each other. Take the ends of the string and feed them through each pulley. Hang a 0.200 kg mass from each end of the string. Suspend the object holder from the middle loop in the string.

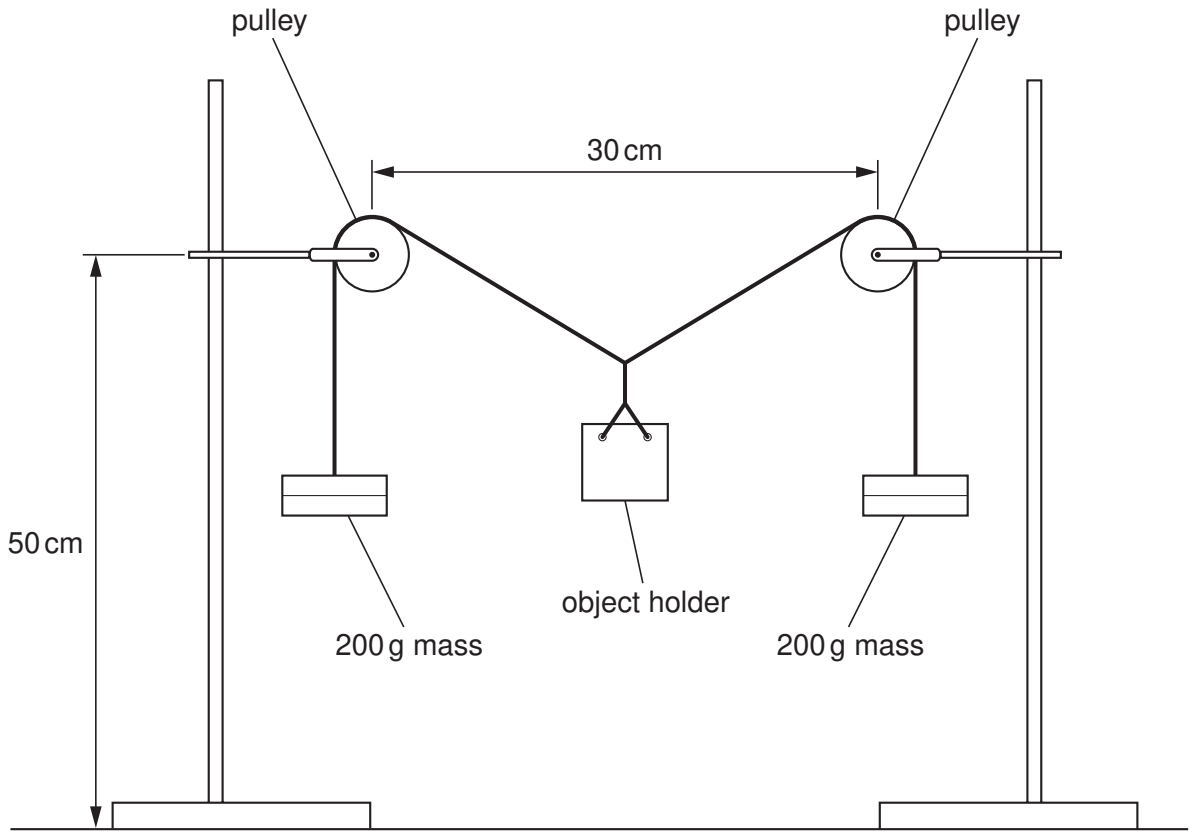

Fig. 1.1

(b) Place one of the eleven identical objects in the object holder and measure the angle θ between the strings as shown in Fig. 1.2.

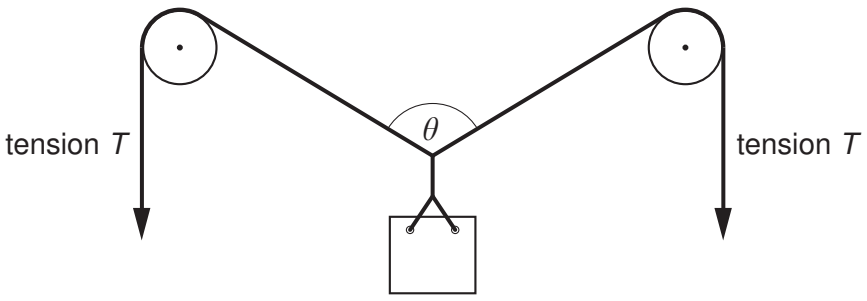

Fig. 1.2

θ = ...

(c) Repeat **(b)**, changing the number of objects placed in the object holder. Repeat this procedure until you have six sets of readings for the number n of objects and angle θ. Include in your table of results values for $\frac{\theta}{2}$ and $\cos\left(\frac{\theta}{2}\right)$.

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(d) Plot a graph of $\cos\left(\frac{\theta}{2}\right)$ on the y-axis against the number n of objects on the x-axis and draw the line of best fit.

(e) Determine the gradient and y-intercept of this line.

gradient = ...

y-intercept = ...

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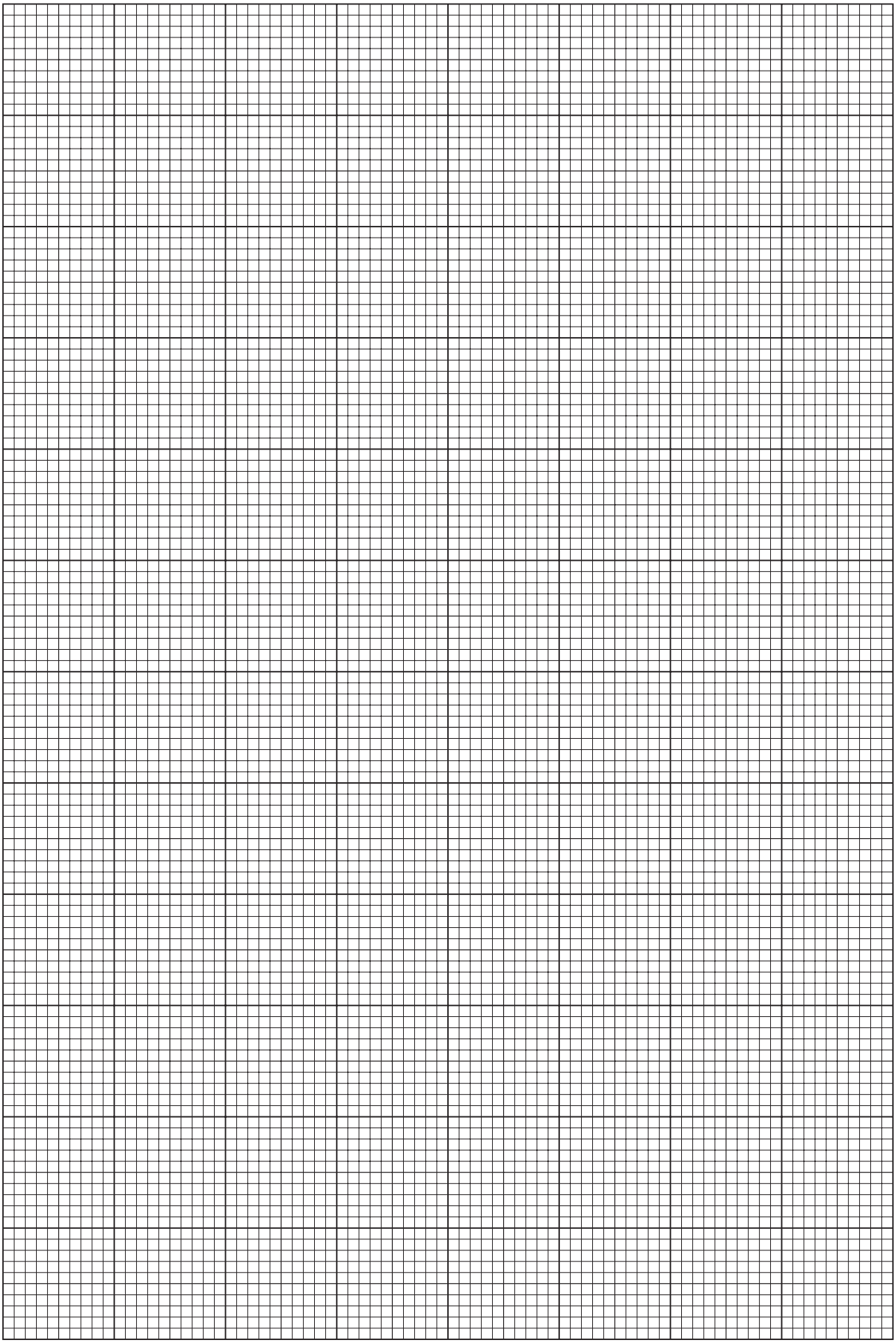

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(f) Determine the value of the tension T in one of the strings shown in Fig. 1.2.

The value of g is $9.81\,\text{N kg}^{-1}$.

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T = ... N

(g) It is suggested that the relationship between $\cos\left(\frac{\theta}{2}\right)$ and n is

$$\cos\left(\frac{\theta}{2}\right) = \frac{mgn}{2T} + k$$

where m is the mass of one object and k is a constant.

Use your answers from **(e)** and **(f)** to determine a value for m.

m = ...

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2 In this question you will investigate how the light detected by a light-dependent resistor (LDR) depends on the thickness of an absorber.

(a) (i) Connect the circuit shown in Fig. 2.1. The light-emitting diode (LED) should be connected the right way round so that light is emitted.

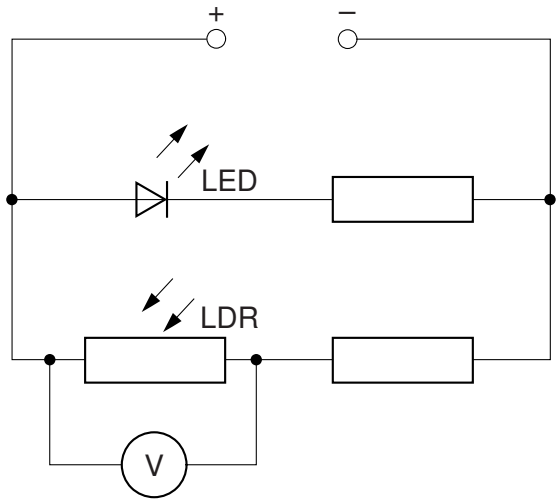

Fig. 2.1

(ii) Use the black paper and the Sellotape to make a cylinder of length 4 cm. The cylinder should fit neatly over the LDR.

(iii) Cut the cylinder in half so that you have two cylinders of length 2 cm.

(iv) Tape one cylinder over the LDR and the other cylinder over the LED as shown in Fig. 2.2.

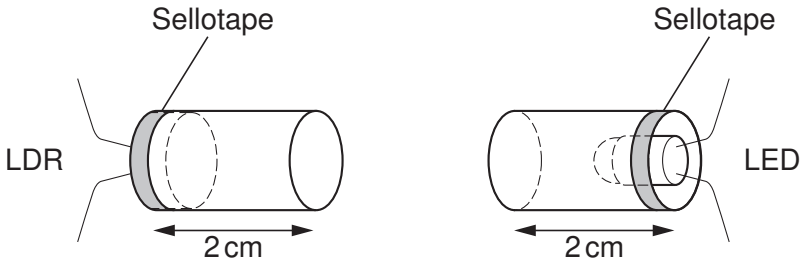

Fig. 2.2

(b) Place the cylinders together, as shown in Fig. 2.3. Record the voltmeter reading V_0.

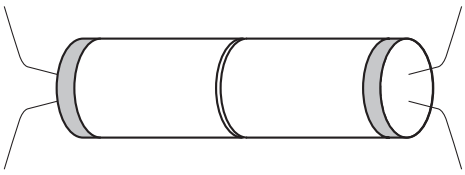

Fig. 2.3

V_0 = ...

(c) Fold the sheet of tracing paper in half four times so that you have 16 layers.

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(i) Measure the thickness of these 16 layers.

thickness of 16 layers = ...

(ii) Estimate the percentage uncertainty in this measurement. Show your working.

percentage uncertainty = ...

(iii) Determine the thickness t of one layer of tracing paper.

t = ...

(iv) Justify the number of significant figures you have given for t.

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(d) **(i)** Place four layers of tracing paper between the LED and the LDR as shown in Fig. 2.4. Record the voltmeter reading V.

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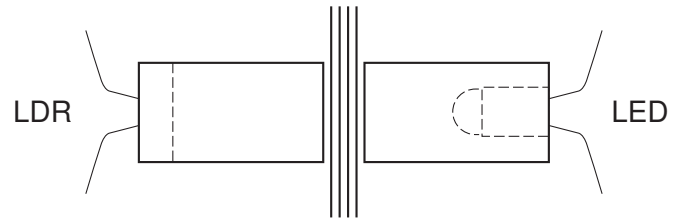

Fig. 2.4

V = ...

(ii) Repeat **(i)** using eight layers of tracing paper.

V = ...

(e) Explain whether your results support the idea that $V - V_0$ is proportional to the number of layers n of tracing paper.

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(f) **(i)** State four sources of error or limitations of the procedure for this experiment.

For Examiner's Use

1. .....

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2. .....

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3. .....

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4. .....

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(ii) Suggest four improvements that could be made to the experiment. You may suggest the use of other apparatus or different procedures.

1. .....

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2. .....

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3. .....

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4. .....

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