Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8887028054

PHYSICS **9702/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2014**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **8** printed pages.

DC (NF/SW) 76986/2

CAMBRIDGE International Examinations

[Turn over

1 Two identical coils are connected together and arranged as shown in Fig. 1.1.

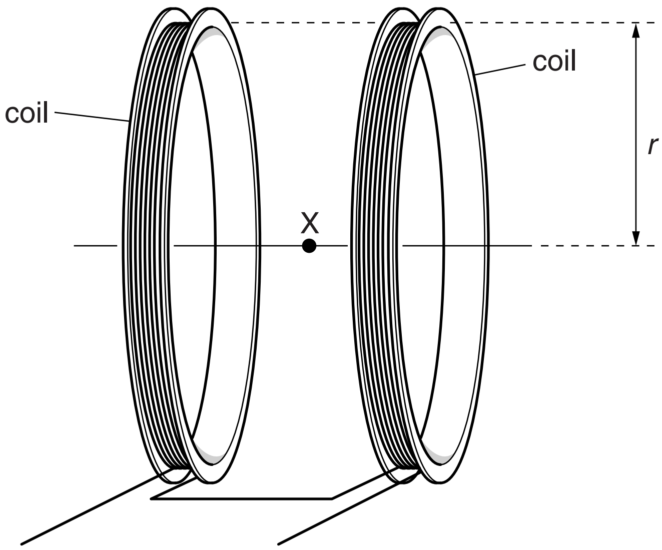

Fig. 1.1

The coils are in the vertical plane and are parallel to each other. When the coils are connected to a power supply, there is a magnetic field between them.

It is suggested that the magnetic flux density B of the field at the point X is related to the radius r of the coils by the relationship

$$B = \frac{0.72\mu_0 NI}{r}$$

where N is the number of turns on each coil, I is the current in the coils and μ_0 is the permeability of free space.

Design a laboratory experiment that uses a Hall probe to test the relationship between B and r and determine a value for μ_0. You should draw a diagram, on page 3, showing the arrangement of your equipment. In your account you should pay particular attention to

(a) the procedure to be followed,

(b) the measurements to be taken,

(c) the control of variables,

(d) the analysis of the data,

(e) the safety precautions to be taken.

[15]

Diagram

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Defining the problem	Methods of data collection	Method of analysis	Safety considerations	Additional detail

2 A student investigates the oscillations of a simple pendulum attached to a pole on the side of a building, as shown in Fig. 2.1.

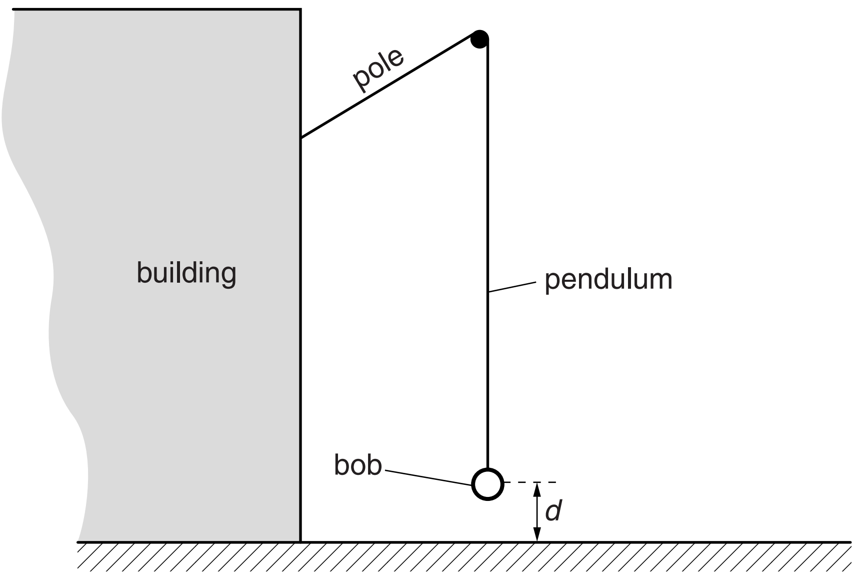


Fig. 2.1

The student records the distance d from the ground to the centre of the pendulum bob and the time t for the pendulum to complete 10 oscillations.

It is suggested that the period T of the oscillations and the distance d are related by the equation

$$T^2 = \frac{4\pi^2}{g}(k - d)$$

where g is the acceleration of free fall and k is a constant.

(a) A graph is plotted of T^2 on the y-axis against d on the x-axis. Determine expressions for the gradient and the y-intercept in terms of g and k.

gradient = ...

y-intercept = ...

[1]

(b) For each value of d the measurement of t is repeated. Values of d and t are given in Fig. 2.2.

d / m	t / s	t / s			
0.45 ± 0.05	56.4	56.4			
0.70 ± 0.05	55.4	55.6			
1.00 ± 0.05	54.6	54.2			
1.20 ± 0.05	53.4	53.8			
1.45 ± 0.05	52.9	52.5			
1.65 ± 0.05	51.6	52.0			

Fig. 2.2

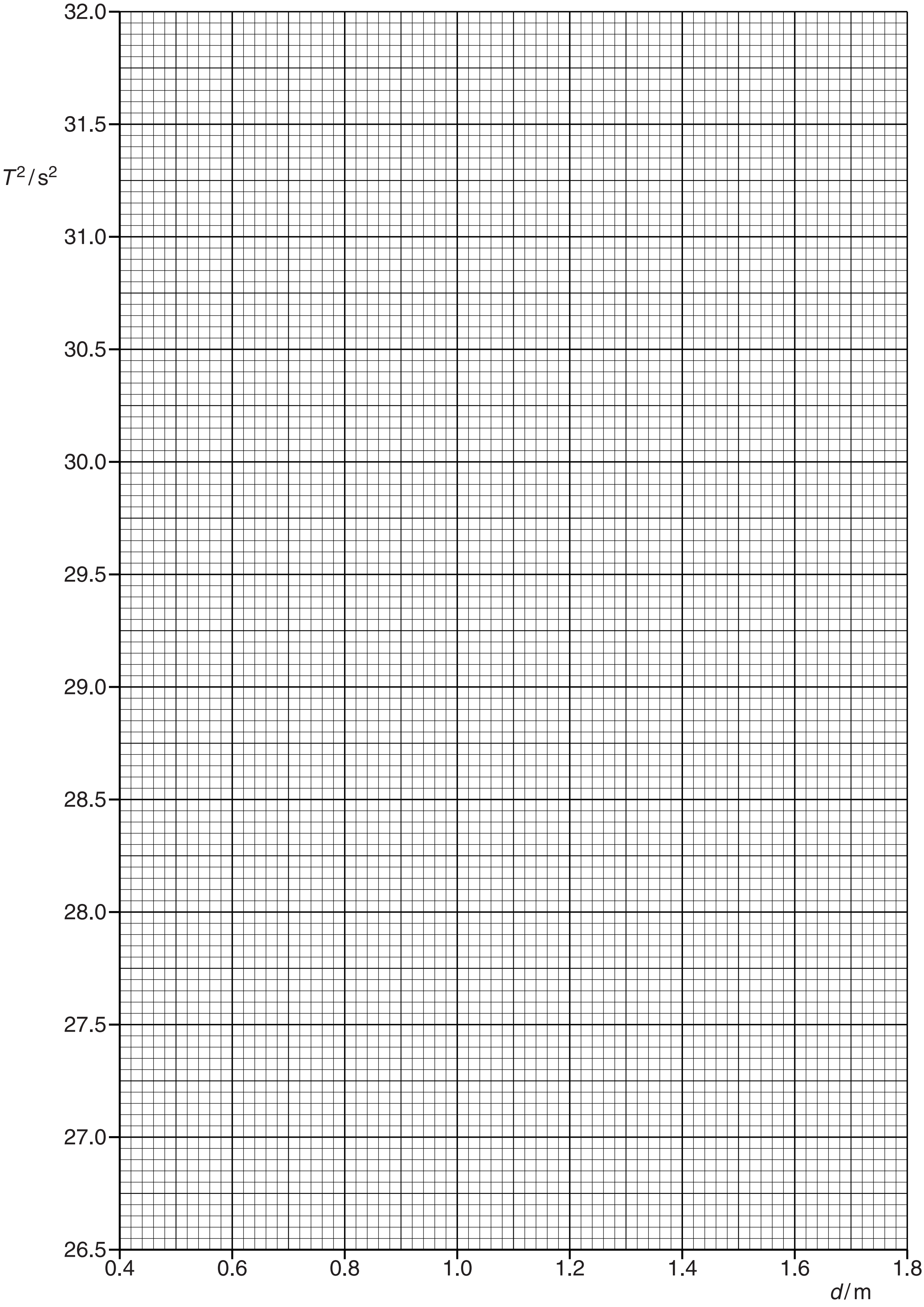
Calculate and record values of mean t / s, T / s and T^2 / s^2 in Fig. 2.2. [2]

(c) **(i)** Plot a graph of T^2 / s^2 against d / m. Include error bars for d. [2]

(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Both lines should be clearly labelled. [2]

(iii) Determine the gradient of the line of best fit. Include the uncertainty in your answer.

gradient = ... [2]



T^2 / s^2
32.0
31.5
31.0
30.5
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
d / m

[Turn over

(iv) Determine the y-intercept of the line of best fit. Include the uncertainty in your answer.

y-intercept = ... [2]

(d) (i) Using your answers to **(c)(iii)** and **(c)(iv)**, determine values for g and k. Include appropriate units.

g = ...

k = ...
[2]

(ii) Determine the percentage uncertainties in g and k.

percentage uncertainty in g = ...%

percentage uncertainty in k = ...%
[2]