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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

3232611177

PHYSICS **9702/52**

Paper 5 Planning, Analysis and Evaluation **October/November 2009**

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 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 **all** questions.
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.

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1	
2	
Total	

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

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1 When a current passes through a wire, the wire becomes hot and expands.

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This can be investigated in a laboratory by passing a current through a wire of diameter d and measuring the displacement y, as shown in Fig. 1.1.

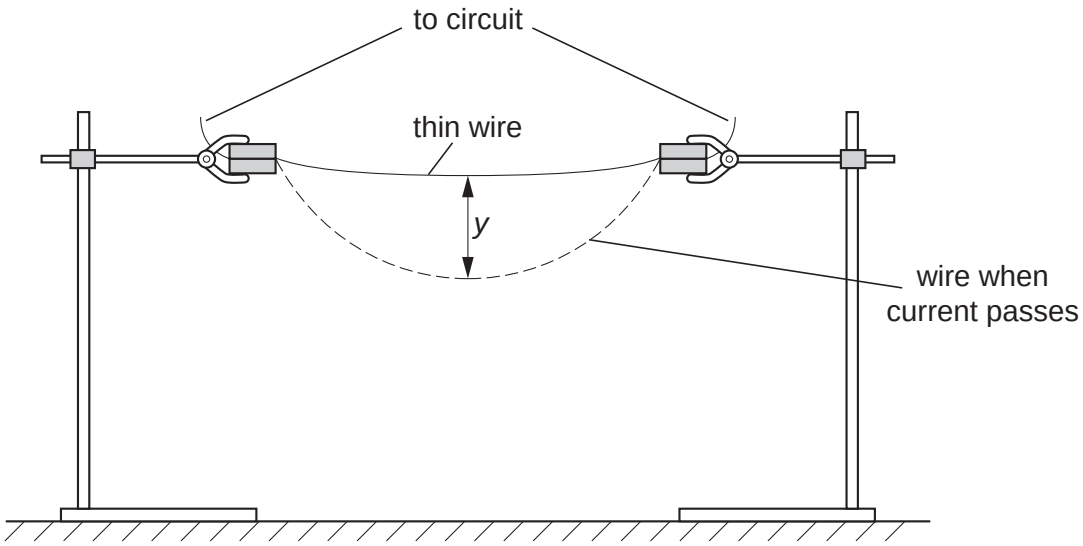


Fig. 1.1

It is suggested that the diameter d of the wire is related to y by the equation

$$y = pd^q$$

where p and q are constants.

Design a laboratory experiment to investigate the relationship between d and y, so as to determine a value for q. You should draw a diagram 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]

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Diagram

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2 An experiment is carried out to investigate how the time *t* for a steel ball to fall through air varies with the height *h* through which it falls.

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The equipment is set up as shown in Fig. 2.1.

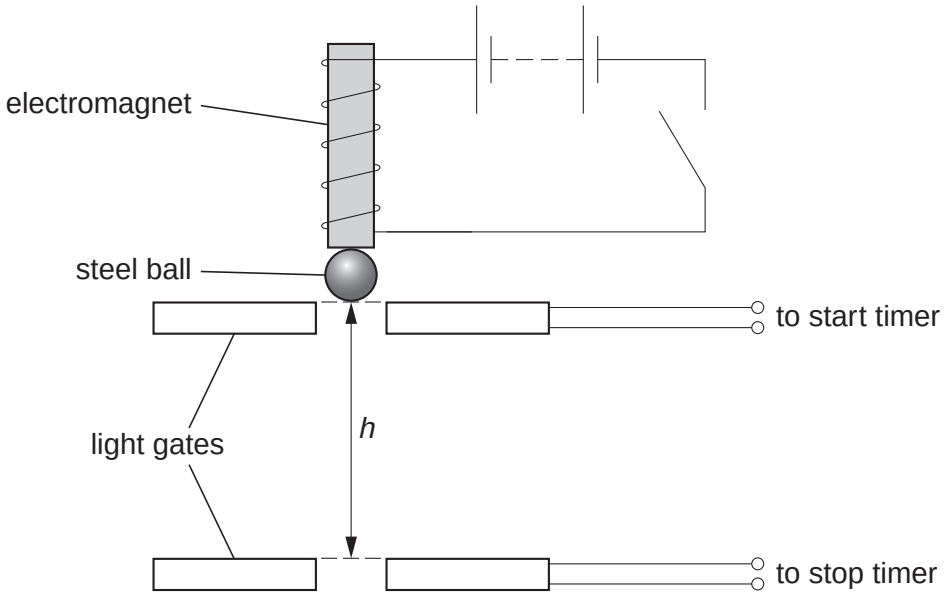


Fig. 2.1

An electromagnet is used to release the ball. As soon as the ball is released, it passes a light gate, which starts a timer. As the ball passes the lower light gate, the timer is stopped.

Question 2 continues on the next page.

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It is suggested that t and h are related by the equation

$$h = \frac{1}{2}gt^2$$

where g is the acceleration of free fall.

(a) A graph is plotted with t^2 on the y-axis and h on the x-axis. Express the gradient in terms of g.

gradient = ... [1]

(b) Values of h and t are given in Fig. 2.2.

h / m	t / s	
0.60	0.35 ± 0.01	
0.75	0.39 ± 0.01	
0.90	0.43 ± 0.01	
1.00	0.45 ± 0.01	
1.15	0.49 ± 0.01	
1.30	0.52 ± 0.01	

Fig. 2.2

Calculate and record values of t^2 in Fig. 2.2. Include the absolute uncertainties. [3]

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

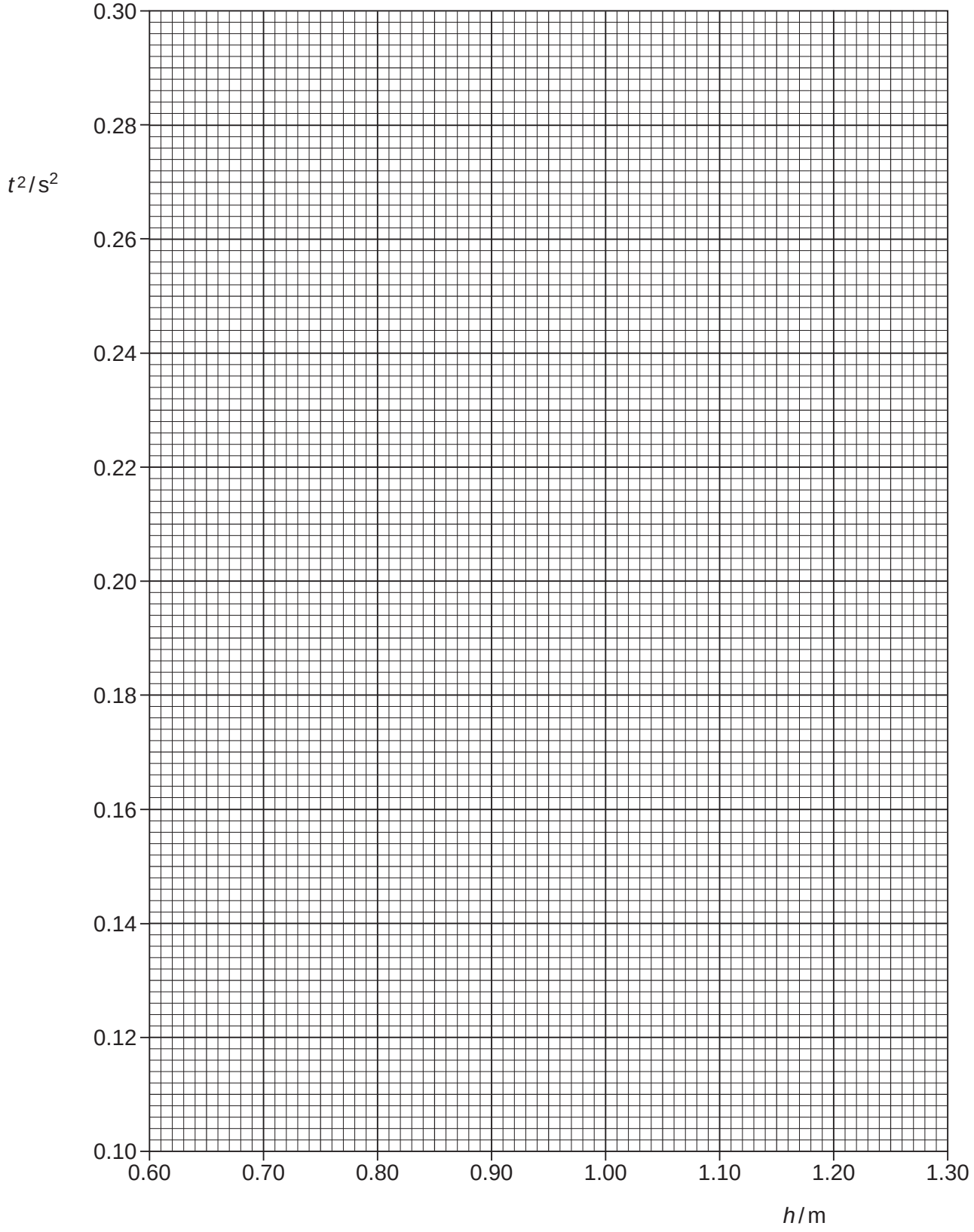
(ii) Draw the straight line of best fit and a worst acceptable straight line on your graph. Both lines should be clearly labelled. [2]

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

gradient = ... [2]

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(d) Using your answer to **(c)(iii)**, determine the value of g. Include the absolute uncertainty in your value and an appropriate unit.

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g = ... [3]

(e) The experiment is repeated from the top of a building.

(i) The time taken for the steel ball to fall is 2.21 ± 0.01 s. Using your value of g, calculate the height b of the building.

b = ... m [1]

(ii) Determine the percentage uncertainty in b.

percentage uncertainty = ... % [1]

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