UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

8256494037

PHYSICS **9702/52**

Paper 5 Planning, Analysis and Evaluation **May/June 2012**

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.

For Examiner's Use	
1	
2	
Total	

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

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1 A hot air balloon is tied to the ground using a rope. As the wind blows with speed v, the rope makes an angle θ to the horizontal, as shown in Fig 1.1.

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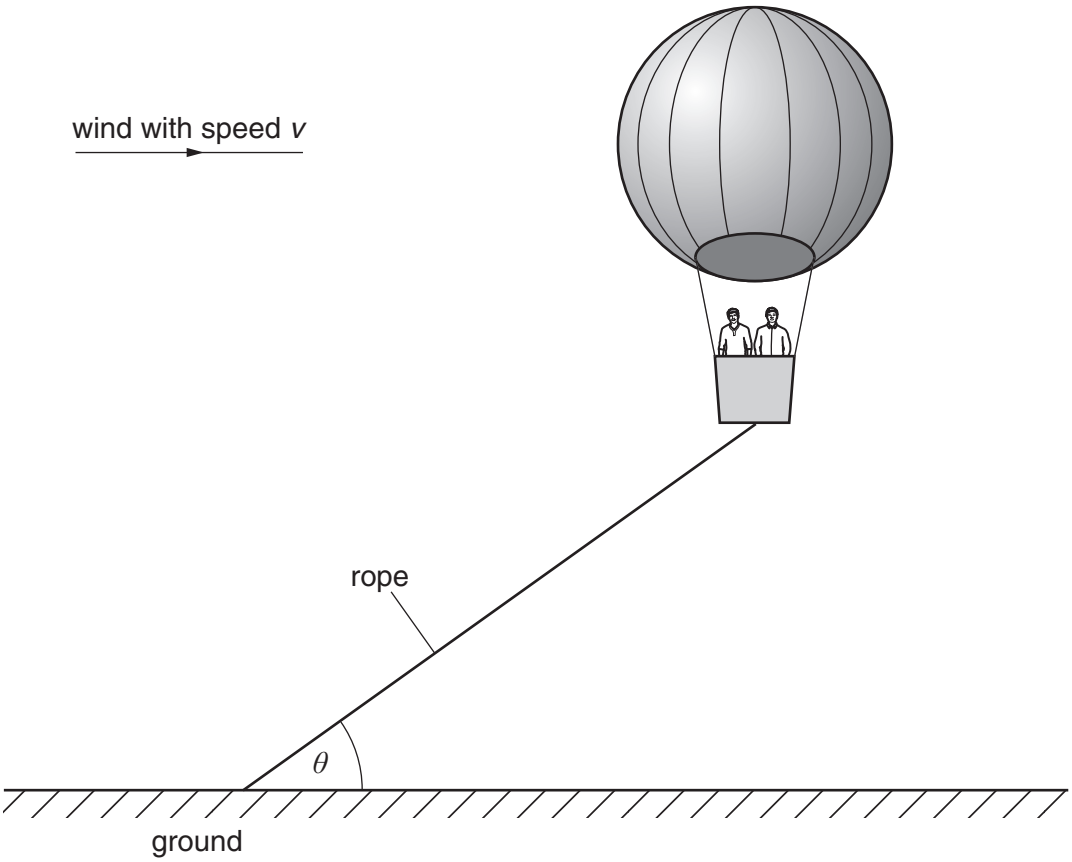

Fig 1.1

It is suggested that $\tan\theta$ is inversely proportional to v^2.

To model the hot air balloon in the laboratory, a balloon filled with helium is used. Design a laboratory experiment using a small helium-filled balloon to test the relationship between θ and v. 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]

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Diagram

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For Examiner's Use	Defining the problem	Methods of data collection	Method of analysis	Safety considerations	Additional detail

2 A student investigates how the resonant length L of a loaded wire varies with frequency f.

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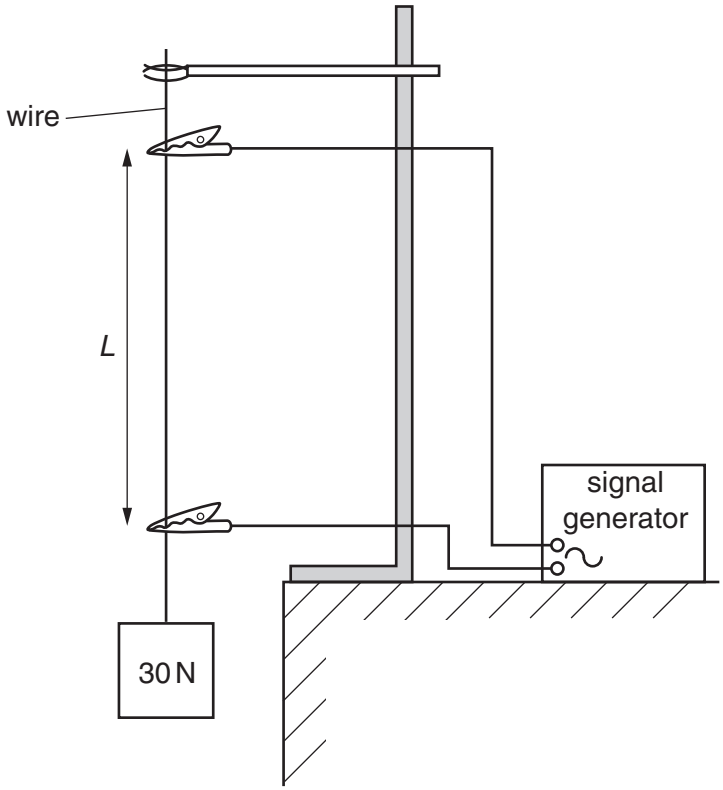

Fig. 2.1

For six different frequencies, the student records the length L.

Question 2 continues on the next page.

It is suggested that f and L are related by the equation

$$f = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$$

where T is the tension in the wire and μ is a constant.

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(a) A graph is plotted of f on the y-axis against $1/L$ on the x-axis. Determine an expression for the gradient in terms of T and μ.

gradient = ... [1]

(b) Values of f and L are given in Fig. 2.2.

f/Hz	L/10^{-2}m	
256	54.5 ± 0.5	
294	48.0 ± 0.5	
330	42.5 ± 0.5	
350	40.0 ± 0.5	
396	35.5 ± 0.5	
440	32.0 ± 0.5	

Fig. 2.2

Calculate and record values of $(1/L)/\text{m}^{-1}$ in Fig. 2.2. Include the absolute uncertainties in $1/L$. [3]

(c) **(i)** Plot a graph of f/Hz against $(1/L)/\text{m}^{-1}$. Include error bars for $1/L$. [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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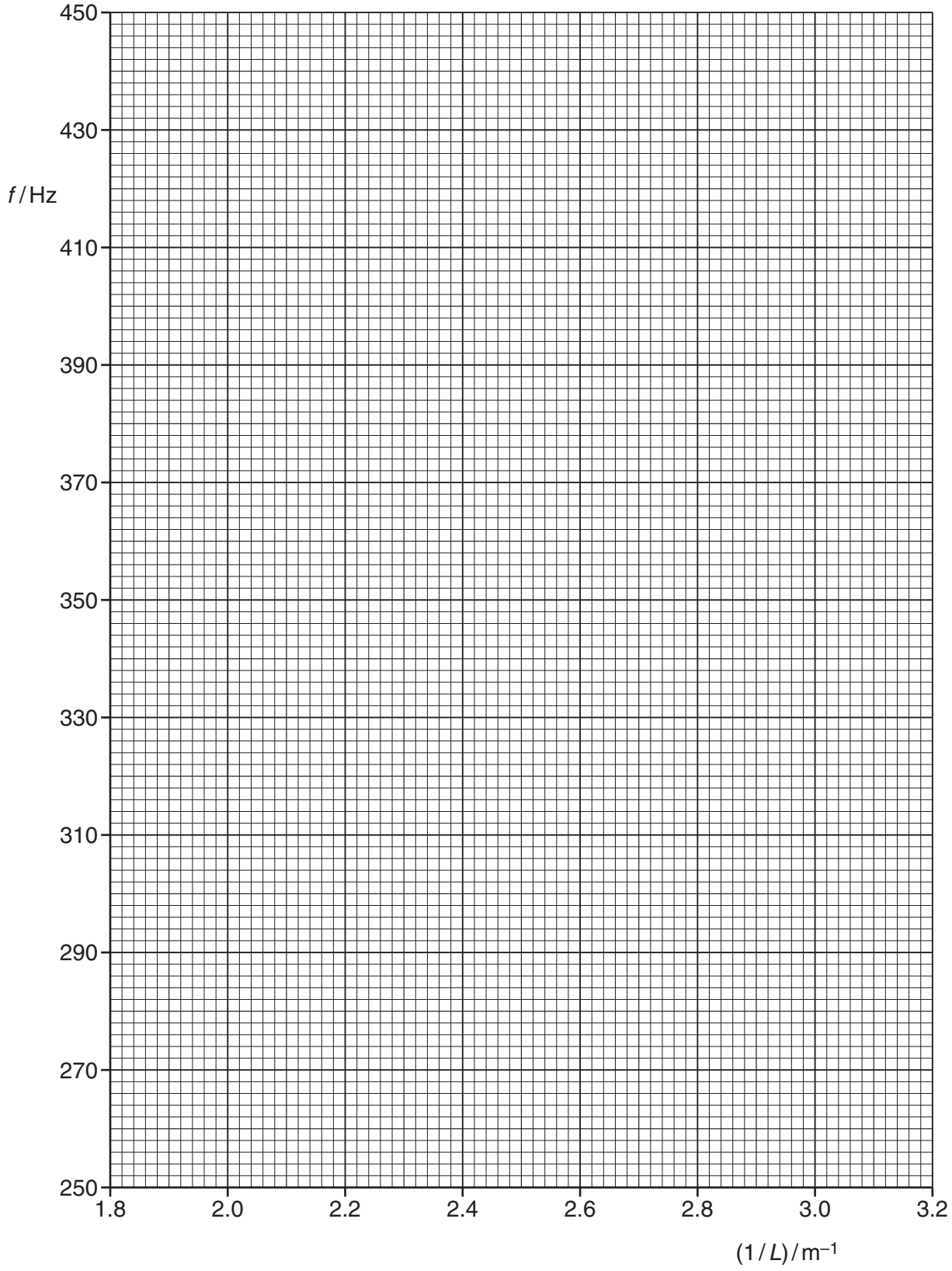

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(d) (i) The tension T in the wire is 30 ± 3 N. Using your answer to **(c)(iii)**, determine the value of μ. Include an appropriate unit in your answer.

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μ = ... [2]

(ii) Determine the percentage uncertainty in μ.

percentage uncertainty = ...% [1]

(e) An expression for μ is

$$\mu = \rho \pi r^2$$

where the density ρ of the wire is 8800 kg m^{-3} and r is the radius of the wire.

(i) Using your answer to **(d)(i)**, determine a value for r.

r = ...m [1]

(ii) Determine the percentage uncertainty in your value of r.

percentage uncertainty = ...% [1]

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