UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1952285491

PHYSICS **9702/53**

Paper 5 Planning, Analysis and Evaluation **October/November 2013**

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 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.

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.

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1 A student is investigating how the resistance R of nichrome in the form of a wire varies with temperature θ.

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It is suggested that

$$R = R_0(1 + \alpha\theta)$$

where R_0 is the resistance at 0 °C, α is a constant and θ is the temperature measured in °C.

Design a laboratory experiment to test the relationship between θ and R and determine the value of α. 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

For Examiner's Use

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For Examiner's Use

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

2 A student is investigating the stopping distance for a motorcycle with high-performance brakes. A motorcyclist riding and stopping a motorcycle on a test track is recorded on film.

For Examiner's Use

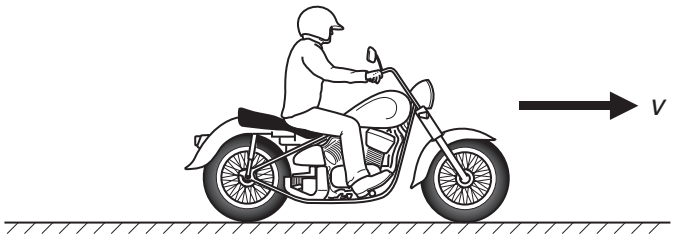

Fig. 2.1

The stopping distance *d* is measured for different speeds *v*.

Question 2 continues on the next page.

For Examiner's Use

It is suggested that v and d are related by the equation

$$d = \frac{v^2}{2a} + vt$$

where a is the deceleration of the motorcycle and t is the thinking time of the rider.

(a) A graph is plotted of $\frac{d}{v}$ on the y-axis against v on the x-axis. Determine expressions for the gradient and y-intercept in terms of a and t.

gradient = ...

y-intercept = ...

[1]

(b) Values of v and d are given in Fig. 2.2.

v/m s^{-1}	d/m	
10 ± 1	13.0 ± 0.5	
15 ± 1	24.5 ± 0.5	
20 ± 1	39.5 ± 0.5	
25 ± 1	57.5 ± 0.5	
30 ± 1	79.0 ± 0.5	
35 ± 1	103.0 ± 0.5	

Fig. 2.2

Calculate and record values of $\frac{d}{v}$/s in Fig. 2.2. Include the absolute uncertainties in $\frac{d}{v}$.

[3]

(c) **(i)** Plot a graph of $\frac{d}{v}$/s against v/m s^{-1}. Include error bars for $\frac{d}{v}$. Do **not** include horizontal error bars for v. [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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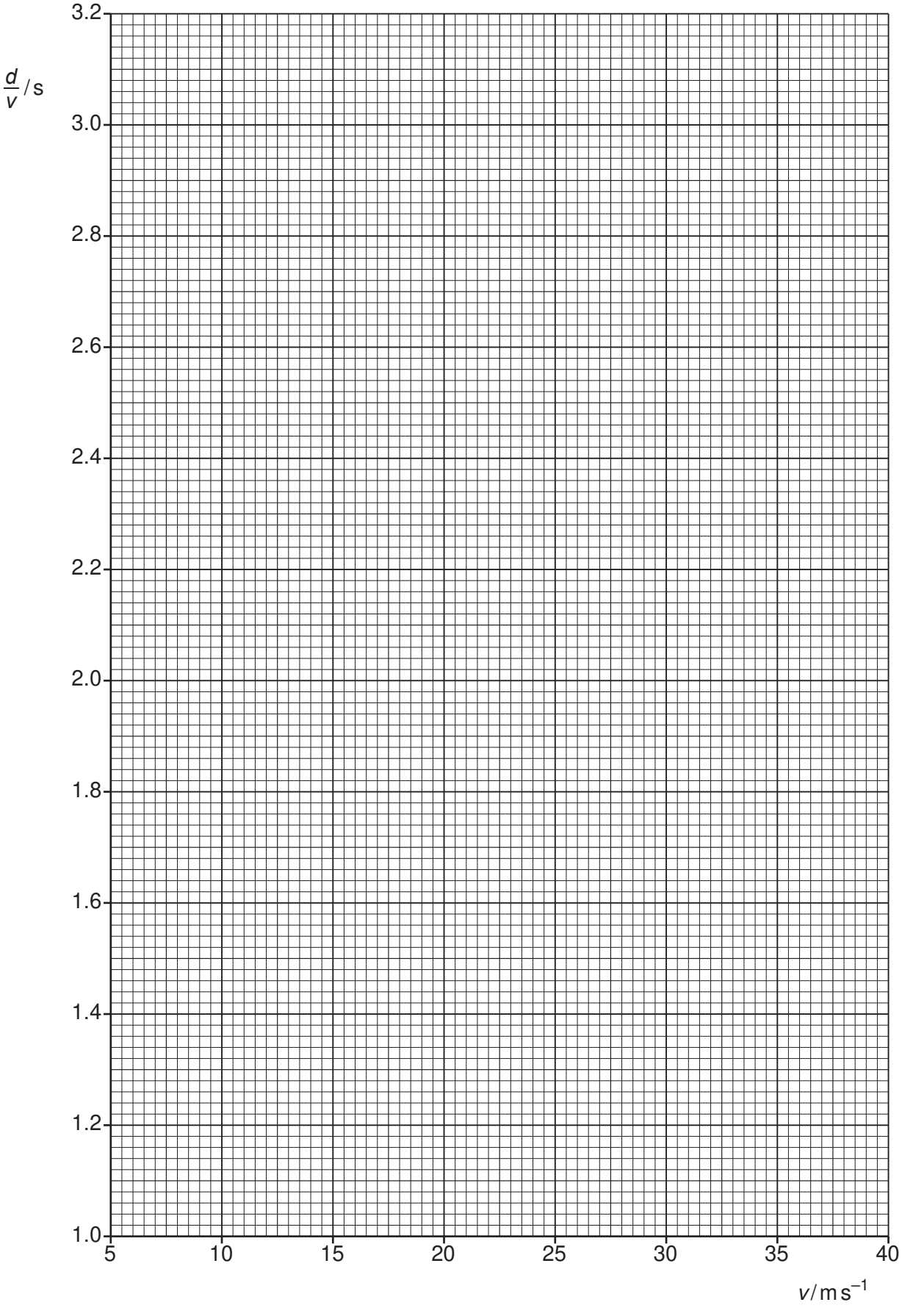

For Examiner's Use

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

For Examiner's Use

y-intercept = ... [2]

(d) (i) Using your answers to **(c)(iii)** and **(c)(iv)**, determine values for *a* and *t*. Include an appropriate unit for each value.

a = ...

t = ...
[2]

(ii) Using your answers to **(c)(iii)** and **(c)(iv)**, determine the percentage uncertainty in *a* and *t*.

percentage uncertainty in *a* = ... %

percentage uncertainty in *t* = ... %
[1]

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