Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Teacher's Use		
		Mark
Stage 1		
Section A	**1**	
Section B	**2**	
	3	
	4	
TOTAL		

General Certificate of Education
Advanced Subsidiary Examination
June 2010

Physics PHY3T/Q10/test

Unit 3 Investigative and Practical Skills in AS Physics

Investigative Skills Assignment (ISA) Q

Written Test

For this paper you must have:
- a calculator
- a ruler
- a protractor
- your completed documentation from Stage 1.

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Attach your documentation from Stage 1 to this booklet before handing it to the invigilator at the end of the examination**.**
- Show all your working.
- Do all rough work in this booklet. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper and the practical task is 41.

Signature of Teacher marking the ISA ..... Date .....

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Section A

Answer **all** questions in the spaces provided.
You should refer to your documentation from Stage 1 as necessary.

1 (a) What was the **dependent** variable in your experiment?

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(1 mark)

1 (b) Suggest **two** reasons why repeat timings at each distance would be expected to be spread about a mean value.

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(2 marks)

1 (c) From your experimental data, estimate the uncertainty in your measurement of t for your largest value of s.

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(1 mark)

1 (d) Theory predicts that for a cylinder rolling down a slope, t^2 is directly proportional to s provided that air resistance is negligible. State and explain whether or not your graph supports this prediction.

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(3 marks)

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1 (e) (i) State and explain the effect that using a steeper slope would have on the **percentage** uncertainty in your timings.

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1 (e) (ii) State and explain what other change could be made to the apparatus so that the effect of air resistance could be investigated.

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(4 marks)

11

Turn over for the next question

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Section B

Answer **all** the questions in the spaces provided.

2 An experiment using light gates and an electronic timer was set up to measure the final velocity v of a solid cylinder rolling from rest down a plane inclined at an angle θ to the horizontal. Some of the results from this experiment have been plotted on the graph on page 5 and all of the measurements are shown in the table below.

v_1, v_2 and v_3 are repeat measurements of the final velocity and v is the mean of those measurements.

θ/°	v_1 / m s^{-1}	v_2 / m s^{-1}	v_3 / m s^{-1}	v / m s^{-1}	v^2 / m^2 s^{-2}	sinθ
5	1.13	1.11	1.15	1.13	1.28	0.087
15	2.06	2.07	2.03	2.05	4.20	0.259
25	2.59	2.56	2.55	2.57	6.61	0.423
32	2.88	2.85	2.91			
38	3.11	3.14	3.15			
45	3.35	3.30	3.33			

2 (a) What must have been kept constant in this experiment to ensure a *fair test*?

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(1 mark)

2 (b) Complete the last three columns of the table above.

(2 marks)

2 (c) (i) Use values from the table to estimate the uncertainty in v for $\theta = 25°$.

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2 (c) (ii) Use your answer to part (i) to find the percentage uncertainty in v for $\theta = 25°$.

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Question 2 continues on page 6

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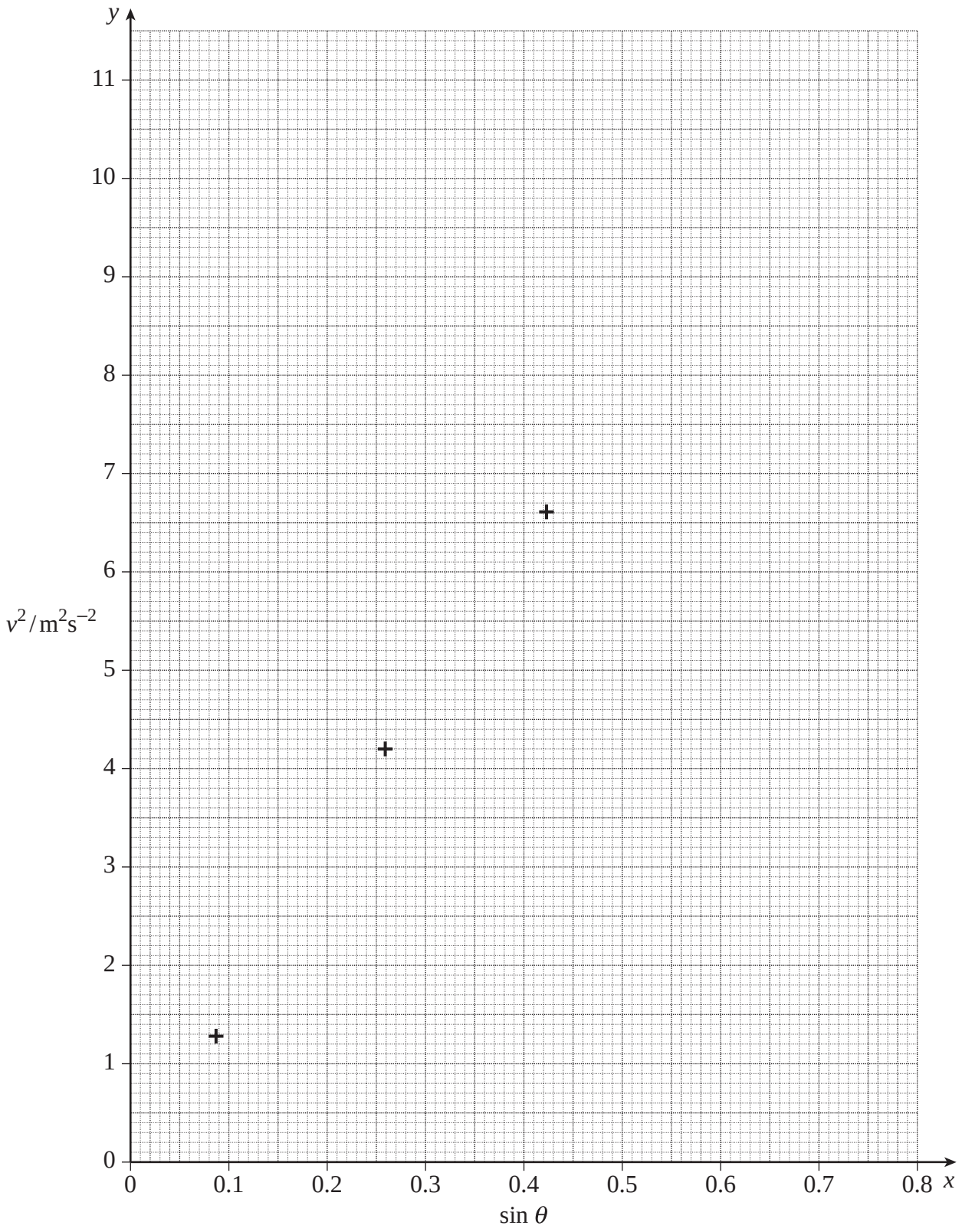
Graph of v^2 against sin θ



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2 (c) (iii) What is the percentage uncertainty in v^2 for $\theta = 25^o$?

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(3 marks)

2 (d) Describe **one** method, using an electronic timer and one or more light gates, that could be used to measure the final velocity of the cylinder in this experiment.

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(3 marks)

2 (e) Plot the last three points and draw the straight line of best fit through all of the points on the graph on page 5.

(2 marks)

11

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3 (a) Find the gradient of your straight line graph.

(3 marks)

3 (b) The general equation of a straight line is $y = mx + c$

The theoretical equation of your straight line graph is $v^2 = \frac{4gs\sin\theta}{3}$

3 (b) (i) In this case c is zero. Explain whether or not your graph confirms this value for c.

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3 (b) (ii) Identify the gradient of the line in the theoretical equation.

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3 (b) (iii) Use the gradient found in part (a) to find s, given that $g = 9.81\,\text{m}\,\text{s}^{-2}$.

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(3 marks)

6

Turn over for the next question

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4 A student predicts that a hollow cylinder will roll more slowly down a slope than a solid cylinder of the same radius. Describe an experiment to test this theory.

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(3 marks)

3

END OF QUESTIONS