Centre Number						Candidate Number				
Surname						Other Names				

Notice to Candidate. The work you submit for assessment must be your own. If you copy from someone else or allow another candidate to copy from you, or if you cheat in any other way, you may be disqualified.

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Candidate Signature		Date	

For Teacher's Use	
Section	Mark
PSA	
Stage 1	
Section A	
Section B	
TOTAL (max 50)	

General Certificate of Education
Advanced Subsidiary Examination
June 2012

Physics (Specification A & B) PHY3T/Q12/test

Unit 3T AS Investigative Skills Assignment (ISA) Q

For submission by 15 May 2012

For this paper you must have:	**Time allowed**
• your documentation from Stage 1 • a ruler with millimetre measurement • a calculator.	• 1 hour
Instructions:	**Information**
• 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 space provided. Do not write outside the box around each page or on blank pages. • Do all rough work in this book. Cross through any work you do not want to be marked.	• The marks for questions are shown in brackets. • The maximum mark for this paper and Stage 1 is 41.

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Yes ☐ No ☐

Teacher Declaration:
I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

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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) State **two** control variables in your experiment.

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(2 marks)

1 (b) Calculate the percentage uncertainty in your largest mean value of y.

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(1 mark)

1 (c) Describe how you measured as accurately as possible the distance y.

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(2 marks)

1 (d) Other than taking more repeat readings, suggest **two** possible ways of reducing the uncertainty in the measurement of y.

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(2 marks)

Do not write outside the box

1 (e) Discuss the reliability of your results.

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(2 marks)

1 (f) State how, if at all, the gradient of your graph would be affected if the slope of the drawing board was reduced. Explain your answer with reference to the physical principles involved.

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(2 marks)

1 (g) Describe the key features of your graph and explain what this indicates about the relationship between y and d.

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(2 marks)

13

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Section B

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

2 A student performs an experiment to simulate projectile motion using a similar arrangement to the one used in your experiment. The student investigates how the horizontal distance, x, travelled to reach maximum height varies with the distance, d, the projectile travels along the runway. The student's results are shown in the table below.

distance along runway d/mm	**horizontal distance travelled to reach maximum height**			
	1st reading x_1/mm	**2nd reading x_2/mm**	**3rd reading x_3/mm**	**mean value x/mm**
30	51	54	50	52
50	83	82	84	83
70	124	125	122	124
90	150	154	159	
110	190	189	193	
130	225	228	232	

2 (a) Complete the table by calculating the mean values of x in the last three rows.

(1 mark)

2 (b) Complete the graph on page 5 by plotting the three remaining points and draw a best fit straight line.

(2 marks)

2 (c) Determine the gradient of the graph.

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(3 marks)

6

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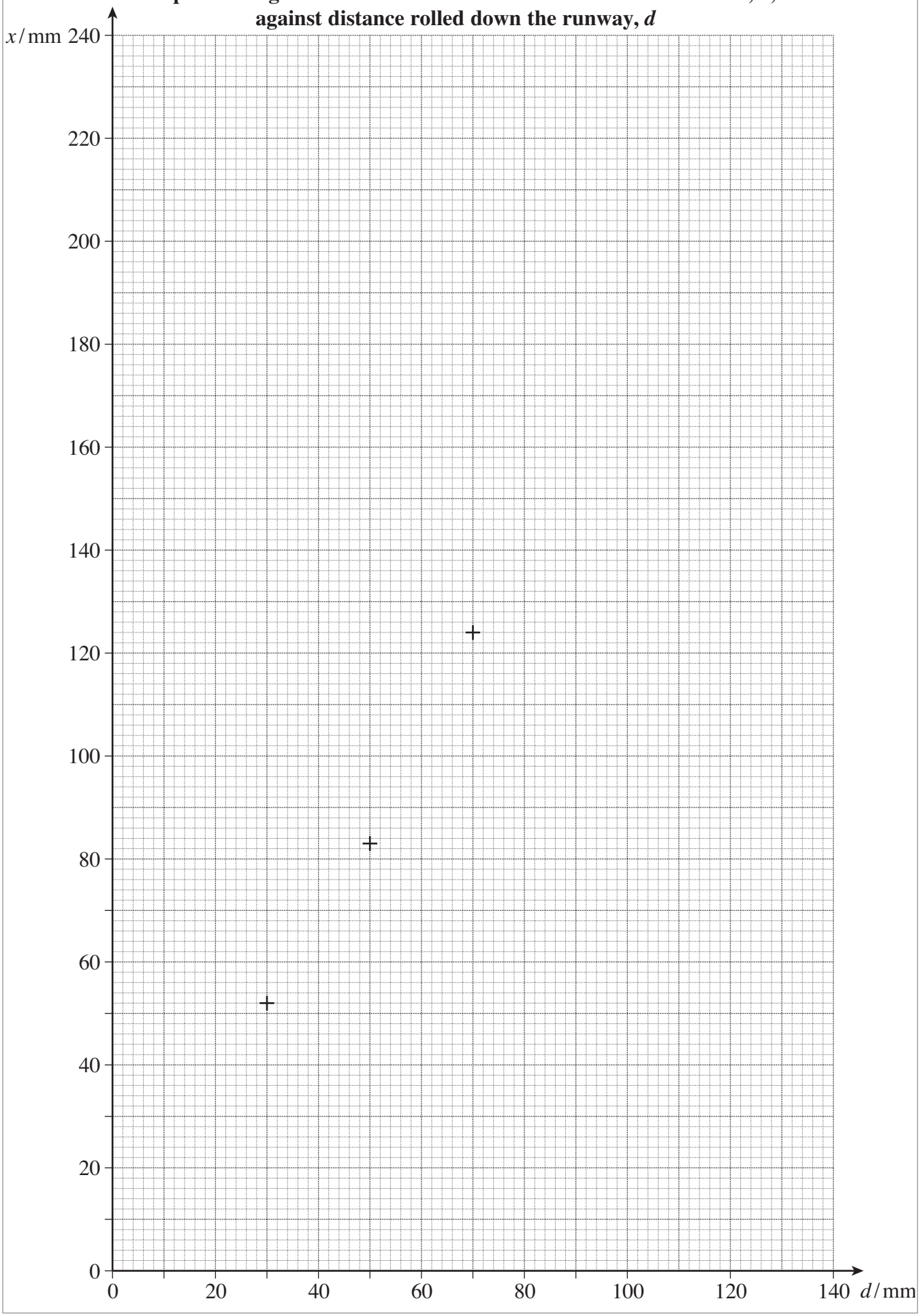
Graph showing the horizontal distance travelled across the board, x, against distance rolled down the runway, d



Do not write outside the box

3 (a) (i) Calculate the percentage uncertainty in the smallest mean value of x from the results in the table in Question 2.

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3 (a) (ii) The uncertainty in d is ± 1 mm. Calculate the percentage uncertainty in the ratio $\frac{x}{d}$ corresponding to the smallest mean value of x.

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3 (a) (iii) State the type of error that accounts for the variation in the values of x measured in this experiment.

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(4 marks)

3 (b) (i) With the arrangement of slope and runway set up by the student, theory predicts that the value of the gradient should be 2.00.
Calculate the percentage difference between your value of the gradient and the predicted value.

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3 (b) (ii) In the light of your calculation in part 3(b)(i), discuss the validity of the prediction.

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(3 marks)

7

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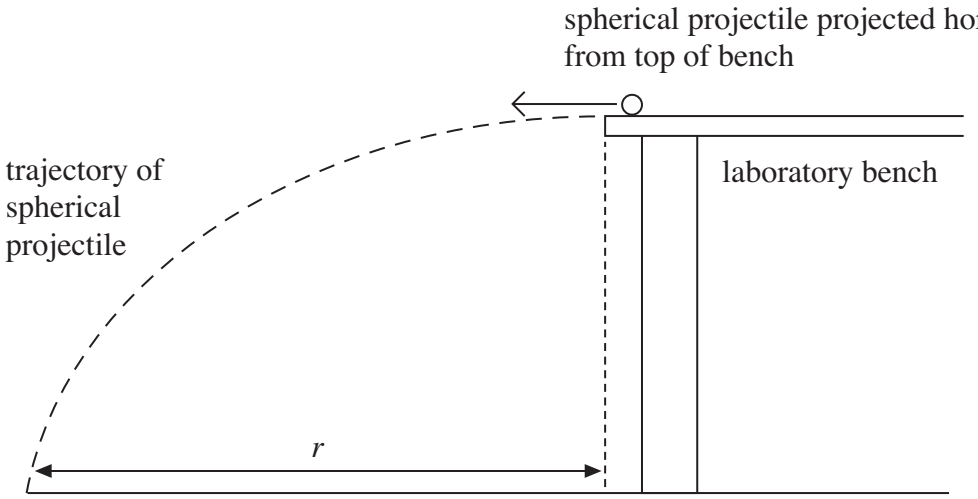
4 An experiment is set up to investigate how the speed, v, of a projectile projected horizontally above ground is related to the horizontal range, r, on the floor below. This is shown in **Figure 1**.

Figure 1



4 (a) Suggest a method to project the steel sphere so that it leaves the bench horizontally with a range of different reproducible speeds.

You may use a diagram to illustrate your answer.

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(2 marks)

Question 4 continues on the next page

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4 (b) The speed of the steel ball as it leaves the bench can be measured in a variety of ways. Describe and explain how this speed can be measured using one light gate connected via an interface to a computer.
You may use a diagram to illustrate your answer.

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(4 marks)

4 (c) It is suggested that r is directly proportional to the horizontal speed of projection, v.
Explain how you would use a set of measurements of r and v to verify this suggestion.

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(1 mark)

7

END OF QUESTIONS

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