

Centre Number						Candidate Number					
Surname						Other Names					
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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 Level Examination
June 2013

Physics (Specification A & B) PHY6T/Q13/test

Unit 6T A2 Investigative Skills Assignment (ISA) Q

For submission by 15 May 2013

For this paper you must have: <ul style="list-style-type: none"> ● your documentation from Stage 1 ● a ruler with millimetre measurement ● a calculator. 	Time allowed <ul style="list-style-type: none"> ● 1 hour
Instructions: <ul style="list-style-type: none"> ● 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. ● Show all your working. 	Information <ul style="list-style-type: none"> ● The marks for questions are shown in brackets. ● The maximum mark for this paper and Stage 1 is 41.
Details of additional assistance (if any). Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page. Yes <input type="checkbox"/> No <input type="checkbox"/>	

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.

Signature of teacher 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) State the **independent variable** in your experiment.

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(1 mark)

1 (b) Describe **one** difficulty you encountered in measuring the amplitude.

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(1 mark)

1 (c) Suggest **two** ways of reducing random error in the measurement of time period T .

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(2 marks)

1 (d) Estimate the percentage uncertainty in your value for T .

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(1 mark)

1 (e) Theory predicts that the amplitude of the oscillations should vary with elapsed time, t , according to the equation, $A = A_0 e^{-\lambda t}$ where A_0 is the amplitude when $t = 0$ and λ is a constant.

1 (e) (i) Show that the equation can be represented in the form $\ln A = a + bt$, and hence identify the constants, a and b .

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(2 marks)

1 (e) (ii) State what the gradient of your Stage 1 graph represents.

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(1 mark)

1 (e) (iii) State what the y-intercept of your graph represents.

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(1 mark)

1 (e) (iv) Discuss how well your results fit the predicted theory.

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(3 marks)

Turn over ►

1 (f) Discuss the possible effects on the accuracy of your measurements if a longer pendulum is used.

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(3 marks)

15

Section B

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

- 2** A student performs an experiment similar to the one you did in stage 1 and finds the value of λ for different balls. The student also finds the time, $t_{1/2}$, for the amplitude to halve in each case. The results are recorded in the table below.

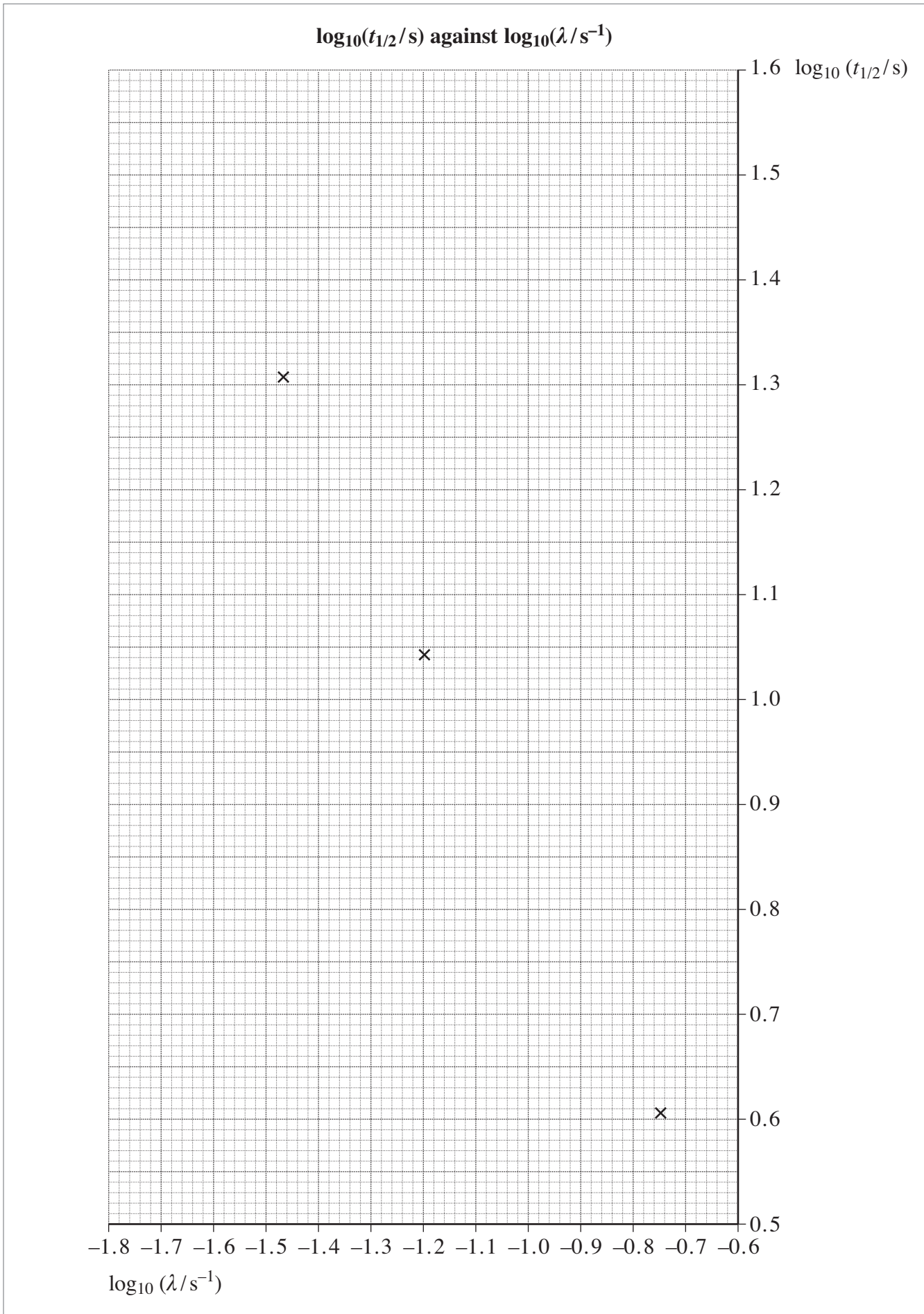
$t_{1/2}/s$				$\log_{10}(t_{1/2}/s)$	λ/s^{-1}	$\log_{10}(\lambda/s^{-1})$
1 st value	2 nd value	3 rd value	Mean			
3.9	4.1	4.0	4.0	0.602	1.79×10^{-1}	-0.747
11.0	11.1	10.9	11.0	1.041	6.34×10^{-2}	-1.198
20.3	20.5	20.1	20.3	1.307	3.41×10^{-2}	-1.467
31.4	31.2	31.1			2.22×10^{-2}	
38.2	37.8	38.0			1.82×10^{-2}	

- 2 (a)** Complete the table. (1 mark)

- 2 (b)** Plot the two remaining points on the graph on page 6 and draw a straight line of best fit. (2 marks)

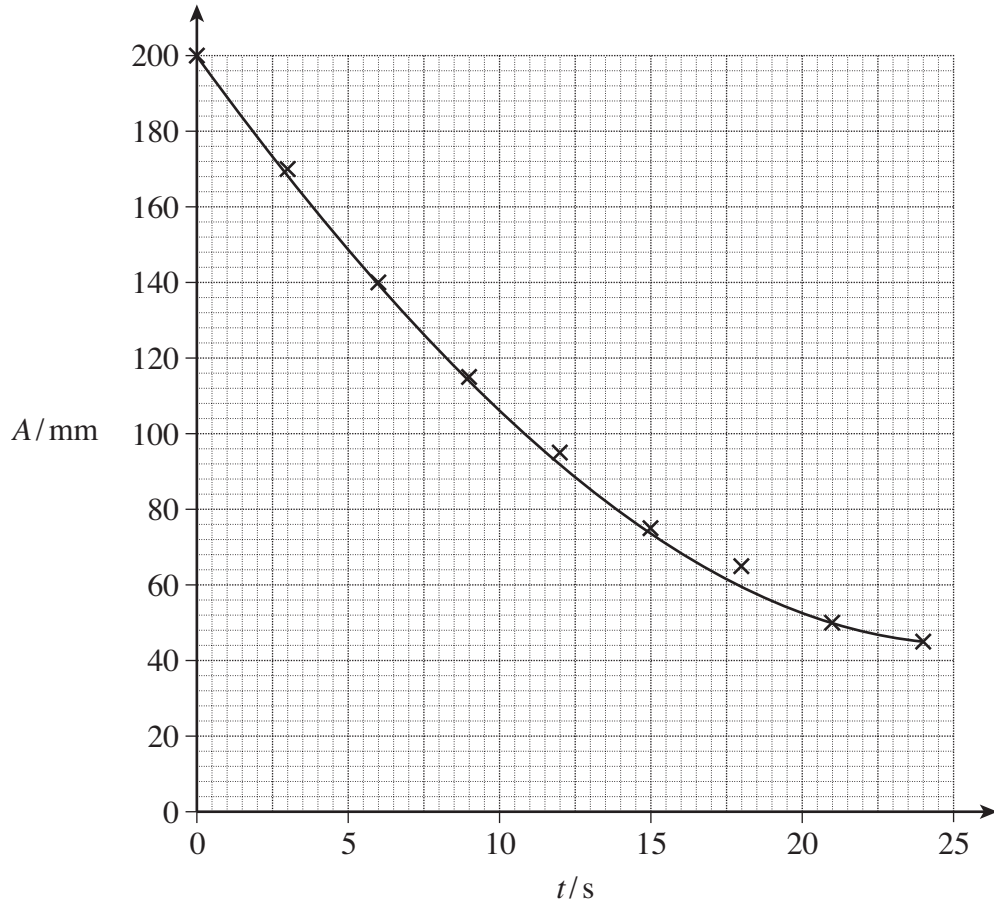
- 2 (c)** Determine the gradient of the graph.
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- (3 marks)

- 2 (d)** Theory predicts the gradient should be an integer. State the likely value of this integer and hence suggest the relationship between λ and $t_{1/2}$.
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- (2 marks)



- 3 To measure $t_{1/2}$ a student plotted a graph of A against t for each ball. One such graph is shown in **Figure 1**. Use this graph to determine $t_{1/2}$ for this ball.

Figure 1



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(3 marks)

3

Turn over ►

4 (a) Calculate the percentage uncertainty in the largest mean value of $t_{1/2}$ from the table on page 5.

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(2 marks)

4 (b) The student estimates that the percentage uncertainty in the corresponding value of λ is $\pm 0.2\%$.

Calculate the percentage uncertainty in $\lambda t_{1/2}$ for the largest mean value of $t_{1/2}$.

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.....
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(1 mark)

3
