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



General Certificate of Education
Advanced Level Examination
June 2011

Physics (Specification A & B) PHY6T/P11/test

Unit 6T A2 Investigative Skills Assignment (ISA) P

For submission by 15 May 2011

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. 	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.

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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) How did you ensure that the ruler was horizontal and the spring was vertical?

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(1 mark)

1 (b) Describe and explain **two** techniques you used to ensure accurate timing.

Technique 1

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Technique 2

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(4 marks)

1 (c) Describe what your graph suggests about the relationship between T^2 and m .

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(2 marks)

1 (d) Evaluate the reliability of your results.

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(1 mark)

1 (e) Describe the effect on your graph of using a ruler with greater mass.

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(2 marks)

10

Turn over for the next question

Turn over ►

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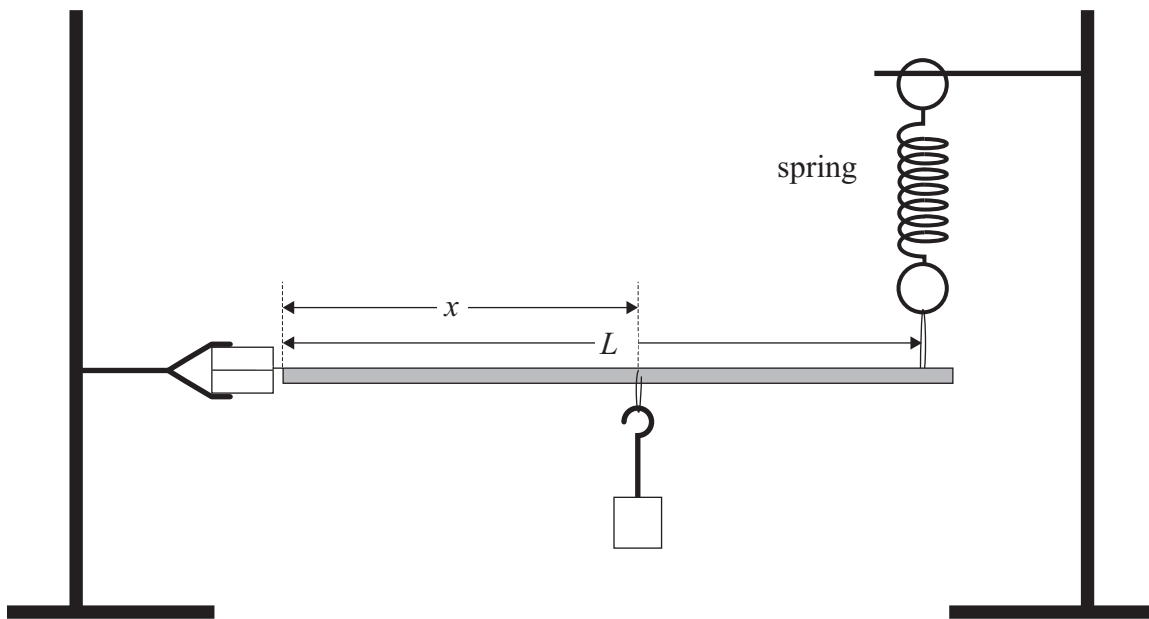
**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Section B

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

- 2 A student performs an experiment using a similar arrangement to the one used in your experiment, as shown in **Figure 2**, but with a different spring and ruler. The student finds the time taken, t , for the ruler to make 20 oscillations for a range of values of x , the distance of the suspended mass from the hinged end of the ruler. The mass is kept constant throughout this experiment.

Figure 2



Question 2 continues on the next page

Turn over ►

The time, T , for one oscillation is found and a graph of $\log_{10}(T/s)$ against $\log_{10}(x/m)$ is plotted. Five of the results are shown on the graph on **page 7**.

x/m	Time for 20 oscillations			t_{mean}/s	Time period T/s	$\log_{10}(T/s)$	$\log_{10}(x/m)$
	t_1/s	t_2/s	t_3/s				
0.300	9.78	9.93	9.99	9.90	0.495	-0.305	-0.523
0.400	11.19	11.07	11.22	11.16	0.558	-0.253	-0.398
0.500	12.82	12.70	12.52	12.68	0.634	-0.198	-0.301
0.600	13.53	13.68	13.71	13.64	0.682	-0.166	-0.222
0.700	14.87	14.74	14.55	14.72	0.736	-0.133	-0.155
0.800	15.78	15.72	15.60				
0.900	16.50	16.68	16.62				

2 (a) Complete the last two rows of the table. (2 marks)

2 (b) Plot the final two points on the graph on **page 7** and draw an appropriate straight line of best fit. (2 marks)

2 (c) Determine the gradient of the graph.

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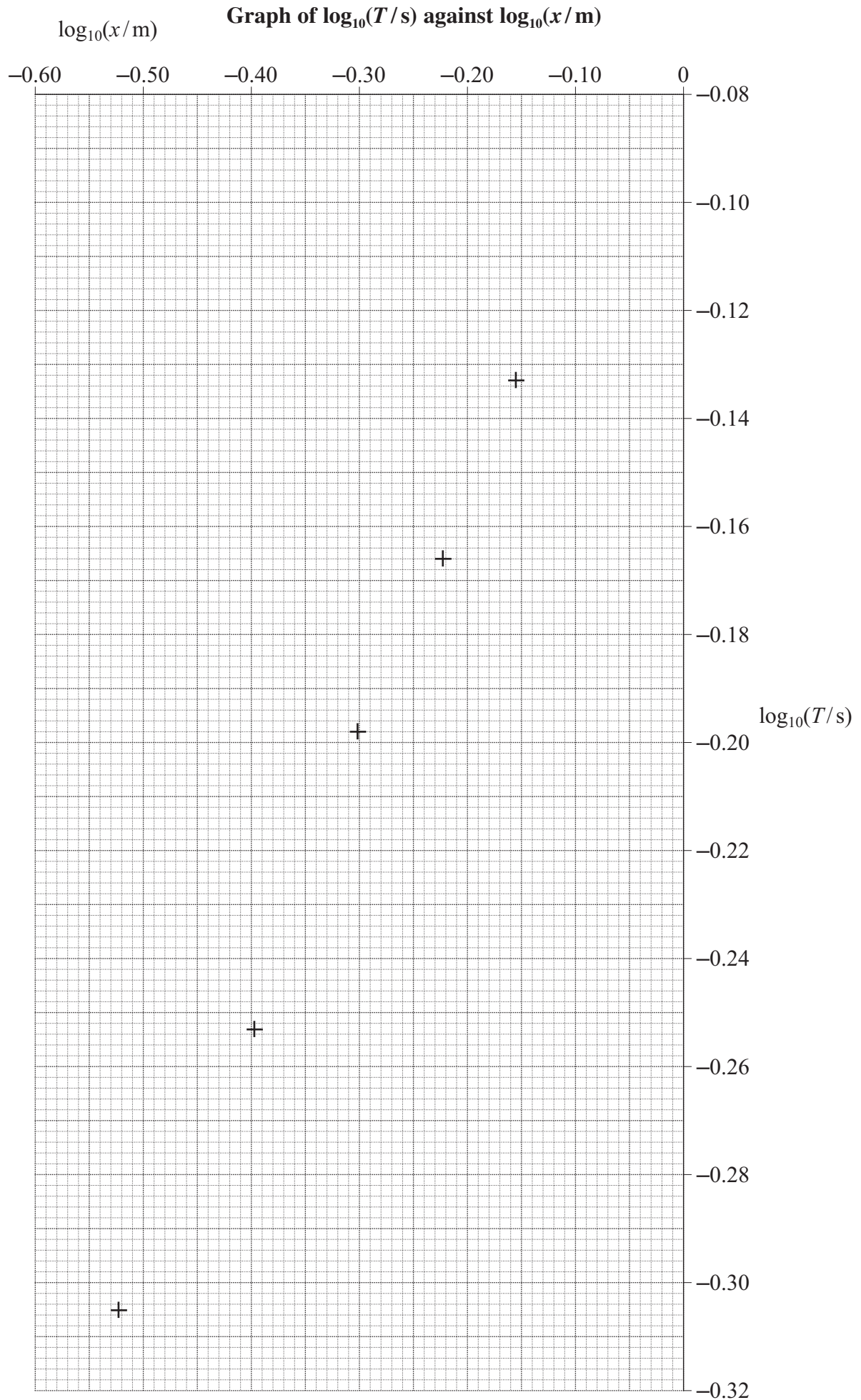
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(3 marks)



Question 2 continues on the next page

Turn over ►

2 (d) The student suggests that $T^2 = \frac{4\pi^2 mx}{kL}$,

where T is the time period of the oscillation, k is the spring constant, m is the mass suspended from the ruler, and x and L are the dimensions shown in **Figure 2**.

With reference to the graph on **page 7**, discuss to what extent the results agree with this relationship.

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(3 marks)

10

Turn over for the next question

3 (a) (i) Determine the percentage uncertainty in the smallest value of t_{mean} , shown in the table on page 6.

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(1 mark)

3 (a) (ii) What is the percentage uncertainty in the corresponding value of the time period, T ?

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(1 mark)

3 (b) State one likely source of this uncertainty.

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(1 mark)

3 (c) State the name given to this type of error.

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(1 mark)

3 (d) Use the equation $T^2 = \frac{4\pi^2 mx}{kL}$,

to calculate a value for the spring constant, k , for the value of $x = 0.300$ m, $L = 0.900$ m and $m = 0.800$ kg.

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.....

answer $k =$
(1 mark)

Question 3 continues on the next page

Turn over ►

- 3 (e)** Using your result from part (a) and the data below, calculate the uncertainty in the spring constant, k .

uncertainty in measured distances x and L is ± 2 mm

percentage uncertainty in mass, m is $\pm 2\%$

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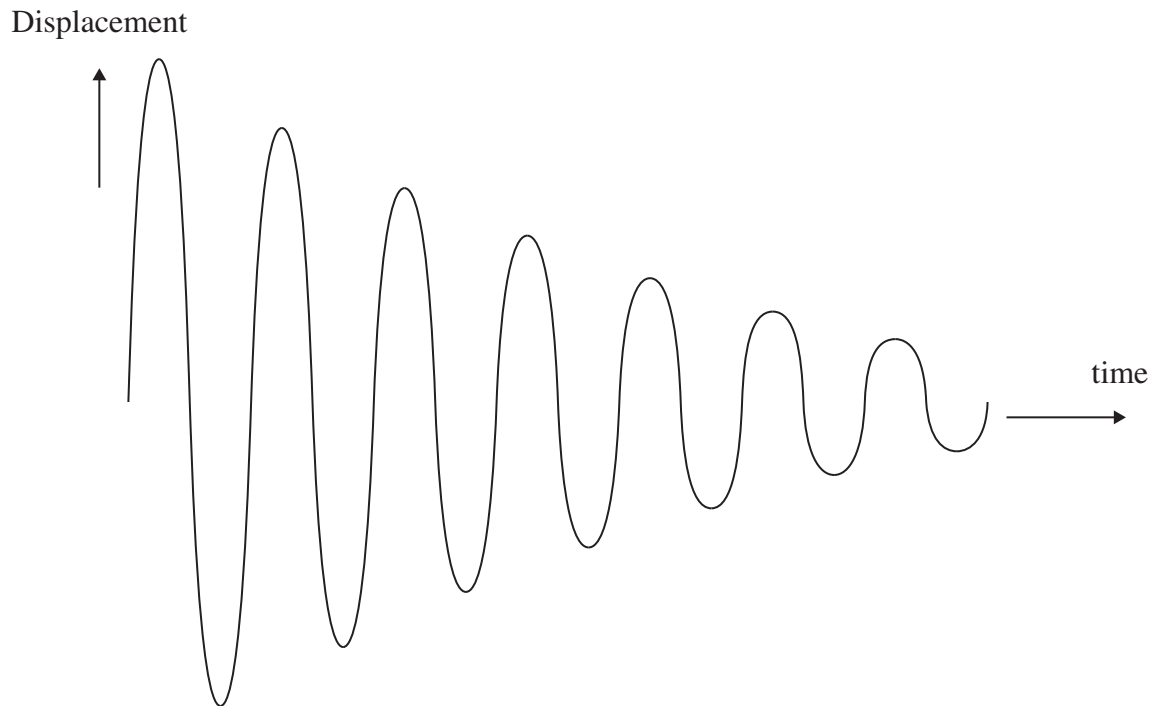
uncertainty = \pm

(4 marks)

9

- 4 The apparatus used in Question 2 is modified to increase the damping. A position sensor is attached to the end of the metre ruler where the spring is attached to the ruler. The trace, shown in **Figure 3**, is obtained when the system oscillates.

Figure 3



- 4 (a) Suggest what might have been done to the apparatus to increase the damping.

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(1 mark)

Question 4 continues on the next page

Turn over ►

4 (b) How would you use the trace shown in **Figure 3**, to determine whether the amplitude of the oscillation decreases exponentially? You should explain what measurements need to be taken and how the data would be processed.

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(3 marks)

4

END OF QUESTIONS