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.

Candidate Declaration. I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.

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 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:	**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.

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 ☐ 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.

Signature of teacher ..... Date

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

There are no questions printed on this page

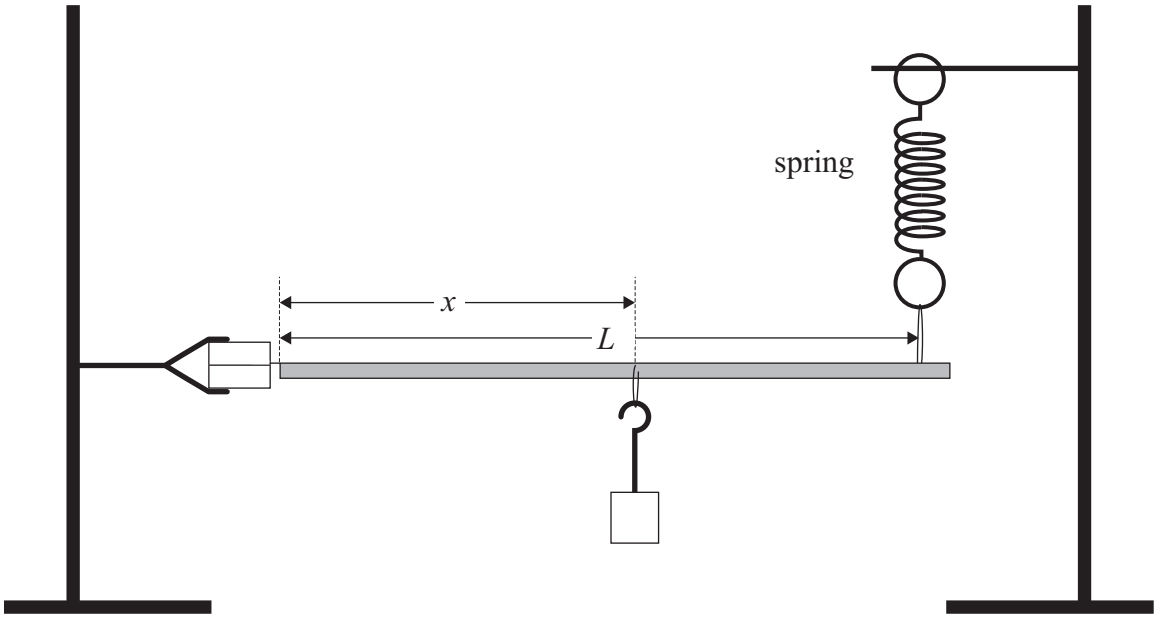
DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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

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

x/m	Time for 20 oscillations t_1/s	t_2/s	t_3/s	t_{mean}/s	Time period T/s	$\log_{10}(T/\text{s})$	$\log_{10}(x/\text{m})$
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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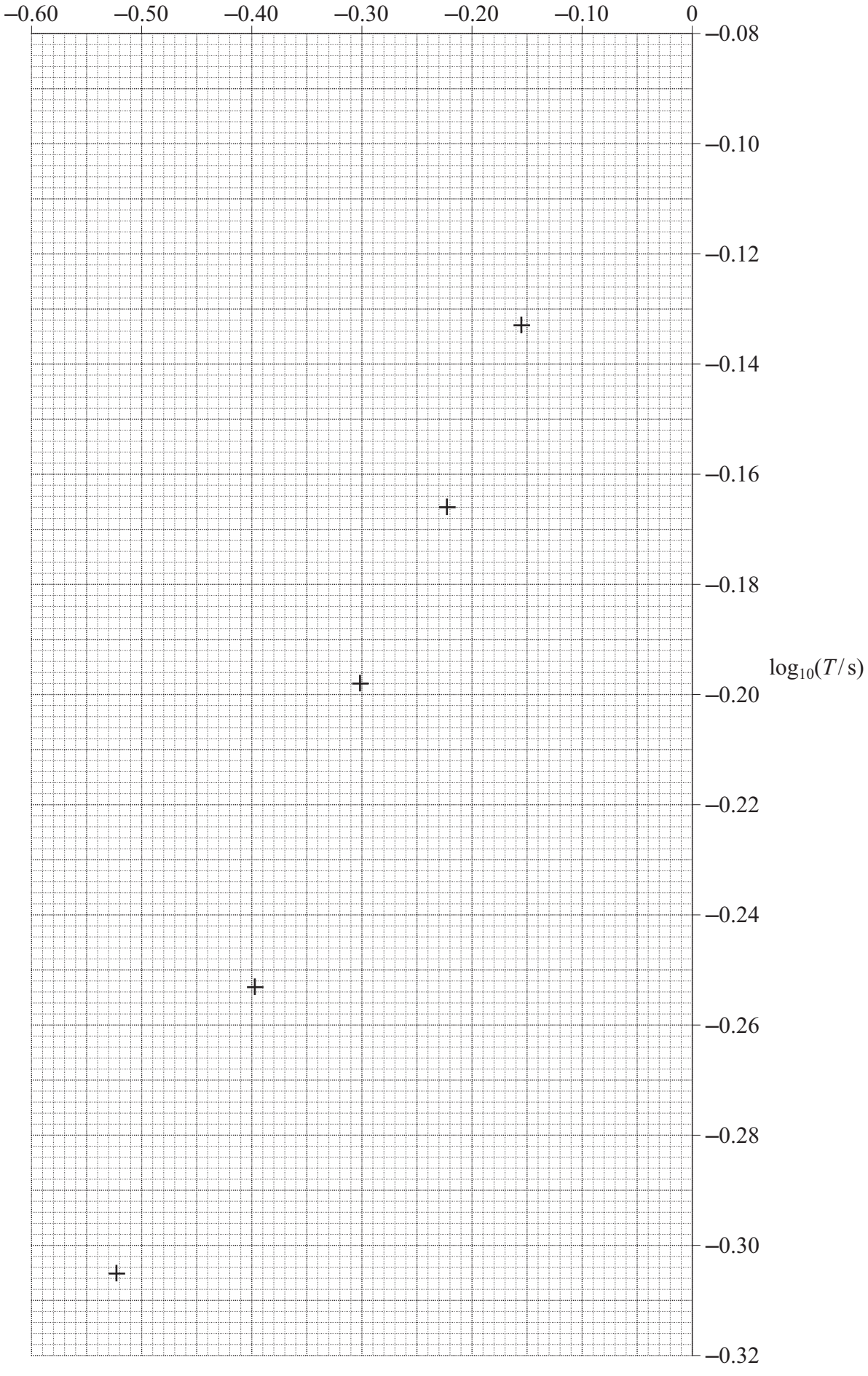
(3 marks)

Do not write outside the

Graph of $\log_{10}(T/\text{s})$ against $\log_{10}(x/\text{m})$



Question 2 continues on the next page

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.

.....

(1 mark)

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

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

.....

.....

answer k = ...

(1 mark)

Question 3 continues on the next page

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 ± 2 %

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.....

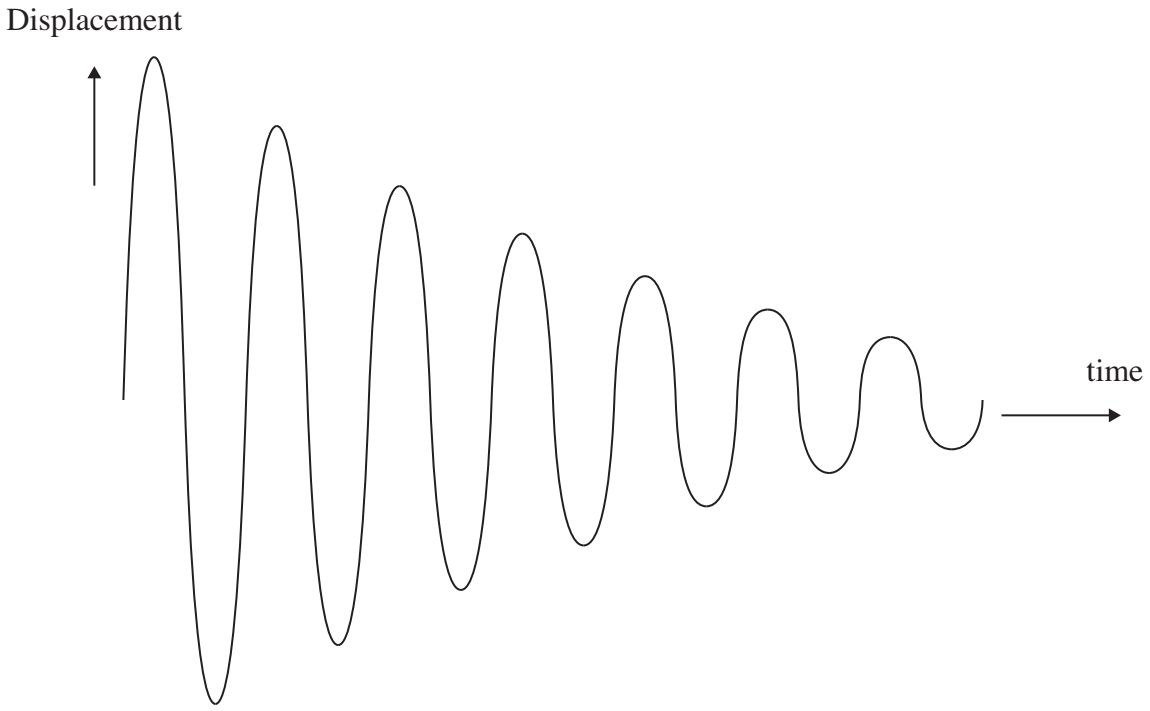
.....

uncertainty = ± .....
(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

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