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 2012

Physics (Specification A & B) PHY6T/Q12/test

Unit 6T A2 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.

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) State and explain what your graph suggests about the relationship between T^2 and l.

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(2 marks)

1 (b) The time period, T, of the oscillations of a liquid in a U-tube is given by

$$T = 2\pi\sqrt{\frac{l}{2g}}$$

where g is the acceleration due to gravity. Explain how a value for g could be obtained from your graph.

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(2 marks)

1 (c) (i) Calculate the uncertainty in your measurement of the internal diameter of the tube.

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1 (c) (ii) Calculate the uncertainty in your smallest value of T.

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Do not write outside the box

1 (c) (iii) State which of your answers to parts (c)(i) and (c)(ii) would contribute more to the uncertainty in a value for *g* found using the formula given in part (b).
Explain your answer.

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(5 marks)

1 (d) (i) From your observations of the motion of the water, how could you tell that there was significant damping within the system?

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1 (d) (ii) State **one** possible cause of the damping within the system.

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....

(2 marks)

1 (e) If the experiment were to be repeated using oil instead of water, state and explain the effect, if any, you would expect this to have on

1 (e) (i) the damping within the system,

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1 (e) (ii) the values of *T*.

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(4 marks)

15

Turn over ▶

Section B

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

2 (a) The time period, T, of oscillations of a liquid in a U-tube is given by

$$T = 2\pi\sqrt{\frac{l}{2g}}$$

Liquids expand when heated. By considering the effect on the length of liquid in the tube, suggest and explain what the effect of increasing the temperature of a fixed mass of liquid in a U-tube would have on its time period when oscillating.

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(2 marks)

The time period, T, of oscillation for a fixed mass of liquid in a U-tube is predicted to vary with liquid density, ρ.

Different concentrations of sulphuric acid were used to investigate this prediction. The tests were all carried out at 20 °C using the same apparatus. The mass of liquid used was the same for each test. Some of the results are shown in the table.

ρ / 10^3 kg m^{-3}	T/ s	log(ρ / 10^3 kg m^{-3})	log(T/ s)
1.00	1.42	0.000	0.152
1.10	1.35	0.041	0.130
1.20	1.29	0.079	0.111
1.30	1.24		
1.40	1.20		
1.50	1.16		

2 (b) Complete the table by finding log ρ and log T for $\rho = 1.30 \times 10^3$ kg m^{-3}, 1.40×10^3 kg m^{-3} and 1.50×10^3 kg m^{-3}.

(2 marks)

Do not write outside the box

2 (c) Complete the graph of log T plotted against log ρ on page 6 by plotting the remaining points and drawing a best fit straight line.

(2 marks)

2 (d) Determine the gradient of your straight line.

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(3 marks)

2 (e) It is known that the relationship between T and ρ is of the form

$$T = k\rho^{1/n},$$

where k is a constant and n is an integer.

2 (e) (i) Use the graph to find the value of the integer n.

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2 (e) (ii) Use the graph to find a value for T when $\rho = 1.00 \times 10^3\,\text{kg m}^{-3}$ and hence calculate a value for the constant k.

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2 (e) (iii) Determine the unit of k.

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2 (e) (iv) If the sulphuric acid in the U-tube were to be replaced by the same mass of another liquid which has the same value for k and a density of $3.10 \times 10^3\,\text{kg m}^{-3}$, calculate its time period.

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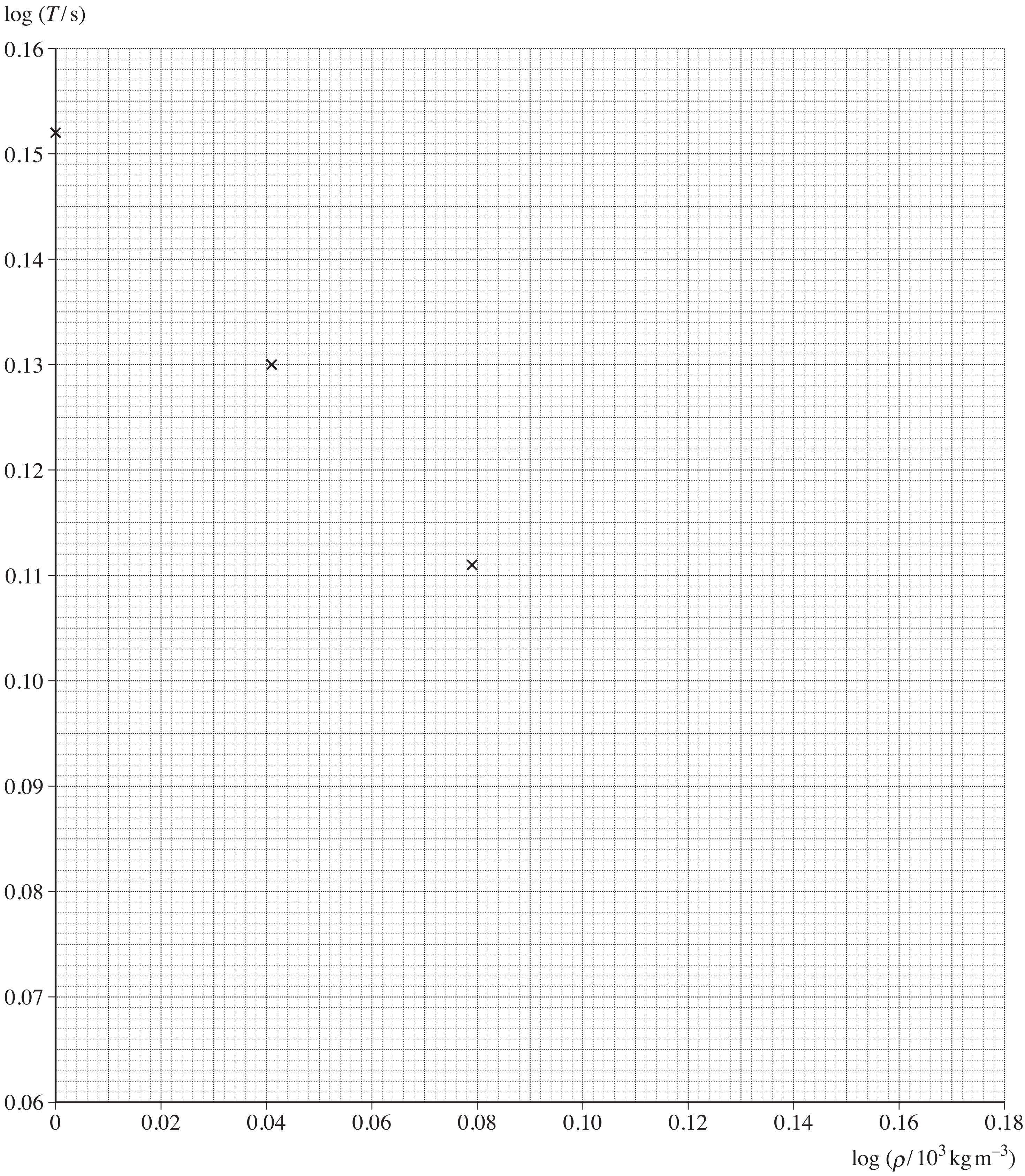
(6 marks)

15

Turn over ▶

Log T plotted against log ρ for liquid oscillations in a U-tube



Do not write outside the box

3 Tuned Liquid Column Dampers (TLCDs) are used in some high buildings to reduce vibrations from earthquakes and high winds. Essentially a TLCD is a large U-tube containing water which oscillates as the building vibrates, absorbing energy and counteracting the forces on the structure. One of the many factors affecting the damping is the diameter of the tube.

One measure of damping is the ratio of successive amplitudes of oscillation. Describe a laboratory experiment to investigate how this ratio varies with tube diameter.

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(4 marks)

4

END OF QUESTIONS