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 2014

Physics (Specification A & B) PHY6T/P14/test

Unit 6T A2 Investigative Skills Assignment (ISA) P

For submission by 15 May 2014

For this paper you must have:	**Time allowed**
• your documentation from Stage 1 • a ruler with millimetre measurement • a calculator.	• 1 hour
Instructions: • 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 working.	**Information** • 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 .....

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Section A

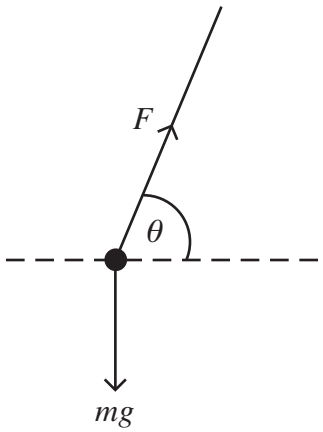
Answer **all** questions in the spaces provided.
You should refer to your documentation from Stage 1 as necessary.

1 (a) The centripetal force for the circular motion of the pendulum bob you investigated in Stage 1 was provided by the horizontal component of the tension, F, in the string.

Centripetal force = $F\cos\theta = ma$ where $\cos\theta = \frac{d}{2l}$

a = centripetal acceleration of the bob
d = diameter of circle
l = length of the string
m = mass of bob

Figure 1



1 (a) (i) Use your measurements from **Stage 1** for d and your shortest pendulum length, l, of the string to calculate a value for $\cos\theta$.

[1 mark]

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1 (a) (ii) Use your estimates for the uncertainties in these measurements to find the percentage uncertainty in your value for $\cos\theta$.

[3 marks]

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1 (a) (iii) It can be shown that

$$F = \frac{4\pi^2 ml}{T^2}$$

Assume that the mass of m was $0.100\,\text{kg}$. Calculate F for your shortest length pendulum.

[1 mark]

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1 (a) (iv) State how each of your measurements d, l and T contribute to the uncertainty in your value for F.

[3 marks]

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1 (b) Referring to your graph from **Stage 1**, describe the variation of T with l over the range of string lengths that you investigated.

[2 marks]

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1 (c) Explain why the **string** cannot be rotated in a horizontal plane.

[1 mark]

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Section B

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

2 An experiment similar to that in Stage 1 was performed using a pendulum with a circular radius, $r = 0.125\,\text{m}$. T is the time period for the rotation and l is the length of the pendulum. Some of the results are summarised in **Table 1**.

Table 1

l/m	$\sqrt{l^2 - r^2}$/m	T/s	T^2/s^2
0.150	0.083	0.57	0.32
0.200	0.156	0.82	0.67
0.250	0.217	0.94	0.88
0.300	0.273	1.05	1.10
0.350		1.14	
0.400		1.25	

2 (a) Complete **Table 1**.

[1 mark]

2 (b) Complete **Figure 2** by plotting the remaining points and drawing a best fit straight line.

[2 marks]

2 (c) Determine the gradient of your straight line (**Figure 2**).

[2 marks]

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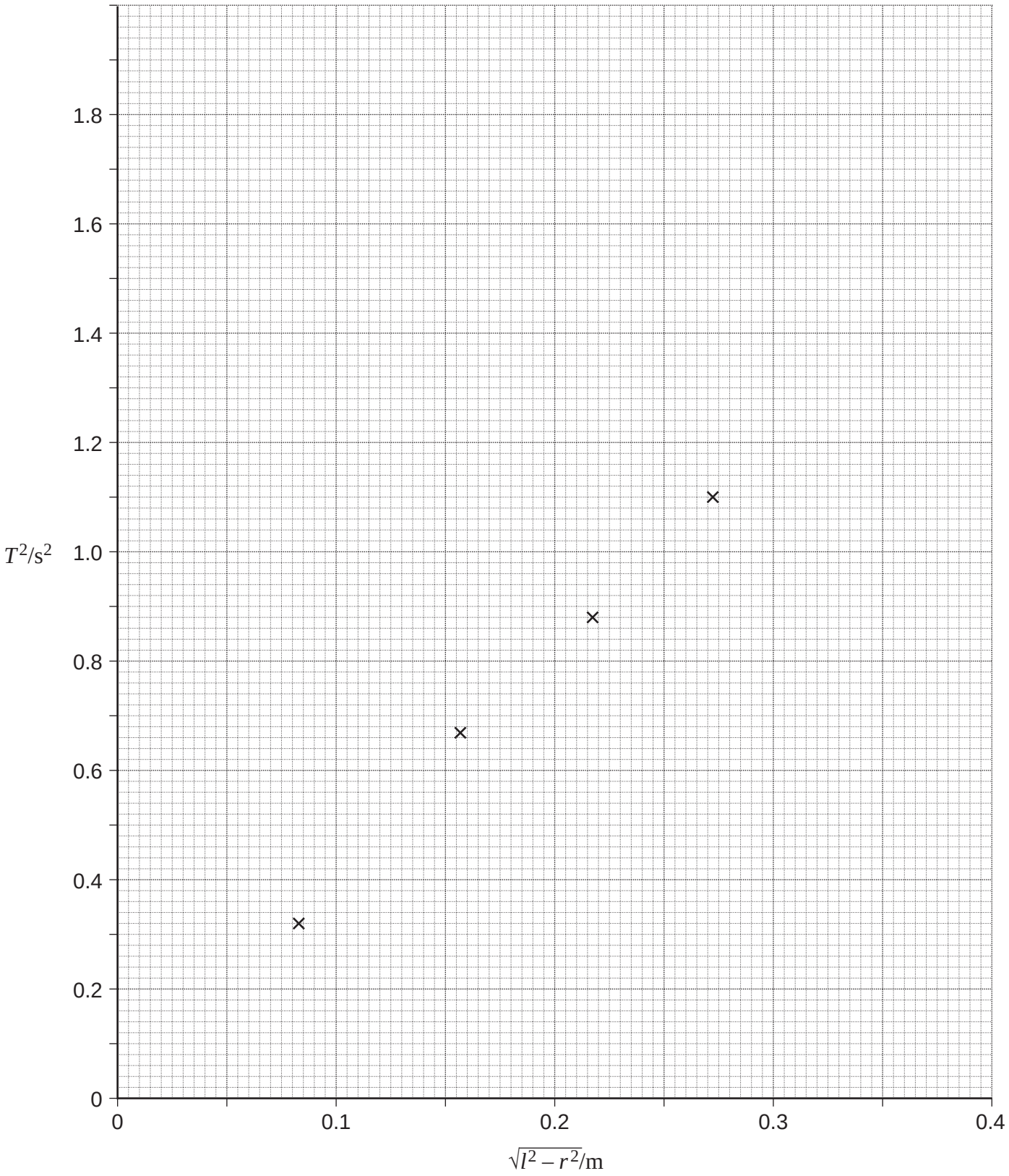
Figure 2



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2 (d) Use your answer to part 2(c) to determine T for the bob of this pendulum when $l = 0.500\,\text{m}$.

[2 marks]

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2 (e) (i) The relationship between T and l is given by

$$T^2 = \frac{4\pi^2}{g}\sqrt{l^2 - r^2}$$

where g is the acceleration due to gravity.

Use your answer to part 2(c) to find the value for the acceleration due to gravity.

[2 marks]

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2 (e) (ii) Referring to the graph, explain whether or not you think this is a reliable answer.

[1 mark]

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2 (e) (iii) Discuss, with reference to the measurement of T, whether a smaller uncertainty in the value of g would be obtained if the experiment were to be carried out with a pendulum of the same length and a smaller radius.

[2 marks]

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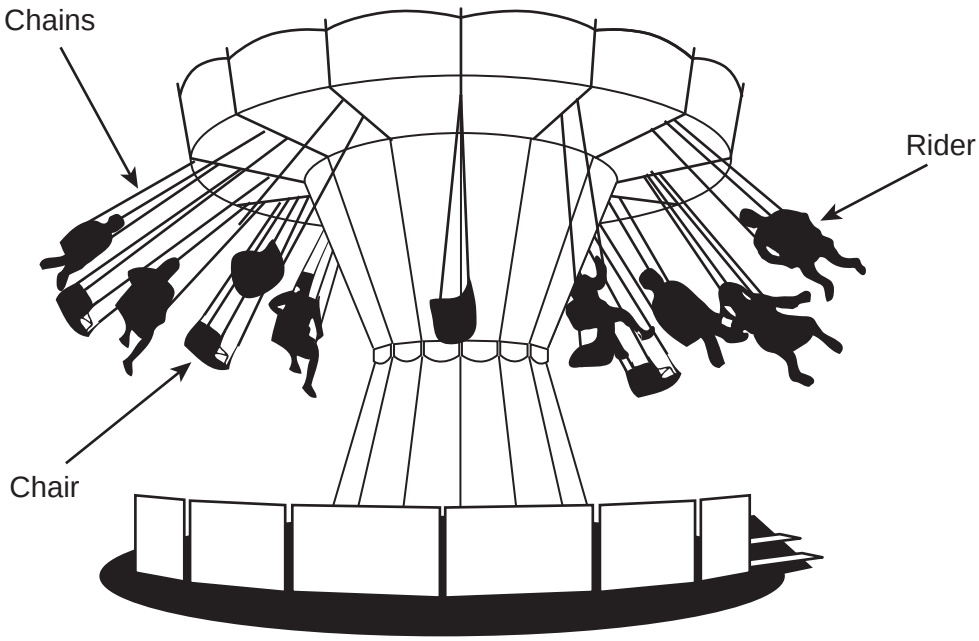
3 Circular motion forms the basis of many popular fairground rides such as the chair-o-plane shown in **Figure 3**.

Figure 3



3 (a) Explain why the empty chairs are swinging outwards at the same angle as those chairs with riders.

[2 marks]

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3 (b) Outline the measurements you would make to determine the speed of a rider around the circle under normal operating conditions.

[2 marks]

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3 (c) Suggest a safety test to check the strength of the chains supporting a newly-fitted chair before a rider is allowed to ride in it. The test is carried out when the ride is stationary. You may assume that the maximum angular speed of the ride is known.

[3 marks]

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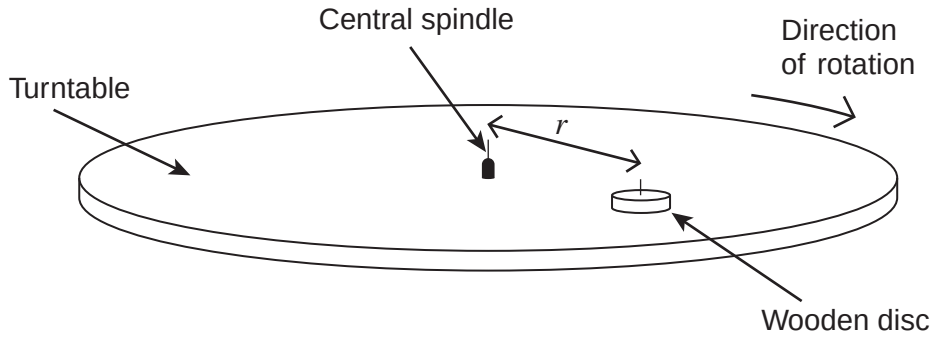
4 A student decides to use a turntable to investigate friction between a wooden disc and the surface of the turntable. **Figure 4** shows the turntable with the disc resting on it.

Figure 4



The turntable is flat and horizontal. When it rotates it does so at a known constant angular speed, ω.

The purpose of the investigation is to find out how the maximum frictional force, F_{max}, between the disc and the surface varies with the weight of the disc on the turntable.

F_{max} is the same at all points on the turntable for a particular disc weight. When the turntable is rotating the disc stays in place provided the centripetal force is less than F_{max}. This centripetal force can be calculated using $mr\omega^2$, where m is the mass of the disc and r is the distance of the centre of the disc from the centre of the turntable.

Describe how you would carry out this investigation, stating what extra apparatus you would need and how you would present your results.

[4 marks]

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Turn over ▶

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END OF QUESTIONS