Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
June 2009
Advanced Subsidiary Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

Physics
Unit 3 Investigative and Practical Skills in AS Physics **PHY3T/Q09/test**

Investigative Skills Assignment (ISA) Q
Written Test

For this paper you must have:
- a calculator
- a ruler
- a protractor
- your completed documentation from Stage 1.

For Teacher's Use		
		Mark
Stage 1		
Section A	**1**	
Section B	**2**	
	3	
	4	
TOTAL		

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided. Attach your documentation from Stage 1 to this booklet before handing it in to the invigilator at the end of the examination.
- Show all your working.
- Do all rough work in this booklet. Cross through any work that you do not want to be marked.

Information
- The marks for the questions are shown in brackets.
- The maximum mark for this paper and the practical task is 41.

SECTION A

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

1 (a) Apart from depth, name **one** other control variable.

.....

(1 mark)

1 (b) From your data, estimate the uncertainty in your largest time measurement.

.....

(1 mark)

1 (c) Use your uncertainty in part (b) to calculate the percentage uncertainty in your largest time measurement.

Answer .....

(1 mark)

1 (d) (i) From your readings, calculate the mean depth, h, of the water in the tray.

Answer .....

1 (d) (ii) State **one** possible source of experimental error in this measurement.

.....

1 (d) (iii) How could your value of the mean depth be made more accurate?

.....

.....

(3 marks)

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1 (e) (i) Use your results for average speed, c in m s^{-1}, and mean depth of water, h in m, to calculate $\frac{c^2}{h}$.

Answer .....

1 (e) (ii) State the unit for the calculated quantity in part (e) (i).

.....

(2 marks)

1 (f) State and explain what your graph suggests about the speed of the wave as it travels further.

.....

.....

(2 marks)

10

Turn over for the next question

SECTION B

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

2 A student performs an experiment similar to the one you have done and finds the speed of the wave, c, for different depths of water, h. A graph of c^2 against h is plotted. Four of the results are plotted on the graph on the next page. These four results and three more results are shown in the table below.

h_1/m	h_2/m	h_3/m	h_{mean}/m	c/m s^{-1}	c^2/m^2 s^{-2}
0.010	0.011	0.009	0.010	0.32	0.10
0.014	0.015	0.015	0.015	0.39	0.15
0.022	0.020	0.019	0.020	0.45	0.20
0.025	0.024	0.027	0.025	0.49	0.24
0.030	0.029	0.031		0.54	
0.034	0.035	0.035		0.59	
0.041	0.037	0.040		0.62	

2 (a) Complete the table by entering the h_{mean} and the c^2 values.

(2 marks)

2 (b) Plot the final three points on the graph and draw the line of best fit.

(3 marks)

2 (c) Find the gradient of the line.

Answer .....

(3 marks)

2 (d) What does the line indicate about the relationship between c^2 and h?

.....

.....

(1 mark)

2 (e) Theory suggests that the gradient of the line should equal the value of the acceleration due to gravity, 9.81 m s^{-2}. Calculate the percentage difference between your value and the accepted value. Comment on your value.

Answer .....

(2 marks)

11

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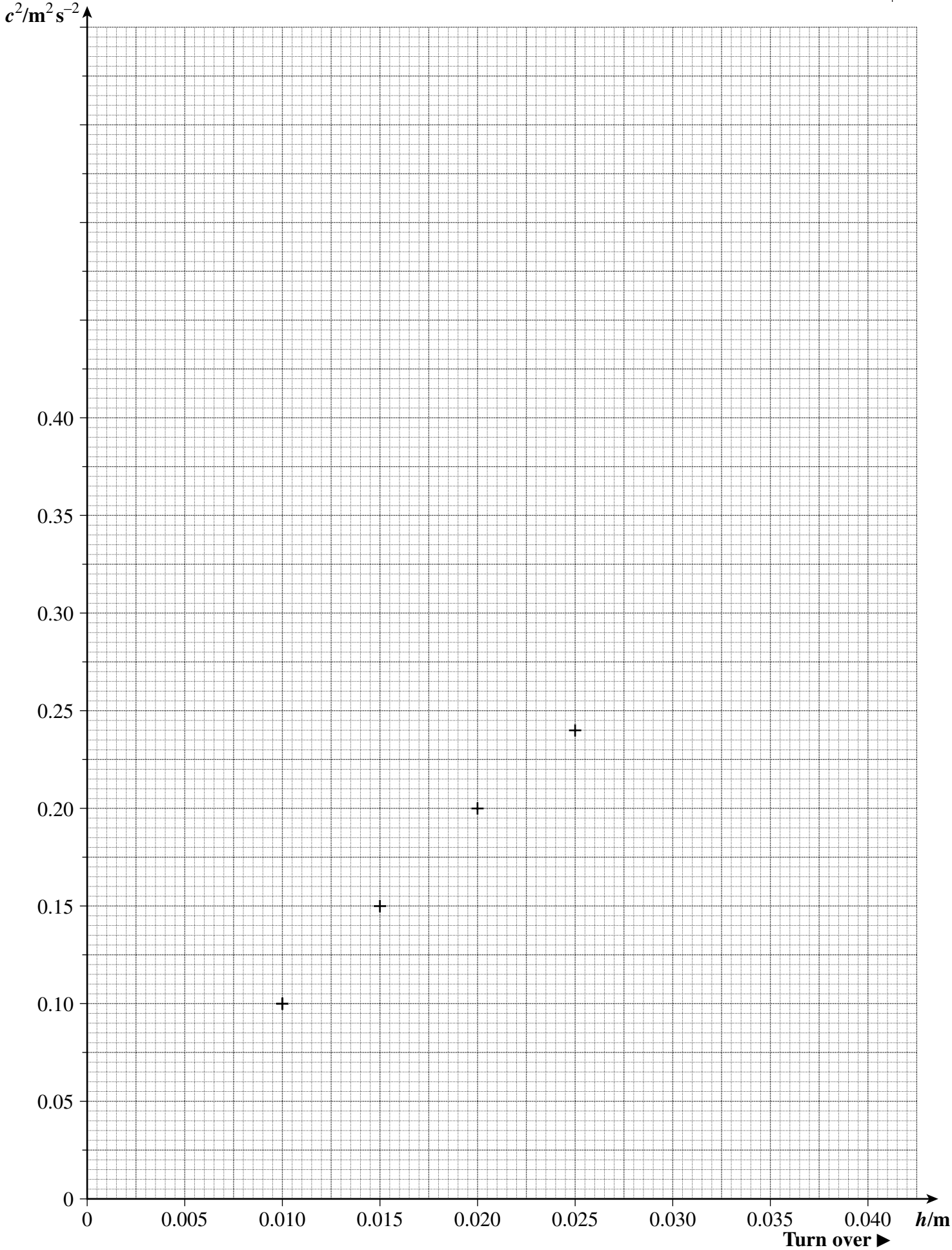
Graph to show the relationship between wavespeed squared and depth of water for waves in shallow water



Turn over ▶

3 (a) (i) From the spread of the repeat values of the **largest** depth measurements, estimate the uncertainty.

.....

.....

3 (a) (ii) What type of error leads to the spread of repeat values in each depth measurement?

.....

(2 marks)

3 (b) By inspection of the graph, comment on the reliability of the results.

.....

.....

(1 mark)

3 (c) In another experiment a student estimates that the maximum uncertainty in the wave speed, c, is 6 %. The smallest depth, h, of 10 mm has an uncertainty of ±1 mm.

3 (c) (i) What is the percentage uncertainty in the calculated value of c^2?

Answer .....

3 (c) (ii) The value of the acceleration due to gravity is given by the formula

$$g = \frac{c^2}{h}$$

State and explain which quantity contributes the greater uncertainty in the value of g.

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.....

(3 marks)

6

4 Describe in detail how you would investigate whether or not the relationship between c^2 and h holds for depths greater than 40 mm. Your answer should include any modifications or improvements.

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(4 marks)

4

END OF QUESTIONS

There are no questions printed on this page