Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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

General Certificate of Education
Advanced Subsidiary Examination
June 2010

Physics PHY3T/P10/test

Unit 3 Investigative and Practical Skills in AS Physics

Investigative Skills Assignment (ISA) P

Written Test

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

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.
- You must answer the questions in the spaces provided. Attach your documentation from Stage 1 to this booklet before handing it to the invigilator at the end of the examination**.**
- Show all your working.
- Do all rough work in this booklet. Cross through any work you do not want to be marked.

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

Signature of Teacher marking the ISA ..... 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) State the uncertainty in your measured angles of incidence.

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(1 mark)

1 (b) (i) Use your readings to estimate the uncertainty in your largest angle of refraction.

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.....

1 (b) (ii) Calculate the percentage uncertainty in the **largest** angle of refraction.

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(2 marks)

1 (c) Give **two** reasons why the percentage uncertainty in the angles of refraction might be expected to be larger than in the angles of incidence.

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(2 marks)

1 (d) Explain what your graph indicates about the relationship between $\sin\theta_2$ and $\sin\theta_1$.

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(2 marks)

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1 (e) The general equation of a straight line graph is $y = mx + c$.
The law of refraction states that $n_2 \sin\theta_2 = n_1 \sin\theta_1$
By rearranging the equation of the law, show that the graph is predicted to be a straight line.

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(1 mark)

1 (f) What does the gradient of the graph represent?

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(1 mark)

1 (g) It has been suggested that angles can be measured more accurately by measuring distances. Explain, using a diagram, how this could be done.

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(2 marks)

11

Turn over for the next question

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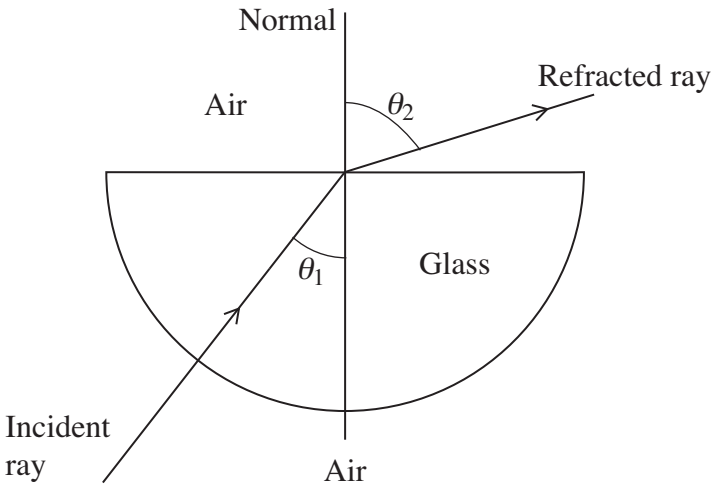
Section B

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

2 In an experiment with a semi-circular glass block, a narrow beam of white light which has passed through a red filter is incident radially on the curved face, so that there is no deviation at the curved face.



A student measures the angle of incidence in the glass at the plane surface, and the angle of refraction in the air.
The results are shown in the table below.

Angle of incidence, θ_1 / °	**Angle of refraction, θ_2 / °**	**$\sin\theta_1$**	**$\sin\theta_2$**
0.0	0.0	0.0	0.0
5.0	8.0	0.087	0.139
10.0	18.5	0.174	0.317
15.0	25.5	0.259	0.431
20.0	35.5	0.342	0.581
25.0	46.0	0.423	
30.0	58.0	0.500	
35.0	77.0	0.574	

2 (a) What is the independent variable in this experiment?

.....

(1 mark)

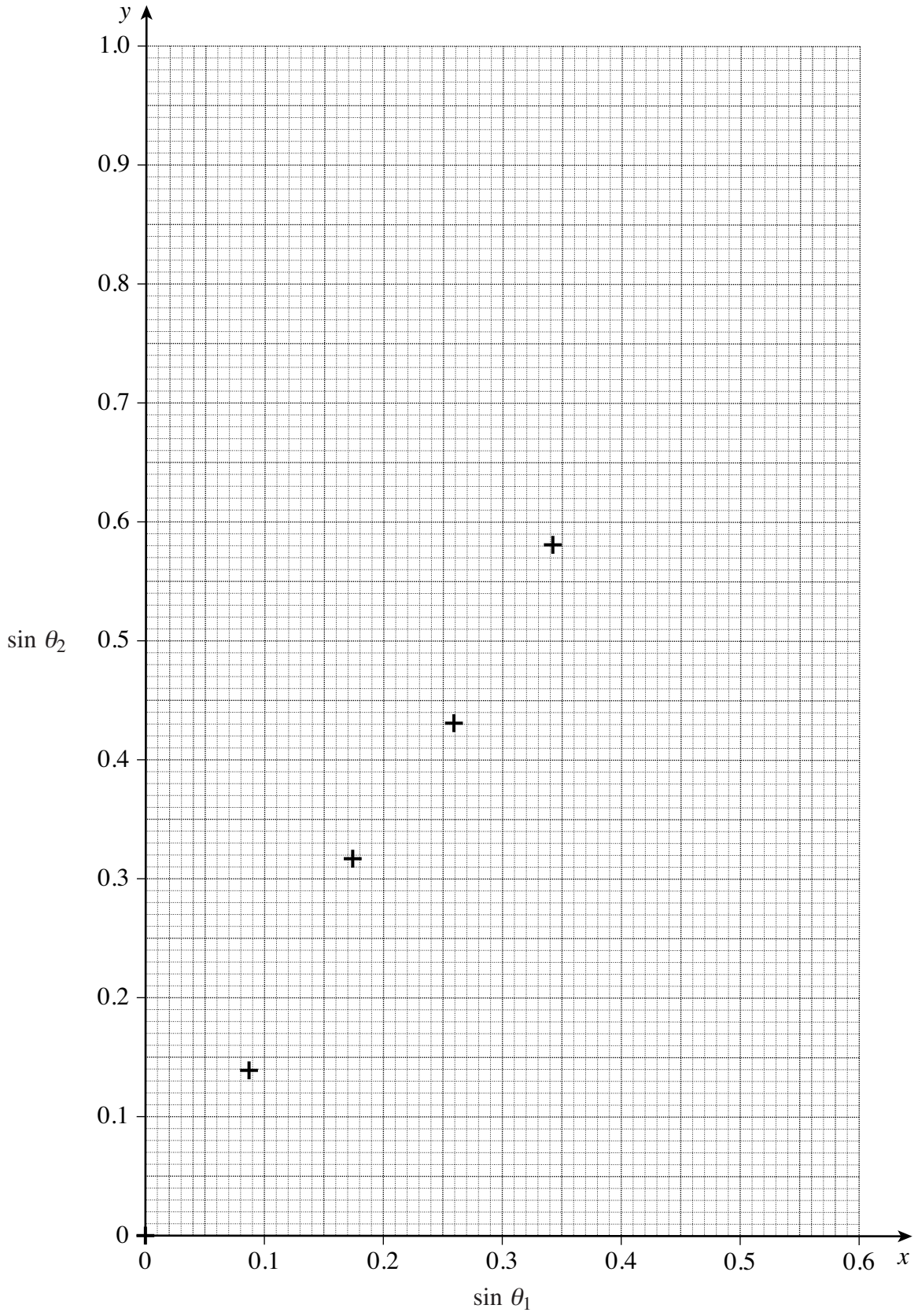
2 (b) Complete the table.

(1 mark)

2 (c) Complete the graph on page 5 by plotting the three remaining points and draw a best fit straight line.

(2 marks)

Graph of sin θ_2 against sin θ_1



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2 (d) Measure the gradient of your graph.

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(3 marks)

2 (e) The absolute value of refractive index, n, is given by the equation $\sin\theta_c = \frac{1}{n}$,

where θ_c = the critical angle for glass.
Use the gradient of your graph to determine the critical angle for this type of glass.

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(2 marks)

2 (f) Explain why there would be no refraction for an angle of incidence of 40°.

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(2 marks)

11

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3 The angles are measured using a protractor to a precision of $\pm 0.5^{o}$.

3 (a) (i) For an angle, θ, measured to be 20.0^{o}, what are the maximum and minimum values of the angle, θ ?

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.....

3 (a) (ii) Calculate the corresponding range of the values of $\sin\theta$.

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(2 marks)

3 (b) What is the resulting percentage uncertainty in $\sin\theta$?

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(1 mark)

3 (c) The experiment is repeated using violet light instead of red light.
The refractive index from air to the glass is 1.80 for violet light.
For the angle of incidence of 20.0^{o}, show that the angle of refraction for violet light is 38.0^{o}.

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(1 mark)

3 (d) The angle of refraction for red light was 35.5^{o}. Discuss whether this change in angle of refraction is measurable with the equipment used.

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(2 marks)

6

Turn over for the next question

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4 It is suggested that using a laser instead of a white light source with filters will produce a more reliable value for the refractive index.

4 (a) Suggest **two** advantages of using a laser.

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(2 marks)

4 (b) Suggest **one** difficulty or disadvantage which might be encountered.

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(1 mark)

3

END OF QUESTIONS