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 2013

Physics (Specification A & B) PHY6T/P13/test

Unit 6T A2 Investigative Skills Assignment (ISA) P

For submission by 15 May 2013

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 .....

Section A

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

1 (a) Name **two** physical quantities concerning the enclosed sample of air which must remain constant during this experiment.

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(1 mark)

1 (b) State the measurement that would be required for you to determine the internal cross-sectional area of the syringe more precisely. Suggest a suitable instrument.

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(2 marks)

1 (c) (i) Estimate the percentage uncertainty in your largest measurement of L.

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1 (c) (ii) A student doing a similar experiment measures the diameter of the bore of the syringe to be 12.2 ± 0.1 mm and the unloaded length L to be 55 ± 2 mm.

Use these results to calculate the volume of the air in the unloaded syringe and the uncertainty in this volume. (Given that $V = \pi r^2 h$ from the physics data sheet).

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Volume..... ± .....

1 (c) (iii) There may be a difference between the actual volume of air inside the syringe and the volume calculated in this way. Suggest what the source of this difference might be and name the type of error it might cause.

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(7 marks)

1 (d) It can be shown that

$$F = \frac{k}{L}$$

where k is a constant.

Explain how you could use your graph to confirm the above equation.

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(3 marks)

1 (e) A student suggests that, with the same volume of air, a longer thinner syringe would be an advantage in this experiment. Discuss whether you agree with this suggestion.

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(2 marks)

1 (f) (i) Describe how you would adapt your apparatus to investigate how the volume of air in the syringe varies when the pressure of the trapped air is increased above atmospheric pressure. You can draw a diagram to illustrate your answer.

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1 (f) (ii) Write an expression for the pressure, p, of the air in terms of p_0, A, M and g, where g is the gravitational field strength.

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(2 marks)

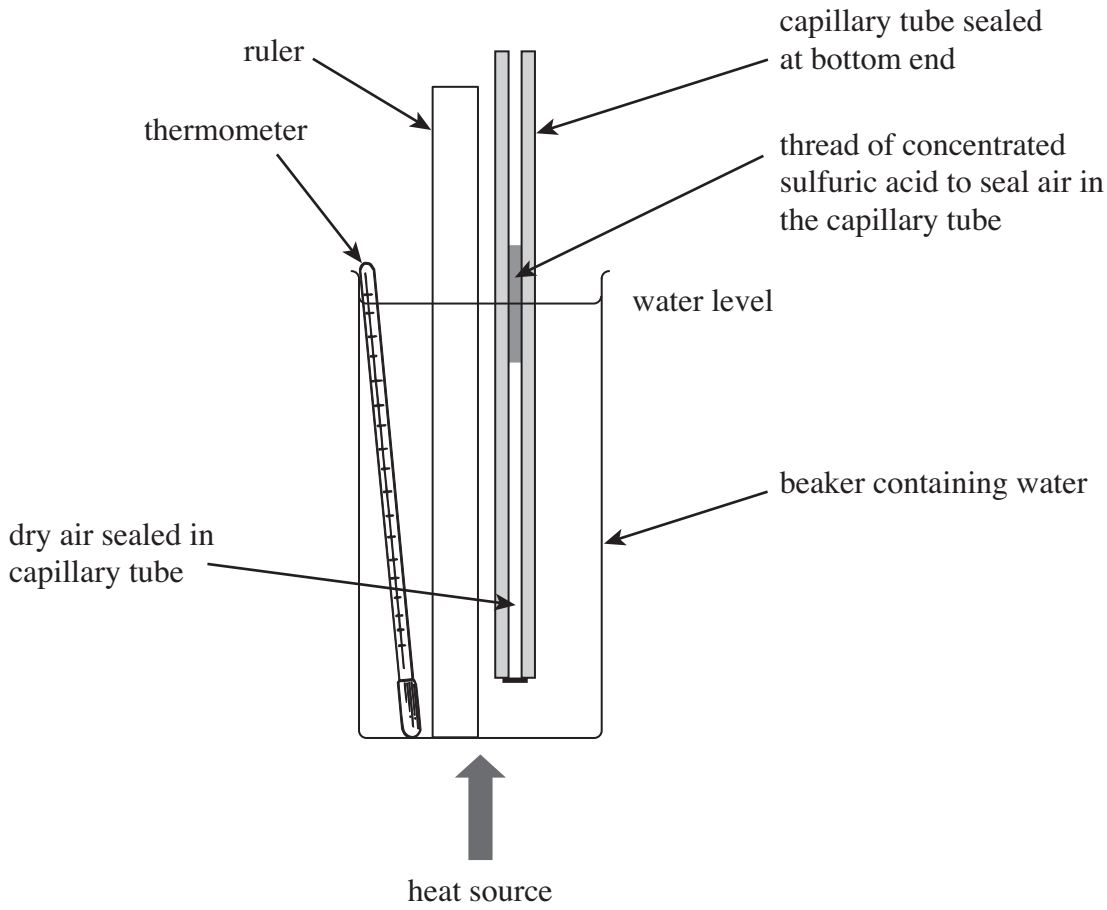
17

Section B

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

2 A student performs an experiment to investigate the relationship between the volume of a gas and the temperature using the apparatus shown in **Figure 1**.

Figure 1



The results of the student's experiment are shown in the table.

temperature / °C	length of air in tube / mm			mean length / mm	volume of air / mm^3
	1st reading	2nd reading	3rd reading		
0	105	103	107	105	116
15	115	115	112	114	125
28	119	115	117	117	129
43	123	125	124	124	136
58	133	127	130	130	143
72	137	134	134	135	149
86	142	140	136		
98	144	147	145		

2 (a) Complete the table on page 5. *(1 mark)*

2 (b) Complete the graph on page 7 by plotting the remaining two points. Draw an appropriate straight line.

(2 marks)

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

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G = ...

(3 marks)

2 (d) Using information from the graph, calculate the temperature at which the volume of the gas would theoretically become zero.

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Temperature = ...

(2 marks)

2 (e) Deduce from the graph what the relationship is between the volume of gas and the temperature in degrees Celsius.

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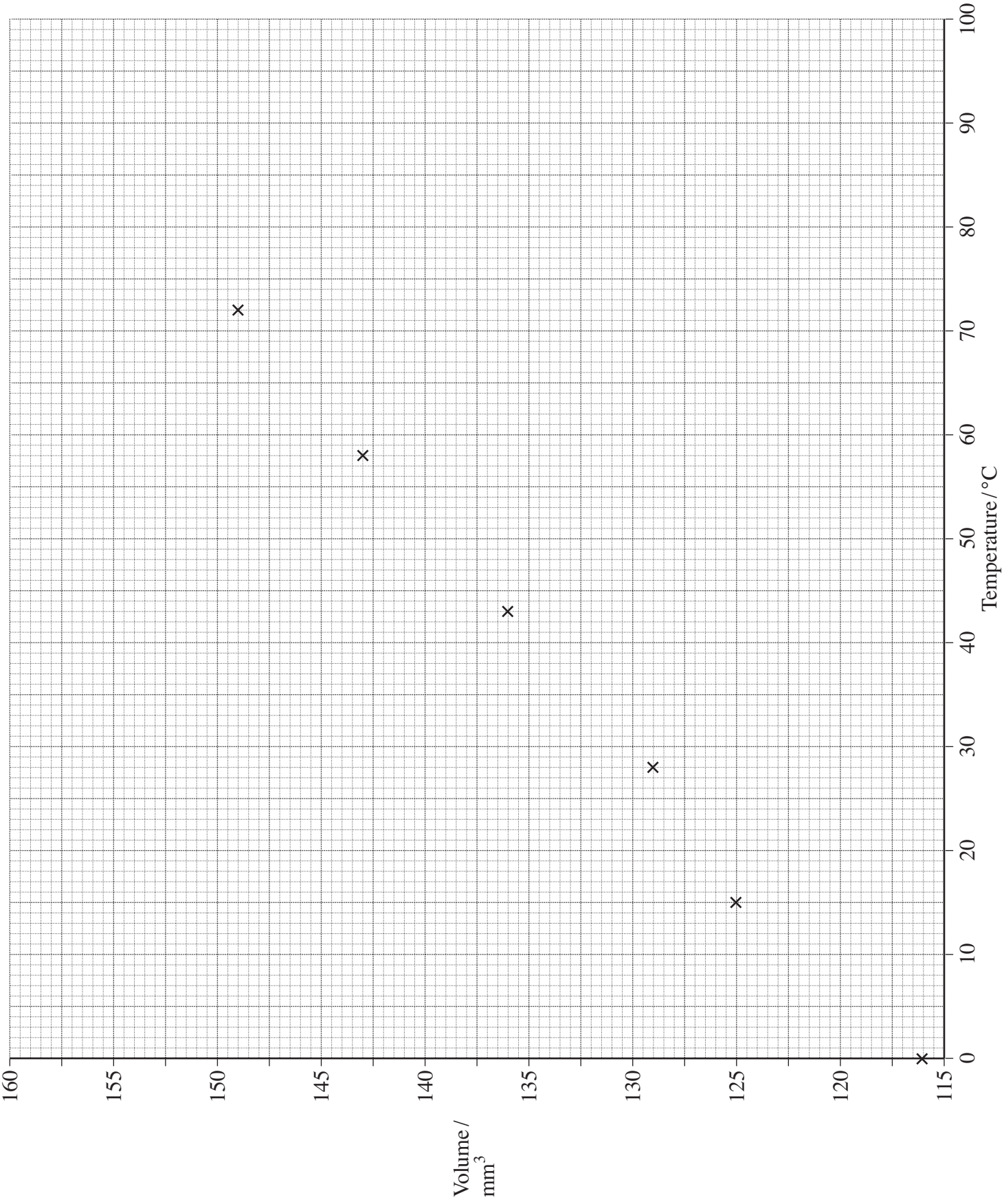
(1 mark)

Graph of volume against temperature for air in capillary tube.



2 (f) State and explain how the graph would differ if the initial length of air trapped in the capillary tube was halved.

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(3 marks)

12

3 The dimensions of a car tyre do not change significantly when the temperature of the air inside the tyre increases. A tyre manufacturer wants to investigate how the change in temperature will affect the pressure of air in car tyres.

To model the car tyre you are provided with a plastic syringe of similar type to the one used in your experiment, with an internal cross-sectional area of approximately $2\,cm^2$ and volume of $10\,cm^3$, and any other laboratory equipment.

Explain how you might carry out this investigation using the syringe. You should indicate how your results might be analysed.

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(5 marks)

5

END OF QUESTIONS