Bishop Heber High School
Advanced Level Preparation
March 2013

# Physics (Specification A & B) PHY6T/PREP/test

## Unit 6T A2 Investigative Skills Assignment (ISA) P

**Not for submission**

**For this paper you must have:**

- your documentation from Stage 1
- a ruler with millimetre measurement
- a calculator

**Time allowed**

- 1 hour

**Instructions**

- answer **all** questions
- 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

## 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)*

(b) How could you measure the internal cross-sectional area of the syringe more precisely?

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*(2 marks)*

(c) i. Work out the percentage uncertainty in your largest measurement of $L$.

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ii. A student doing a similar experiment measures the diameter of the bore of the syringe to be $11.3 \pm 0.1$ mm and the unloaded length $L$ to be $64 \pm 2$ mm.
Use these results to calculate the volume of 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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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)*

(d) It can be shown that

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

where $k$ is a constant.
Explain how you could use your graph to show this.

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*(3 marks)*

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

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*(2 marks)*

(f) i. Describe how you could adapt your experiment and apparatus to find out how the volume of air in the syringe varies as the pressure of the trapped air is decreased below atmospheric pressure. You can draw a diagram to illustrate your answer.

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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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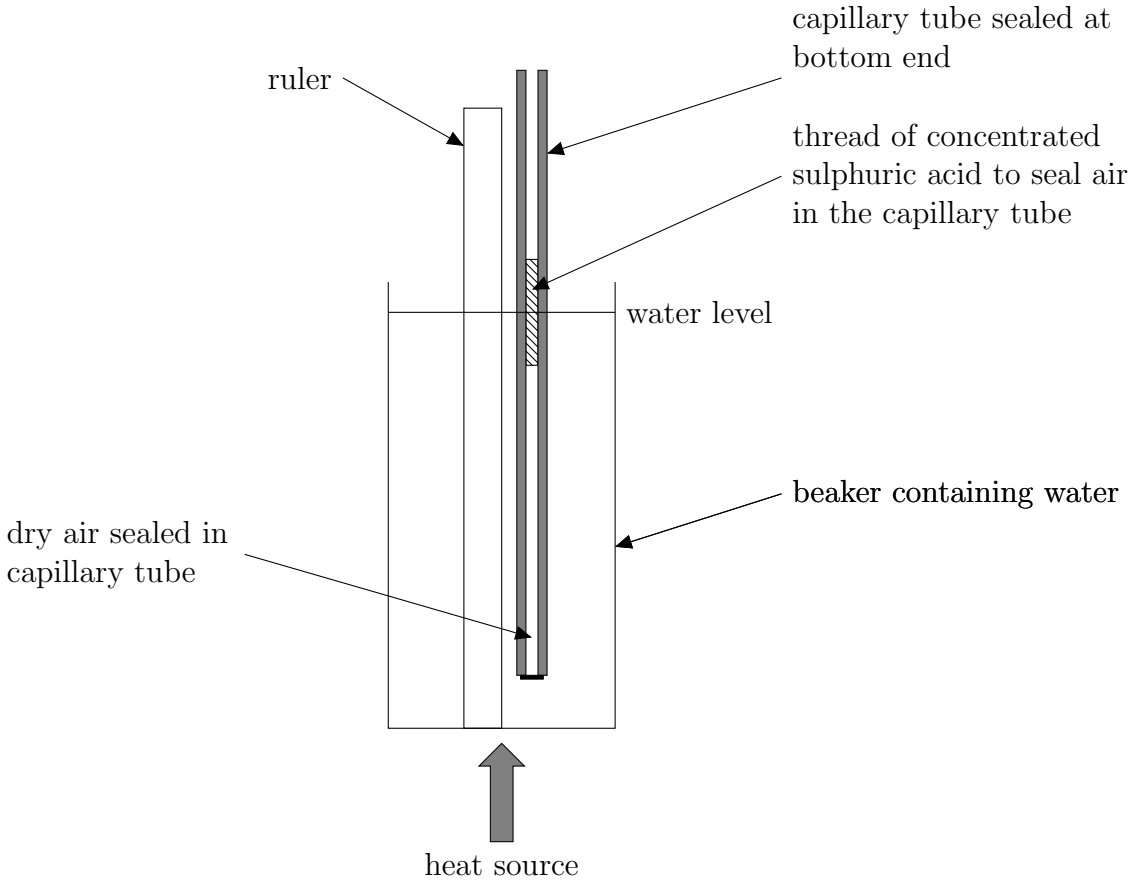
*(2 marks)*

## 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 we used last week, shown below in **Figure 1**.

**Figure 1**




The results of Lauren'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 | | |
| 25 | 150 | 151 | 151 | 121 |
| 35 | 156 | 156 | 156 | 125 |
| 45 | 159 | 160 | 160 | 128 |
| 55 | 163 | 163 | 163 | 130 |
| 65 | 166 | 166 | 166 | 133 |
| 75 | 169 | 167 | 168 | 134 |
| 85 | 172 | 168 | | |
| 95 | 170 | 172 | | |

(a) Complete the table. *(1 mark)*

(b) Complete the graph by plotting the two remaining points. Draw an appropriate line of best fit. *(2 marks)*

(c) Determine the gradient $G$ of your line.

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(d) Using your line of best fit and its gradient, calculate the temperature at which the volume of the gas would theoretically become zero.

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*(2 marks)*

(e) What relationship does your graph show between the volume of gas and the temperature in degrees Celsius?

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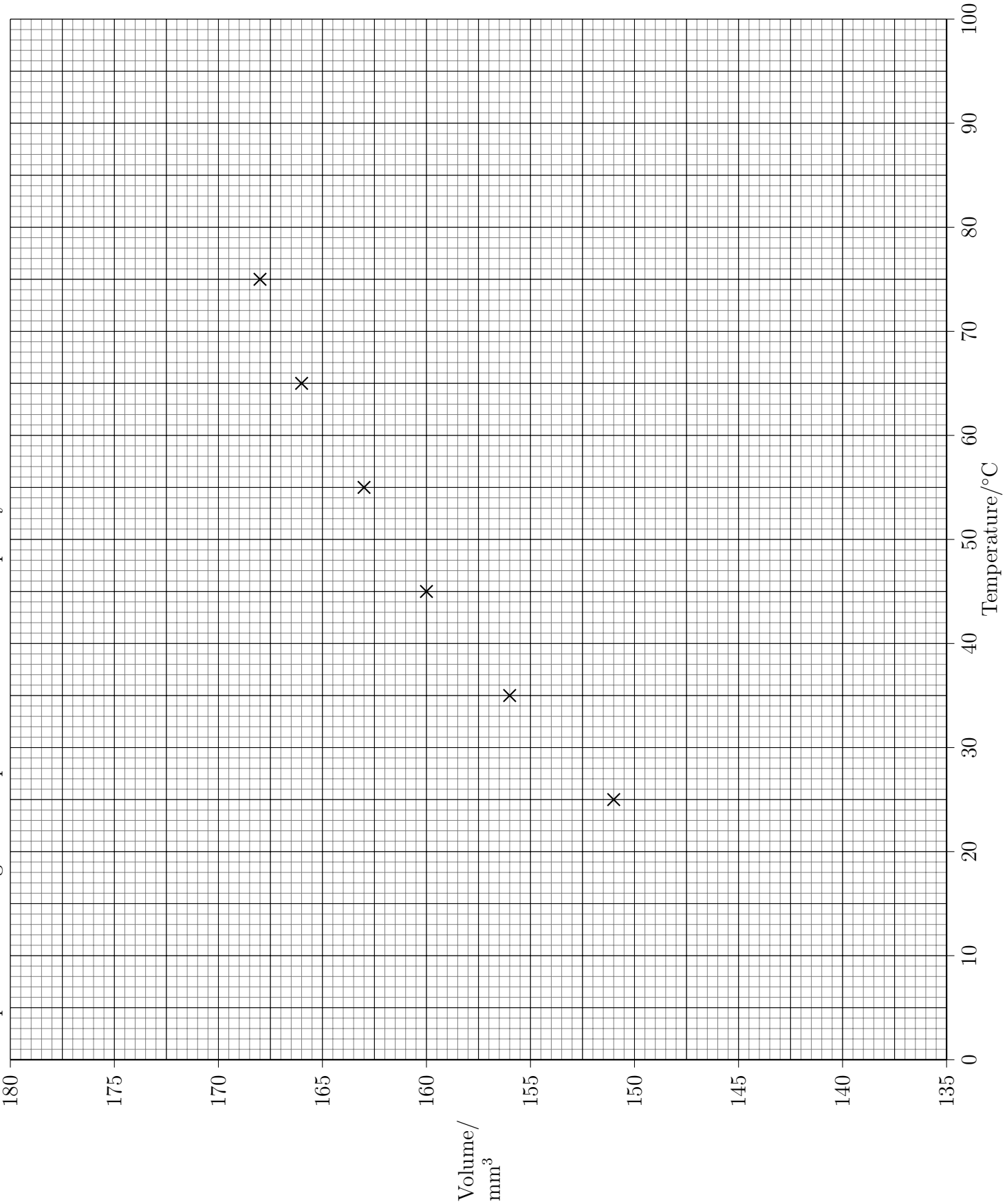
*(1 mark)*

Graph of volume against temperature for air in a capillary tube.



(f) How would the graph change if the initial length of air in the capillary tube were doubled? Explain your answer.

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*(3 marks)*