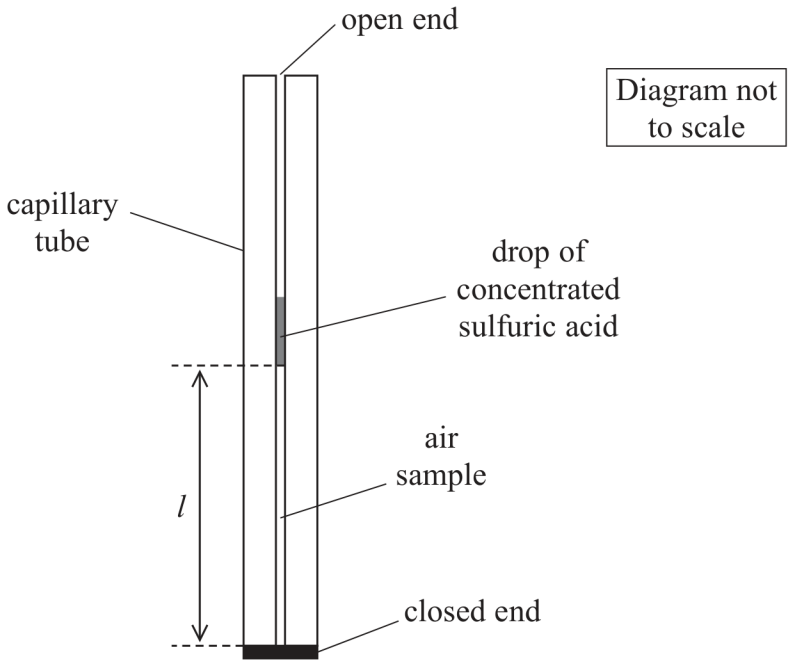
**Answer ALL questions.**

**1** A student investigated the relationship between the length $l$ of a column of air and its temperature $\theta$ using the apparatus shown.




A sample of air is trapped inside the tube between the closed end and the drop of concentrated sulfuric acid.

(a) Suggest why one end of the tube is left open.

**(1)**

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(b) The student suggested placing the apparatus in a beaker of boiling water and allowing the water to cool. Boiling water is a hazard.

Explain one other reason why this method may be hazardous.

**(2)**

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(c) The capillary tube was attached to a 30 cm ruler and placed in a beaker of water at room temperature. The water was heated gradually and $\theta$ was measured using a thermometer.

(i) State two techniques that should be used to ensure the measurement of $\theta$ is as accurate as possible.

**(2)**

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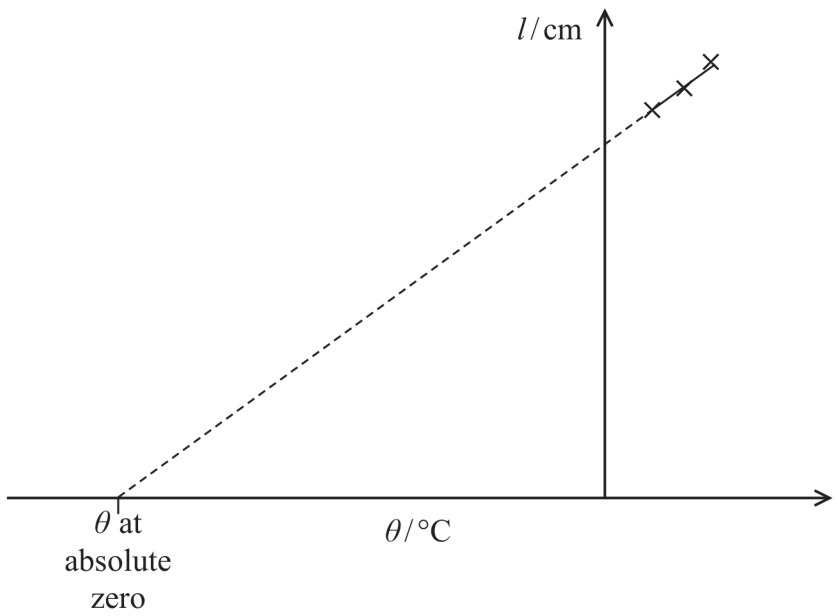
(ii) The student recorded the following measurements.

| $\theta$ / °C | $l$ / cm |
|---|---|
| 19.0 | 16.0 |
| 35.0 | 16.9 |
| 49.0 | 17.7 |

The student predicted that a graph of $l$ against $\theta$ could be used to estimate a value for $\theta$ at absolute zero as shown.



Discuss whether the student's measurements would lead to an accurate value of $\theta$ at absolute zero.

**(3)**

**(Total for Question 1 = 8 marks)**