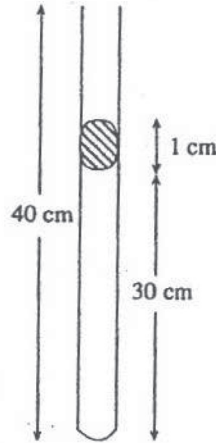


1999 A/L Structured Essay Question No (02)

A student is given a narrow glass tube closed at one end having an air column trapped by a small mercury thread, as shown in the figure. The lengths of the air column and mercury thread at room temperature are shown in the figure. Student is asked to measure the variation of the length of the air column ( $l$ ) with the temperature ( $\theta$ ) when the tube is held vertically.



- (a) Suppose three separate water baths of heights 10 cm, 30 cm and 50 cm are available in the laboratory. Which bath is most suitable for this experiment?

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- (b) In order to ensure that the measured temperature of the water is the temperature of the air column, what experimental procedure should he follow?

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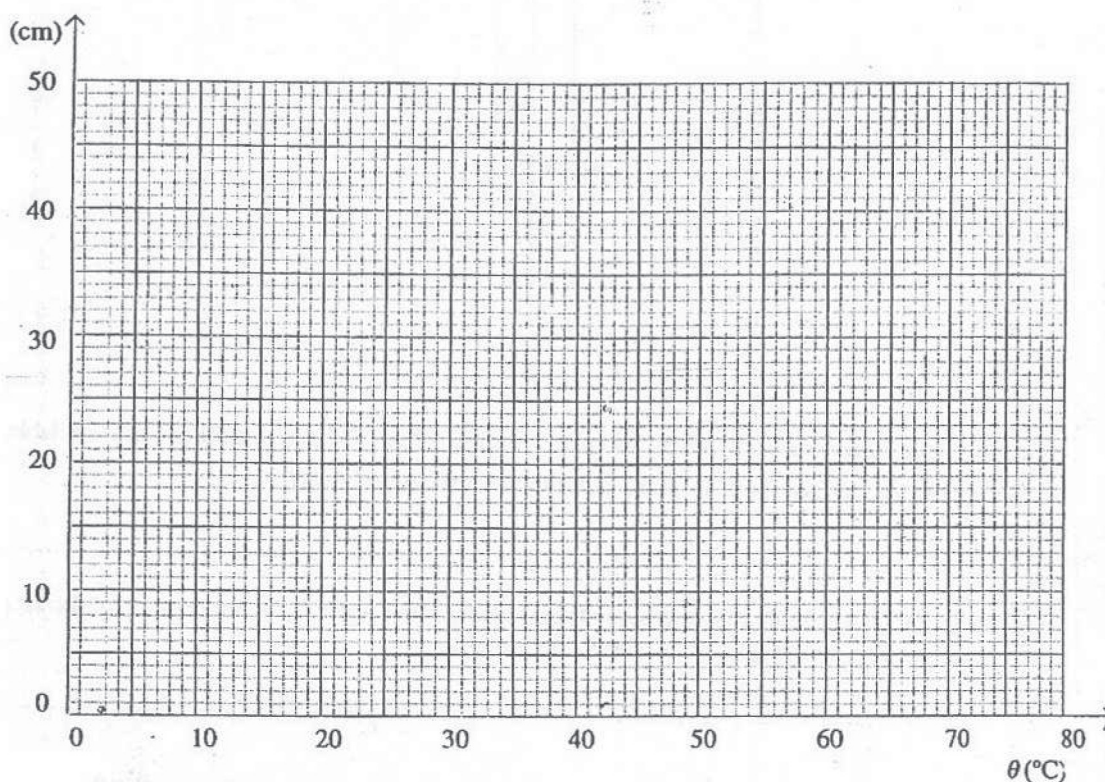
- (c) As the temperature is increased mercury thread will also expand. Can the student assume that the pressure of the air column remains constant? Explain your answer.

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(d) The following data were obtained by the student for  $\theta$  and  $l$ .

$\theta$ ( $^{\circ}\text{C}$ )	30	40	50	60	70	80
$l$ (cm)	30	31	32	33	34	35

(i) Plot the graph  $l$  vs  $\theta$  selecting  $0^{\circ}\text{C}$  and  $0$  cm as the origin.



(ii) Determine the intercept of the graph on the  $l$  axis.

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(iii) Calculate the gradient of the graph.

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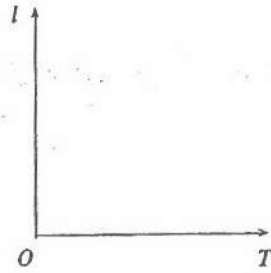
(iv) Use the above results to calculate the absolute zero temperature in Celsius.

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(e) Draw a rough sketch to show the variation of  $l$  with the absolute temperature  $T$ .



(f) State the gas law which is verified by the graph in (e).

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