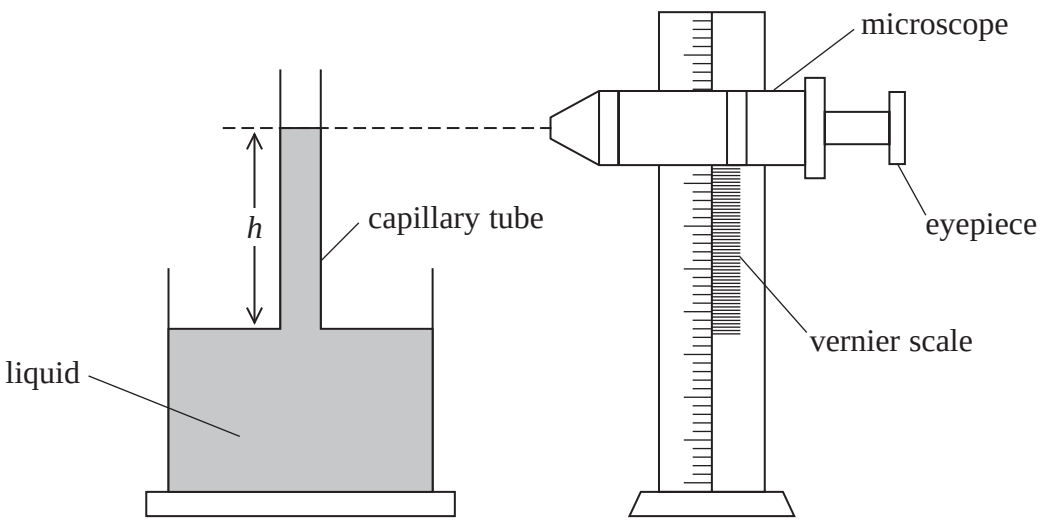
5 A student measured the height h of a liquid column in a capillary tube. She used a travelling microscope to make measurements of the positions of the top and bottom of the liquid column.

The travelling microscope consists of a simple microscope that can be moved vertically along a vernier scale.



(a) The student used a capillary tube with an internal radius r equal to 0.10 mm and recorded the following readings from the vernier scale.

Bottom of liquid column / cm	**Top of liquid column / cm**
12.00	27.10

(i) State the uncertainty in each of these readings.

(1)

(ii) Calculate the percentage uncertainty in the student's value of h.

(2)

Percentage uncertainty in h = ...

(iii) The student repeated the measurement of h for capillary tubes of different radii.

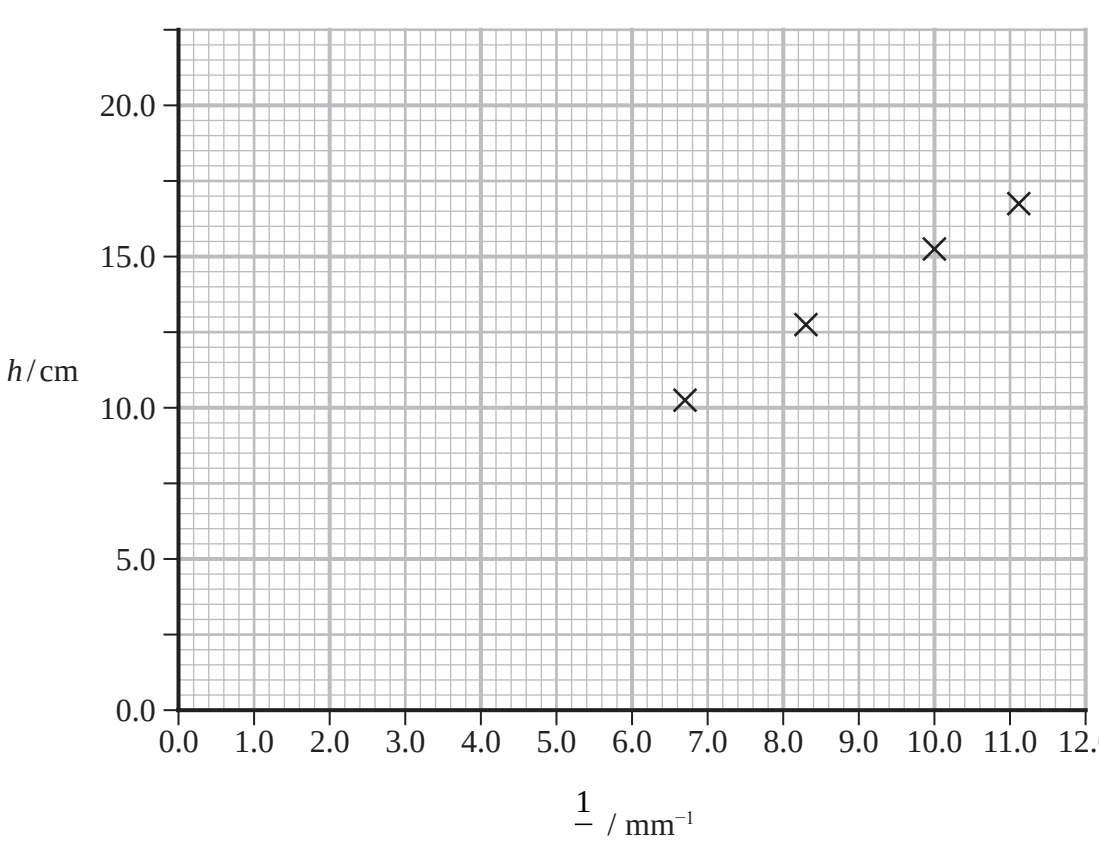
The table shows the student's final data.

r / mm	$1/r$	h / cm
0.09	11.1	16.56
0.10	10.0	15.1
0.12	8.3	12.6
0.15	6.7	10.33

Criticise the student's recording of the data.

(2)

(b) The student plotted the following graph.



(i) Determine the height of the liquid column that the student could expect for a tube with an internal radius of 0.11 mm.

(3)

Height of liquid column = ...

(ii) In her notes it stated that

$$h = \frac{k}{r} \qquad \text{where } k \text{ is constant}$$

Assess the extent to which the student's data supports this relationship.

(4)

(Total for Question 5 = 12 marks)