2 A student determined the speed of sound in air using a standing wave.

The student used a tuning fork to create a sound wave in the column of air inside a plastic tube. He placed the plastic tube into a measuring cylinder of water so he could adjust the length l of the column of air.

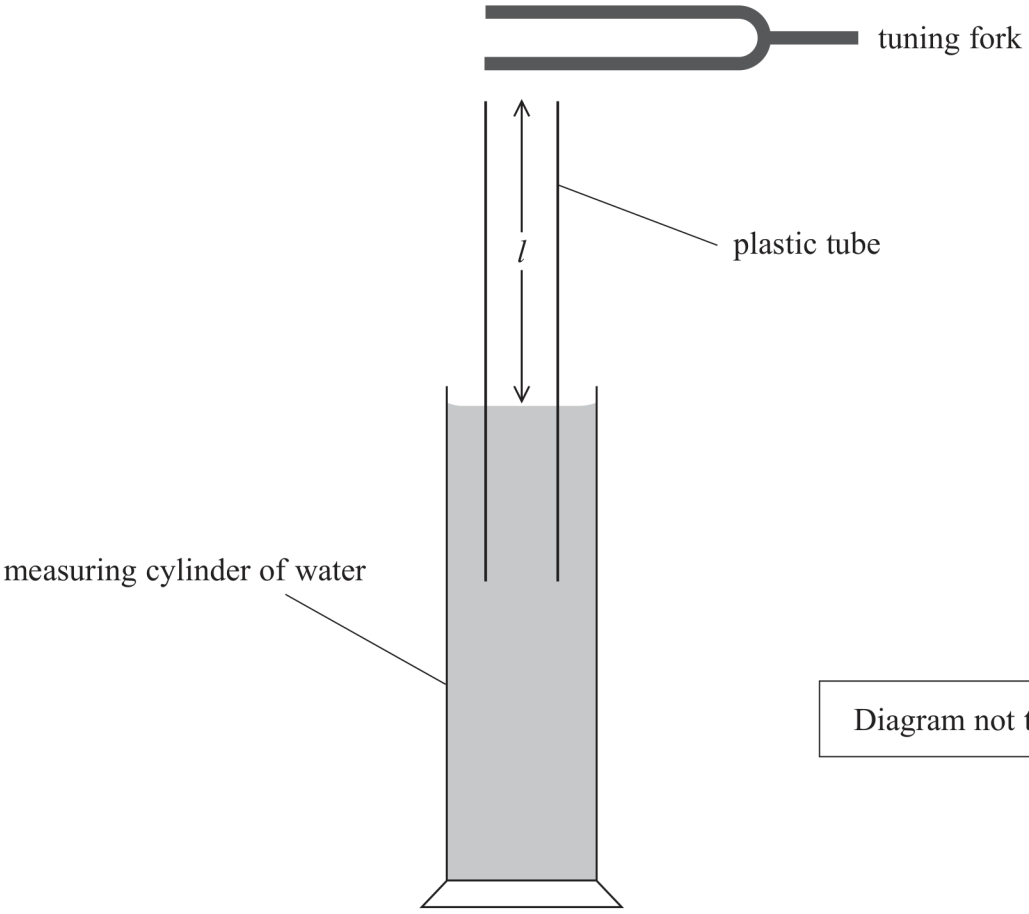

Diagram not to scale

The student adjusted l until the loudest sound was heard, indicating that a standing wave had formed. He marked the water level on the plastic tube and measured l.

He repeated this process several times and recorded the results.

l / cm	18.4	18.0	19.2	19.4	19.2

(a) Suggest two reasons for the variation in the lengths the student measured.

(2)

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(b) (i) Calculate the mean value of l.

(2)

Mean value of l = ...

(ii) Calculate the percentage uncertainty in l.

(2)

Percentage uncertainty = ...

(c) The frequency of the tuning fork was 440 Hz. The standing wave produced had a wavelength $4l$.

Calculate the speed of sound in air.

(2)

Speed of sound = ...

(d) The percentage uncertainty in the student's value for the speed of sound is equal to the percentage uncertainty in l.

The accepted value for the speed of sound in air is 343 m s^{-1}.

Comment on whether the student's value is consistent with the accepted value for the speed of sound in air.

(2)

(Total for Question 2 = 10 marks)