5 A sonometer is a piece of equipment used to investigate the frequency of waves on a string.

The photograph shows a sonometer.

bridge   string

length of string
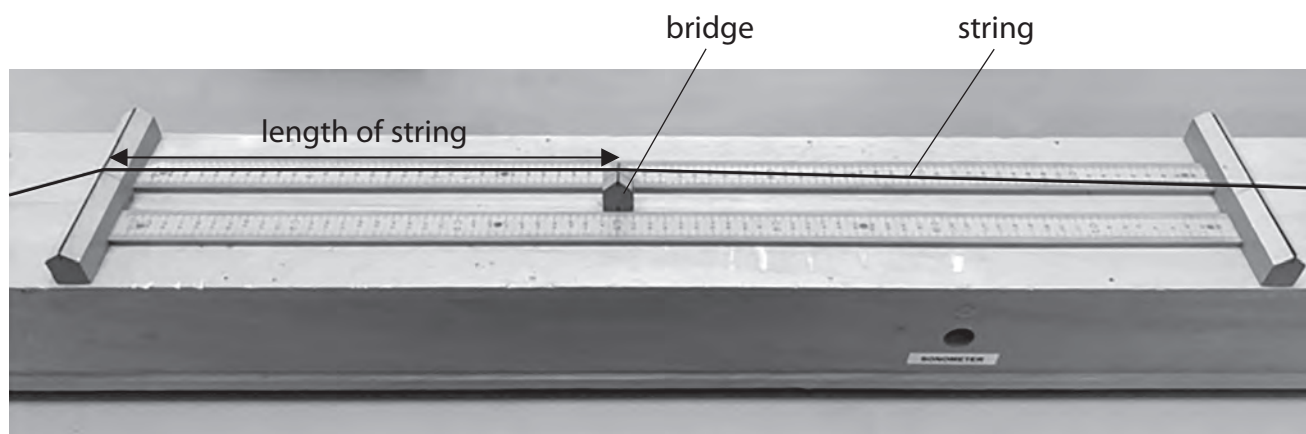
The string is under tension. When the string is plucked it vibrates to produce a sound wave.

(a) Describe how an oscilloscope should be used to measure the frequency of the sound wave from the sonometer.

(4)

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(b) A student investigates how the frequency of sound from the sonometer varies with the length of the string.

This is the student's method.

- apply a constant tension force to the string
- pluck the string and measure the frequency of the sound wave produced
- move the bridge to change the length of the string
- pluck the string and measure the new frequency of the sound wave produced

Repeat the method for different lengths of string.

(i) Give a control variable for the student's investigation.

(1)

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(ii) The table shows the student's results.

String length in cm	Frequency in Hz			
	Test 1	Test 2	Test 3	Mean
20	105	104	108	106
40	53	54	52	53
60	36	32	35	
80	25	28	26	26
100	22	20	21	21
120	20	17	18	18
140	15	15	14	15

Calculate the mean frequency for a string length of 60 cm.

(2)

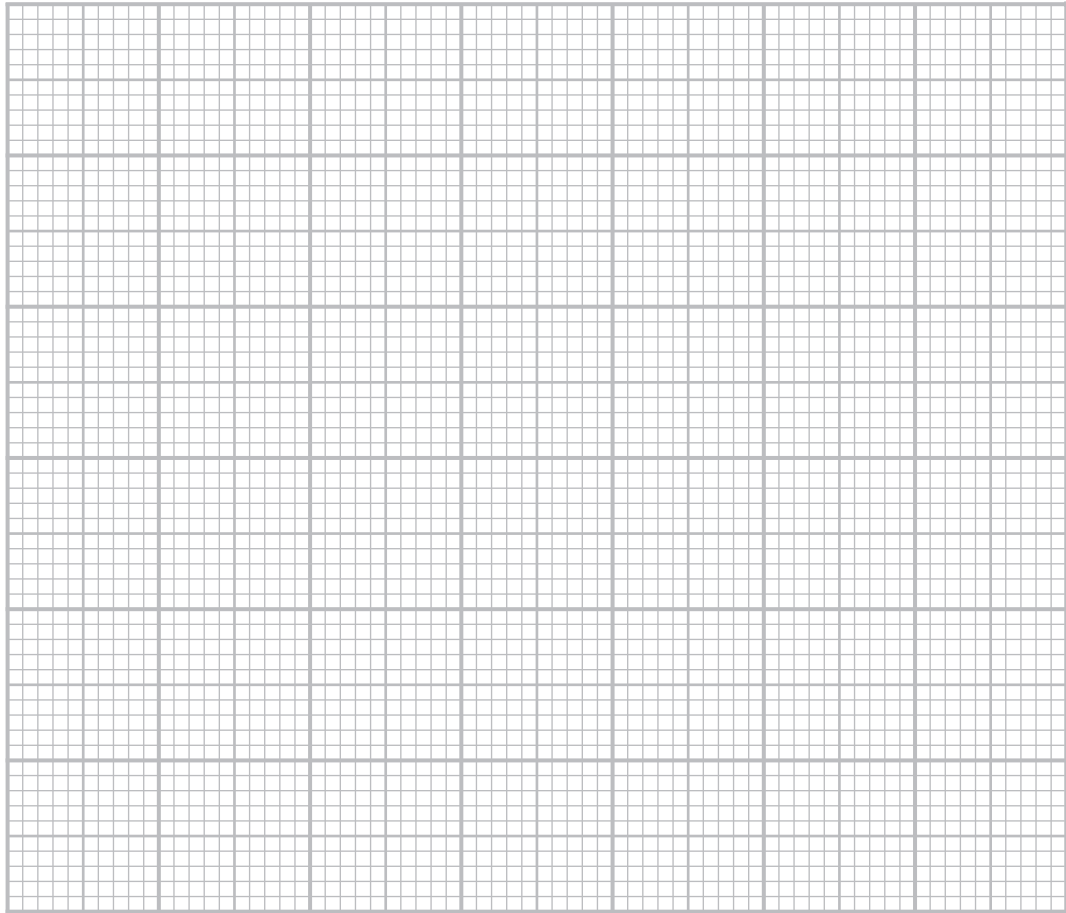mean frequency = ... Hz

(iii) Plot a graph of the mean frequency and string length data on the grid.

(3)

(iv) Draw the curve of best fit.

(1)

(v) Determine the string length needed to produce a sound wave of frequency 75 Hz.

(1)

string length = ... cm

(vi) The student cannot hear the sound from the sonometer for some of the string lengths tested.

Explain which of the string lengths produce sounds that humans cannot hear.

(2)

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(Total for Question 5 = 14 marks)