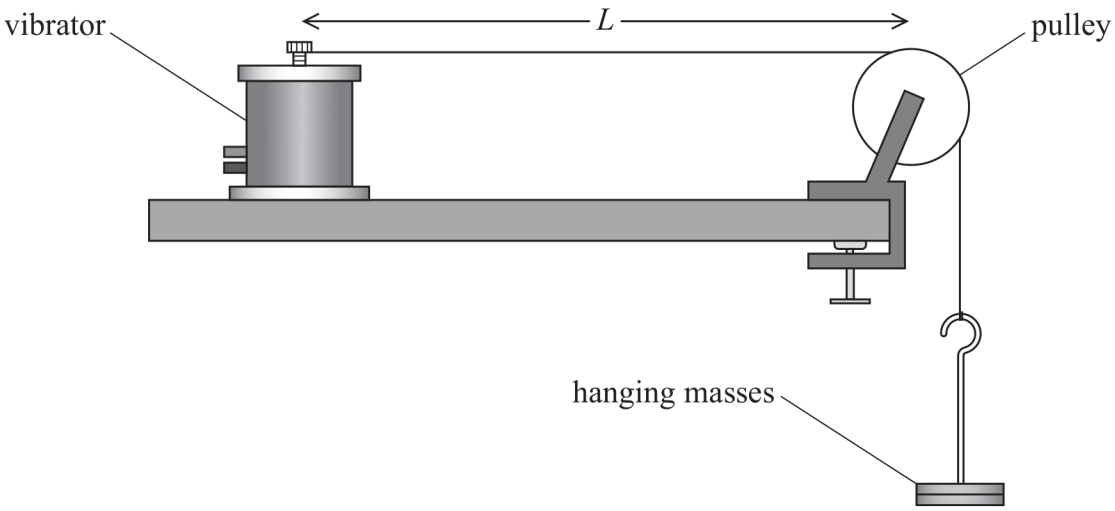
17 A student investigated how the frequency of vibration of a string varies with the tension in the string. The student connected masses to one end of the string and attached the other end to a vibrator as shown.



(Source: http://www.schoolphysics.co.uk/age16-19/Sound/text/Vibrating_strings/index.html)

A signal generator was connected to the vibrator. The signal generator was adjusted until a stationary wave was produced on the string. The stationary wave had nodes at both ends of the vibrating length of the string, L, and an antinode in the middle.

(a) Explain how nodes and antinodes are created on a string.

(3)

(b) The student changed the weight W applied to the string and adjusted the frequency f of the signal generator until the same stationary wave was set up on the string.

The student plotted a graph of f^2 against W.

Explain why the graph was a straight line through the origin.

(5)

(c) Describe a method that can be used to confirm that the frequency value stated on the signal generator is correct.

(2)

(d) When W is 80.0 N, f is 659 Hz.

Calculate the mass per unit length of the string.

length $L = 0.328$ m

(3)

Mass per unit length = ...

(Total for Question 17 = 13 marks)

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