Q1.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A string is stretched between two fixed points and set into oscillation.

The frequency of the vibrating string is **not** dependent on

☐ **A** the amplitude of the string's vibration.

☐ **B** the length of the string.

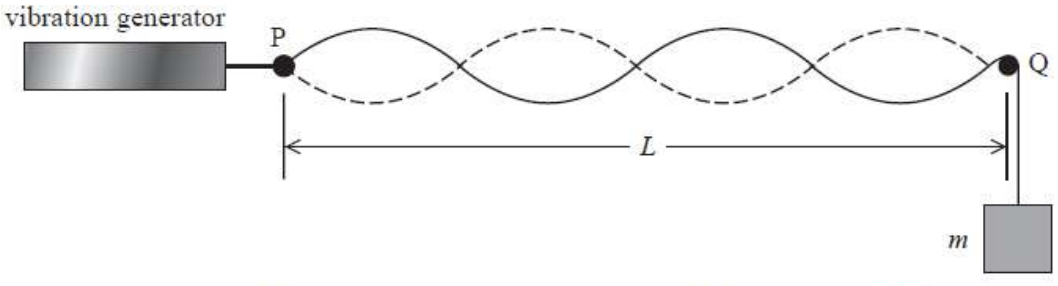
☐ **C** the mass per unit length of the string.

☐ **D** the tension in the string.

(Total for question = 1 mark)

Q2.

An experiment is carried out to investigate the speed of transverse waves on a stretched string of length *L*. A vibration generator causes the string to oscillate so that a stationary wave is produced. The frequency of the vibration generator is adjusted until the wave pattern shown in the diagram is produced.



Sourced from: https://people.highline.edu/iglozman/classes/physnotes/media/waves_9.jpg

(a) Determine the wavelength of the waves on the string when vibrating as shown.

length *L* = 1.70 m

(2)

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Wavelength = ...

(b) Calculate the speed of waves on the string.

mass m = 0.20 kg
mass per unit length of string = 4.5×10^{-3} kg m^{-1}

(3)

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Speed = ...

(c) The frequency of the vibration generator is reduced until the wave pattern shown below is produced.

Explain the effect that this would have on the speed of the waves on the string.

(2)

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(Total for question = 7 marks)

Q3.

An Aeolian harp is a stringed musical instrument that is 'played' by the wind. An Aeolian harp is shown in the photograph.

(Source: *www.youtube.com*)

As air passes the strings, it forces them to vibrate, creating stationary waves on the strings.

(a) Explain how stationary waves are formed on the strings.

(2)

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(b) When the strings of an Aeolian harp vibrate, the frequency f of the string vibrations is given by the equation

$$f = \frac{Ku}{d}$$

where u is the speed of the moving air, d is the diameter of the string and K is a constant.

(i) Show that the constant K has no units.

(2)

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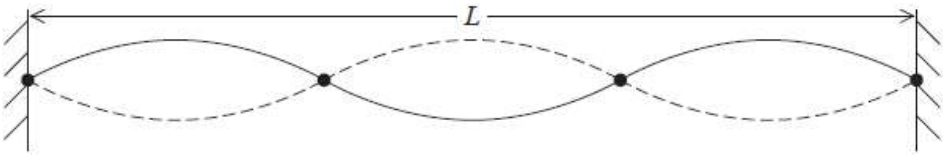
(ii) A stationary wave is produced on a string of length L as shown.



(Source: *hep.physics.indiana.edu*)

Calculate the speed of the air required to produce this stationary wave.

length of string = 0.33 m
diameter of string = 0.15 mm
tension in string = 63 N
mass per unit length of string = 0.58×10^{-3} kg m^{-1}
K = 0.20

(5)

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Speed of the air = ...

(Total for question = 9 marks)