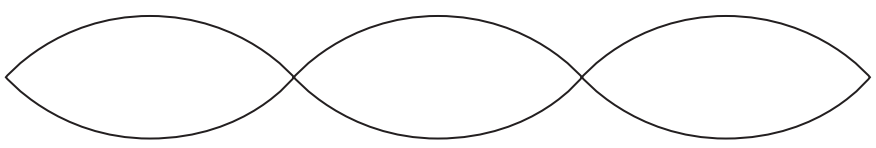
15 The photograph shows a guitar.

When a guitar string is plucked, a standing wave is created.

(a) Explain how a standing wave is created on the string.

(3)

(b) The diagram shows a standing wave on a guitar string.



The oscillating length of the guitar string is 66 cm.

(i) State the wavelength for this standing wave.

(1)

Wavelength = ...

(ii) Calculate the frequency of vibration for this standing wave.

tension in guitar string = 88.6 N

mass per unit length of guitar string = 4.47×10^{-3} kg m^{-1}

(3)

Frequency = ...

(c) One end of the guitar string is wrapped around a cylindrical tuning peg. Turning the peg changes the total length of the string and hence changes the tension in the string. This changes the frequency of vibration of the string.

(i) The length of one string is 68 cm.

Calculate the extension required to produce a tension of 93.4 N in the string.

Young modulus of string material = 1.8×10^{9} N m^{-2}

cross-sectional area of string = 6.6×10^{-7} m^{2}

(4)

Extension = ...

(ii) The vibrating length of string is unchanged by turning the tuning peg.

Explain the effect that tightening the string has on the frequency of the sound produced.

(2)

(Total for Question 15 = 13 marks)