1 The fundamental frequency f is the lowest frequency heard when a stretched string is vibrating.

The string is now lightly touched one third of the way along its length.

What is the lowest frequency heard?

A $\frac{f}{3}$ ⬭

B $\frac{2f}{3}$ ⬭

C f ⬭

D $3f$ ⬭

(Total 1 mark)

2 Two points on a progressive wave have a phase difference of $\frac{\pi}{6}$ rad

The speed of the wave is 340 m s^{-1}

What is the frequency of the wave when the minimum distance between the two points is 0.12 m?

A 240 Hz ⬭

B 470 Hz ⬭

C 1400 Hz ⬭

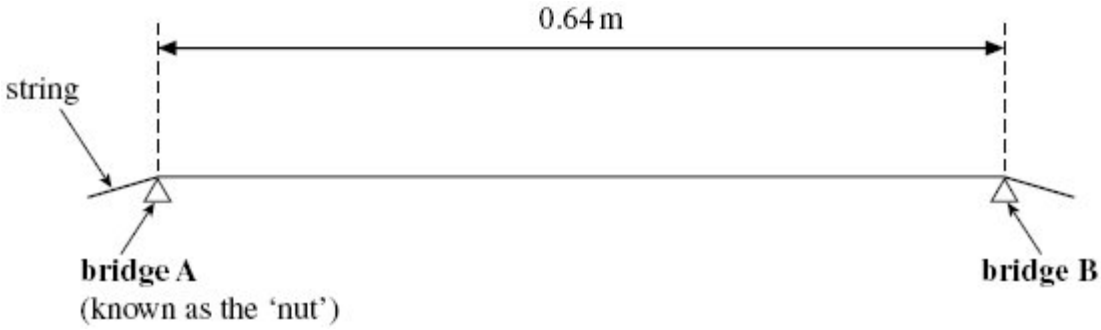
D 2800 Hz ⬭

(Total 1 mark)

3 **Figure 1** shows a side view of a string on a guitar. The string cannot move at either of the two bridges when it is vibrating. When vibrating in its fundamental mode the frequency of the sound produced is 108 Hz.

(a) (i) On **Figure 1**, sketch the stationary wave produced when the string is vibrating in its fundamental mode.

Figure 1



(1)

(ii) Calculate the wavelength of the fundamental mode of vibration.

answer = _____ m

(2)

(iii) Calculate the speed of a progressive wave on this string.

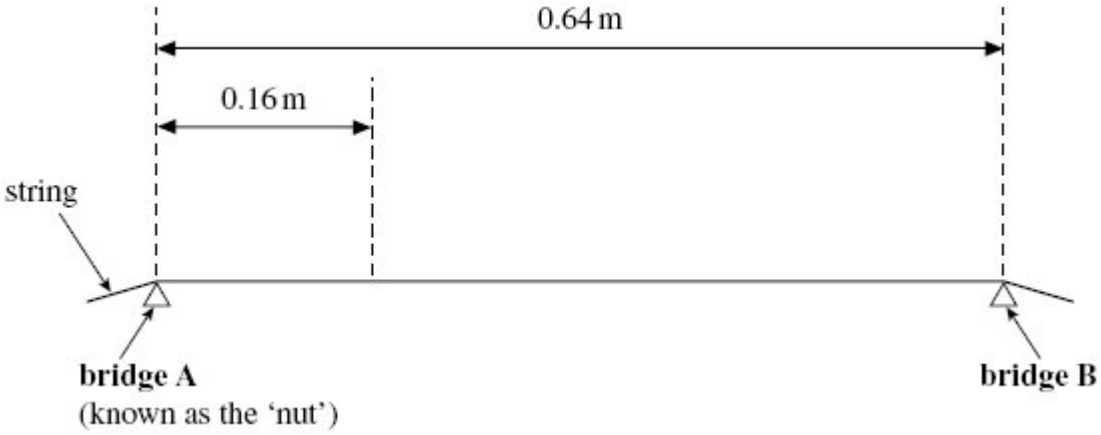
answer = _____ m s^{-1}

(2)

(b) While tuning the guitar, the guitarist produces an overtone that has a node 0.16 m from **bridge A**.

(i) On **Figure 2**, sketch the stationary wave produced and label all nodes that are present.

Figure 2



(2)

(ii) Calculate the frequency of the overtone.

answer = _____ Hz

(1)

(c) The guitarist needs to raise the fundamental frequency of vibration of this string. State **one** way in which this can be achieved.

_____

_____

(1)

(Total 9 marks)

4 Which statement is **not** correct for ultrasound and X-rays?

A Both can be refracted ⬭

B Both can be diffracted ⬭

C Both can be polarised ⬭

D Both can be reflected ⬭

(Total 1 mark)

6 **Figure 1** shows the structure of a violin and **Figure 2** shows a close-up image of the tuning pegs.

Figure 1

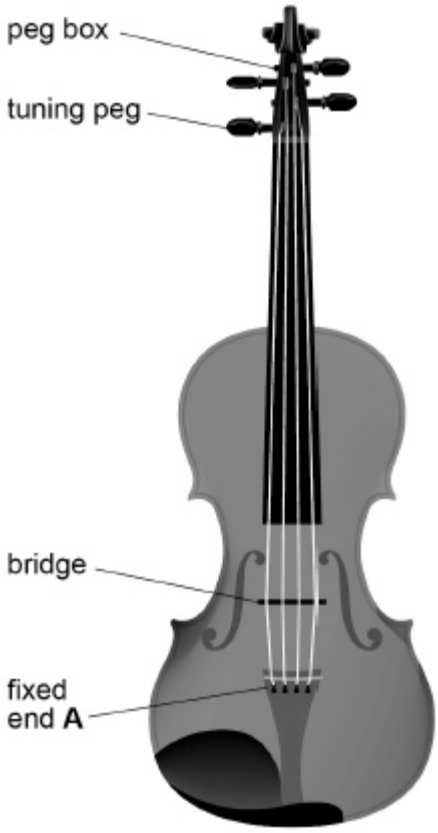
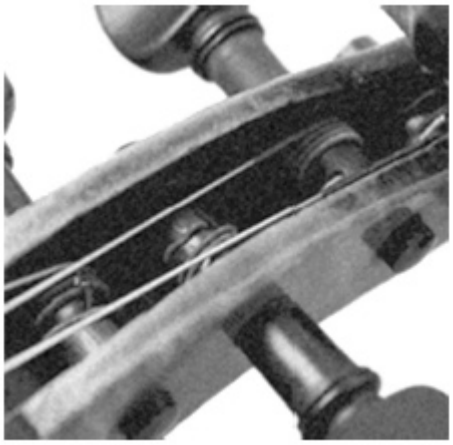


Figure 2

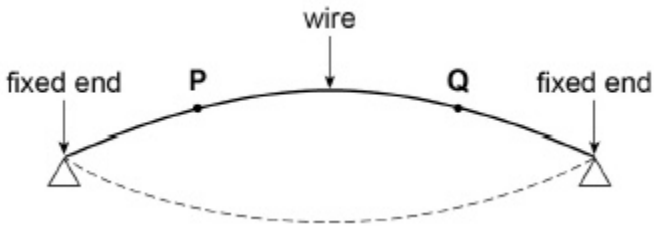


The strings are fixed at end **A**. The strings pass over a bridge and the other ends of the strings are wound around tuning pegs that have a circular cross-section. The tension in the strings can be increased or decreased by rotating the tuning pegs.

(a) Explain how a stationary wave is produced when a stretched string is plucked.

(3)

7 A uniform wire, fixed at both ends, is plucked in the middle so that it vibrates at the first harmonic as shown.



What is the phase difference between the oscillations of the particles at **P** and **Q**?

A zero ⬭

B $\frac{\pi}{4}$ rad ⬭

C $\frac{\pi}{2}$ rad ⬭

D $\frac{3\pi}{4}$ rad ⬭

(Total 1 mark)