

Question 16 (7 marks)

Standing waves are formed on a string of length 4.0 m that is fixed at both ends. The speed of the waves is 240 m s^{-1} .

- a. Calculate the wavelength of the lowest frequency resonance.

2 marks

$$\lambda = 2L$$

$$= 2 \times 4$$

62%

8 m

- b. Calculate the frequency of the second-lowest frequency resonance.

2 marks

$$f_0 = \frac{v}{\lambda} = \frac{240}{8} = 30 \text{ Hz}$$

$$f_2 = 2 f_0 = 60 \text{ Hz}$$

57%

60 Hz

- c. Explain the physics of how standing waves are formed on the string. Include a diagram in your response.

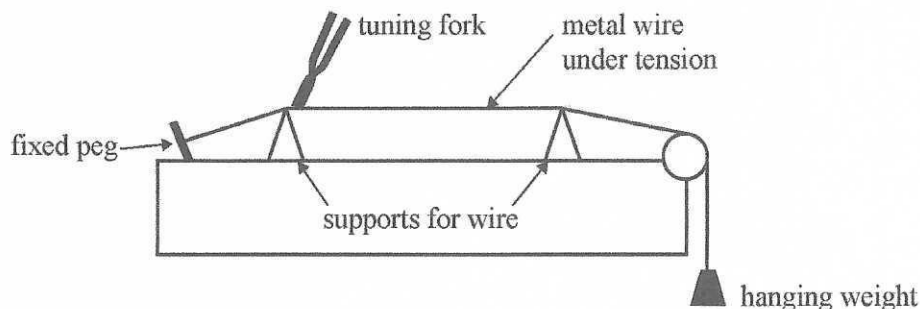
3 marks

Standing wave is formed when 2 waves travel in the opposite directions ~~overlap~~ and reflecting at the ends overlap (superimpose) to produce an interference pattern with nodes (destructive) and antinodes (constructive interference).



Question 14 (6 marks)

Figure 13 shows a simple apparatus that can be used to determine the frequency of a tuning fork.

**Figure 13**

The apparatus consists of two supports and a metal wire that is stretched between a fixed peg and a hanging weight. The wire is under tension.

The tuning fork is set vibrating and is then touched onto the wire close to the left-hand support, which makes the wire vibrate at the same frequency as the tuning fork.

- a. Draw a diagram of the simplest standing wave pattern that can exist on the vibrating section of the wire (the fundamental) between the two supports. 2 marks



- b. When the distance between the supports is 0.92 m, the fundamental frequency resonates in the wire.

Calculate the wavelength of the fundamental. Show your working. 2 marks

$$\lambda = 2L = 2 \times 0.92$$

1.84 m

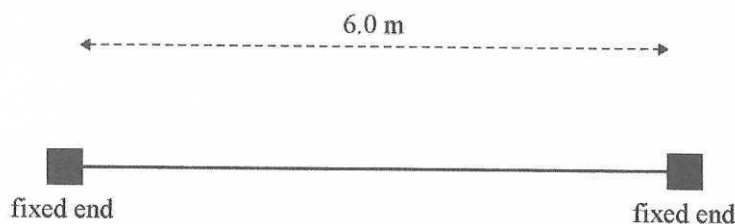
- c. Calculate the frequency of the tuning fork if the speed of the waves in the wire is 224 m s^{-1} . Show your working. 2 marks

$$f = \frac{v}{\lambda} = \frac{224}{1.84}$$

122 Hz

Question 13 (3 marks)

In an experimental set-up used to investigate standing waves, a 6.0 m length of string is fixed at both ends, as shown in Figure 12. The string is under constant tension, ensuring that the speed of the wave pulses created is a constant 40 m s^{-1} .

**Figure 12**

In an initial experiment, a continuous transverse wave of frequency 7.5 Hz is generated along the string.

- a. Determine the wavelength of the transverse wave travelling along the string.

1 mark

$$\lambda = \frac{v}{f} = \frac{40}{7.5}$$

81%

5.3 m

- b. Will a standing wave form? Give a reason for your answer.

2 marks

17%

~~1.53~~ $\frac{\lambda}{2} = 2.65 \text{ m}$

$\frac{6}{2.65} = 2.26$ - not a whole number so

standing wave will ~~not~~ not form