Waves - 4

1.
Fig. 4.1 shows a thin taut wire held horizontally between supports 0.40 m apart.

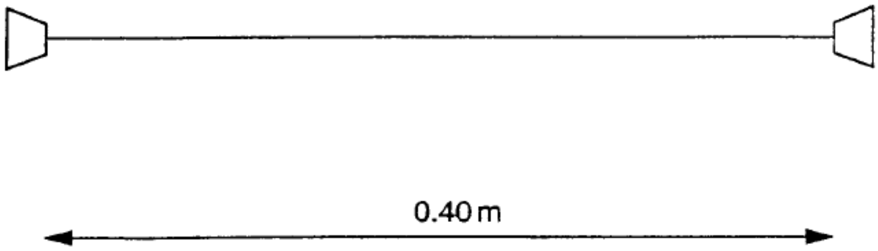

Fig. 4.1

(a) When the wire is plucked at its centre a standing wave is formed and the wire vibrates in its fundamental mode.

(i) Explain how the standing wave is formed.

....

....

....

....

....[2]

(ii) On Fig. 4.1, draw the fundamental mode of vibration. Label the position of any nodes with the letter **N** and any antinodes with the letter **A**. [3]

(iii) Determine the wavelength of this standing wave.

wavelength = ... m [2]

(b) **(i)** Describe how the wire could be made to vibrate with a frequency double that of the fundamental mode of vibration.

....

....

....[2]

(ii) On Fig. 4.2, sketch the appearance of this standing wave. [1]

Fig. 4.2

2.

Fig. 3.2 shows, at a given instant, the shape of the stretched rope on which a **stationary** wave has been produced.

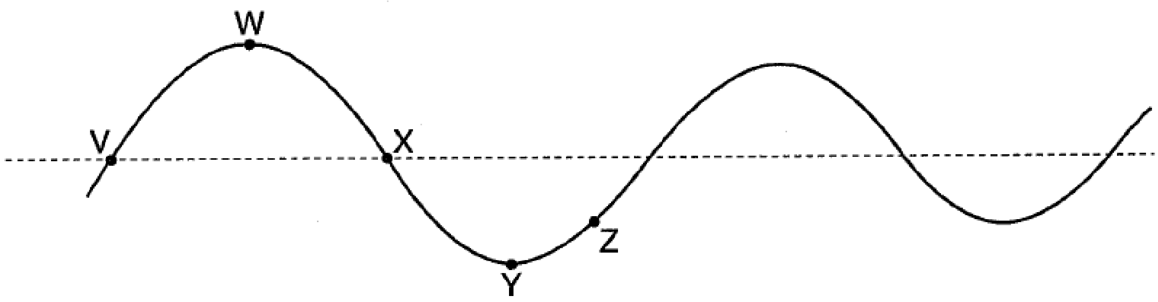

Fig. 3.2

(i) Briefly explain how a stationary wave may be formed on the rope.

....

....

.... [2]

(ii) State the phase difference between the oscillations of the following pairs of particles on this stationary wave.

1. W and Y

....

2. Y and Z

.... [2]

(iii) For a stationary wave, state what is meant by

1. a node

....

2. an antinode.

.... [2]

(iv) State which of the particles on Fig. 3.2 are

1. at a node

....

2. at an antinode.

.... [2]

3.

(a) Fig. 6.1 shows a string stretched between two points A and B.

Fig. 6.1

State how you would set up a standing wave on the string.

....

....[1]

(b) The standing wave vibrates in its fundamental mode i.e. the lowest frequency at which a standing wave can be formed. Draw this standing wave on Fig. 6.2.

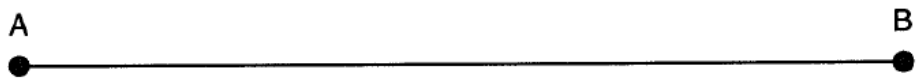

Fig. 6.2 [1]

(c) Fig. 6.3 shows the appearance of another standing wave formed on the same string.

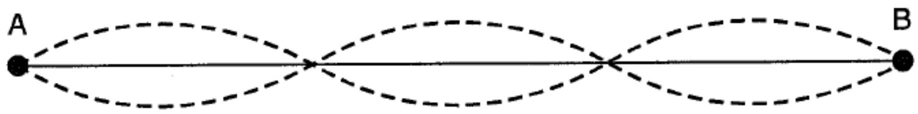

Fig. 6.3

The distance between A and B is 1.8 m. Use Fig. 6.3 to calculate

(i) the distance between neighbouring nodes

distance = ... m [1]

(ii) the wavelength of the standing wave.

wavelength = ... m [1]

4.

(a) State **one** similarity and **one** difference between progressive waves and standing waves.

similarity

....

....

difference

....

.... [2]

(b) A standing sound wave can be produced in an air column by blowing across the open end of a tube as shown in Fig. 5.1.

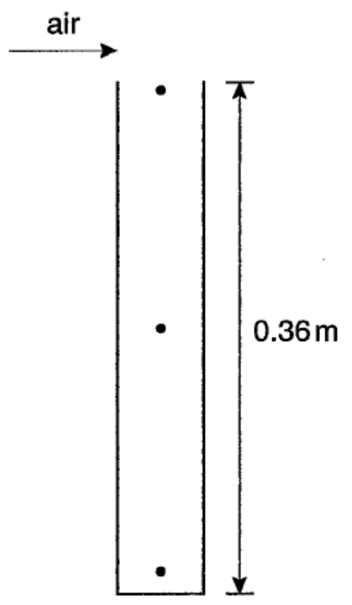

Fig. 5.1

The length of the tube is 0.36 m. The air column in the tube is sounding its lowest (fundamental) frequency note.

(i) Add **arrowed** lines to the dots in Fig. 5.1 to show the direction of movement and relative amplitudes of the air at these positions. [3]

(ii) Calculate the wavelength of the sound produced.

wavelength = ... m [1]

(iii) The speed of sound in air is 330 $m\,s^{-1}$. Determine the frequency of this standing wave.

frequency = ... Hz [2]

(iv) Determine the value of the lowest frequency of the note produced in a tube of this length but open at **both** ends. Show your reasoning.

lowest frequency = ... Hz [3]