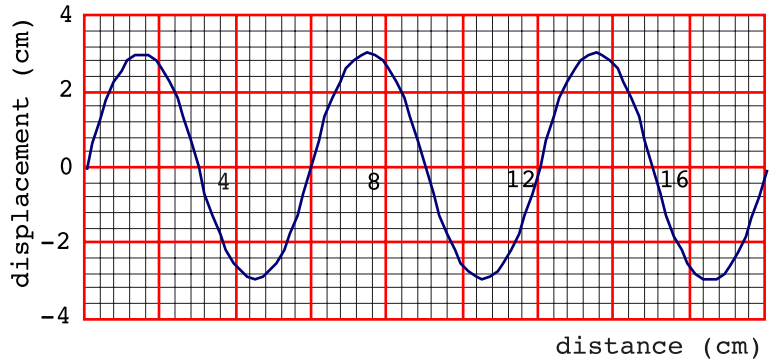
Waves

1 The diagram represents a segment of a string along which a transverse wave is travelling.

(i) What is the amplitude of the wave?



_____ [1]

(ii) What is the wavelength of the wave?

_____ [1]

(iii) how many cycles are shown in the diagram?

_____ [1]

2 The diagram shows a segment of a transverse wave drawn full scale. The frequency of this wave is 2 Hz.

Measure its amplitude and wavelength

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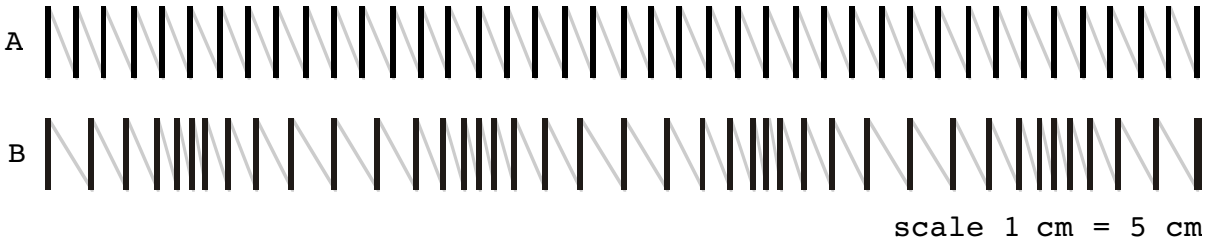
_____

_____ [2]

3 The diagrams below show a stretched slinky spring drawn to a scale 1 cm = 5 cm. Diagram A shows a section of the slinky before a wave reaches it. Diagram B shows the slinky at an instant as a wave travels through it.



(a) What kind of wave is travelling through the slinky?

_____ [1]

(b) On diagram B mark two successive compressions and two successive rarefactions. [1]

(c) Use a ruler and the scale of the diagram to determine the wavelength of this wave.

_____ [1]

(d) Find and mark a coil in diagram B that has moved furthest from its equilibrium position in diagram A, and hence determine the amplitude of the wave.

_____

_____ [2]

4 The speed, *c*, of a transverse wave along a string or wire under tension is given by $c = \sqrt{T/\mu}$, where *T* is the Tension in Newtons and μ is the mass per unit length in kg/m.

(a) Show that this equation is homogeneous.

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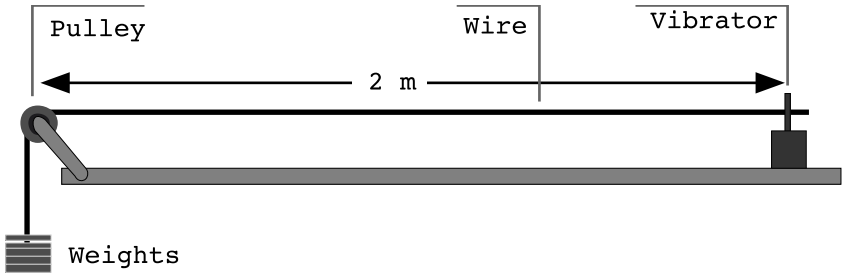
_____ [2]

(b) The diagram shows a wire of length 2 metres kept in tension by hanging a weight from one end. The mass per unit length for this wire is 5 g/m. If the weight that keeps the wire in tension is 0.5 Newtons. A vibrator is used to produce standing waves in the wire.



(i) calculate the speed of the transverse wave travelling along the wire when it is oscillating.

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_____ [2]

(ii) Does the speed of the wave depend on the frequency at which the vibrator oscillates the wire? Explain your answer.

_____

_____

_____ [2]

(iii) Calculate the wavelength of the fundamental.

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_____ [2]

(iv) What is the lowest frequency for standing waves in this set up?

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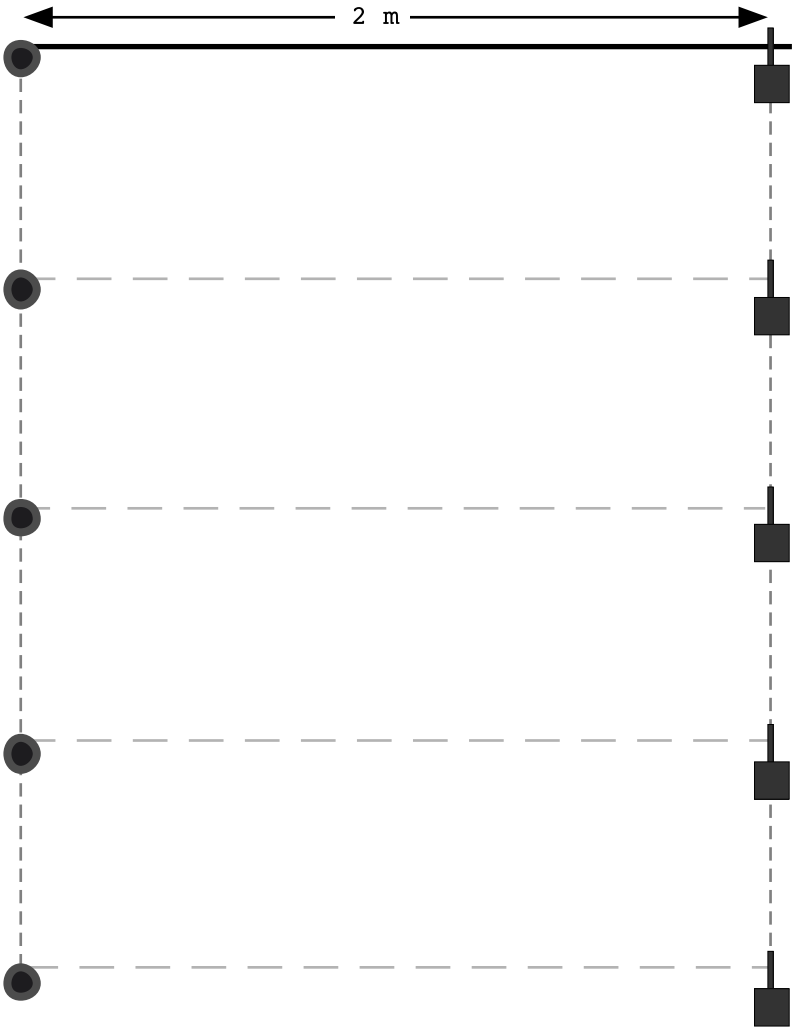
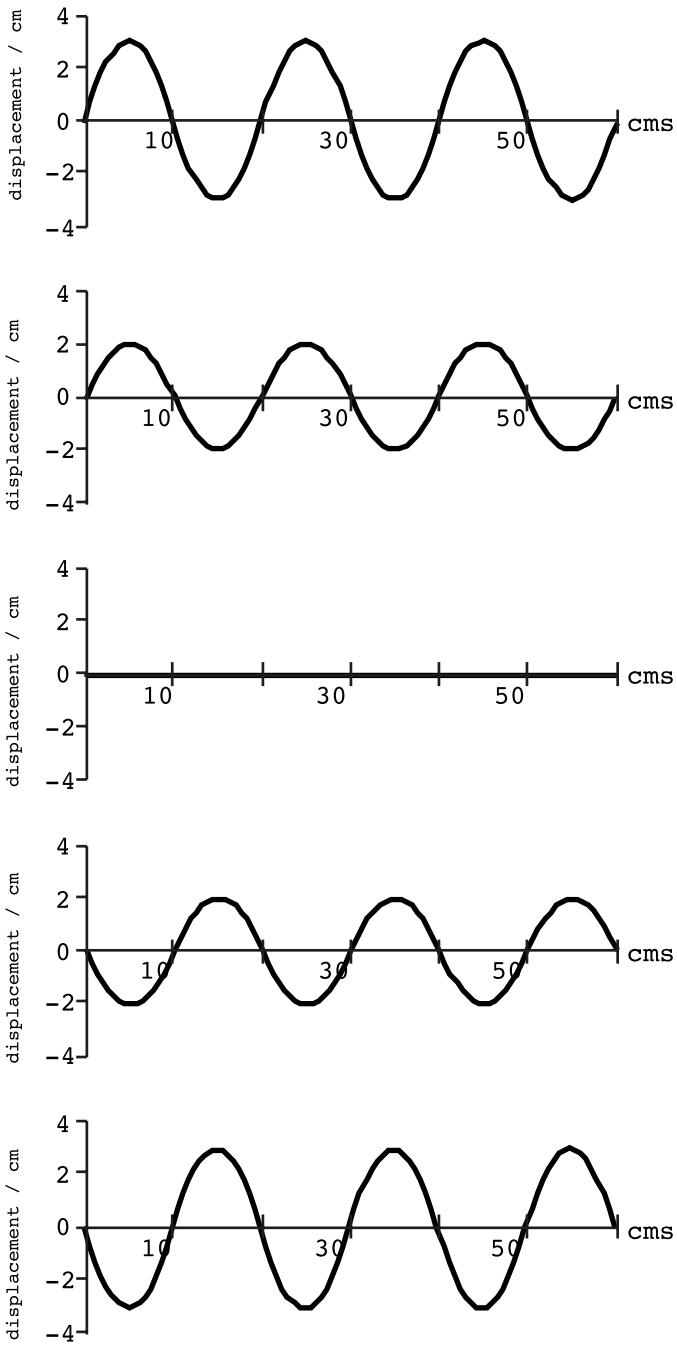
_____ [2]

(c) Draw diagrams to show the first four harmonics for standing waves. In each case calculate the wavelength and frequency of the standing wave. Show all working.



5 The diagrams on the right show snapshots of successive positions of a segment of a string at intervals of 1/8th of the period of the wave.



(a) Mark the nodes on one of the diagrams, and explain why these points are nodes.

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_____

(b) Mark the positions of the antinodes, and explain why these points are antinodes.

(c) Use the scale on the diagrams to determine the amplitude and wavelength of the standing wave.

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_____

(d) How many cycles are displayed in these diagrams?

_____

(e) If the time interval between successive diagrams is 0.1 seconds, calculate the frequency of the standing wave, and hence its speed.

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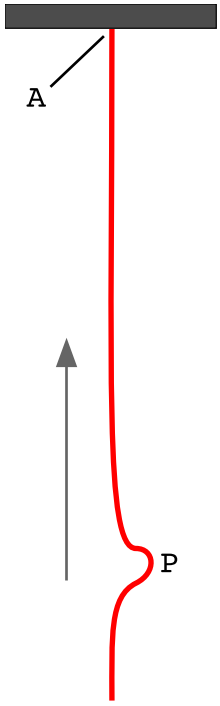
_____ [3]

6 The diagram shows a pulse, P, travelling up a heavy rope. The rope is firmly attached to a ceiling at A. Given that the speed of a transverse wave through a string is given by $c = \sqrt{T/\mu}$, will the speed of the pulse change as it moves up the rope, and if so does the speed increase or decrease. Explain your answer as fully as you can.



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_____ [2]