St Peter's RC High School

MUS HW 1 Making Sounds

38 min
38 marks

1. Which of the following statements about standing waves is true?

A particles between adjacent nodes all have the same amplitude.

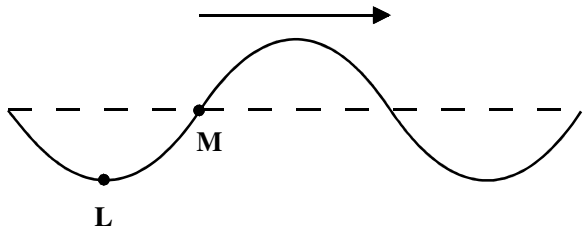
B particles undergo no disturbance at an antinode.

C particles immediately either side of a node are moving in opposite directions.

D particles between adjacent nodes are out of phase with each other.

(Total 1 mark)

2. The diagram shows a wave on a rope. The wave is travelling from left to right.



At the instant shown, point **L** is at a maximum displacement and point **M** has zero displacement. Which row in the table correctly describes the motion of points **L** and **M** during the next half cycle of the wave?

	Point L	**Point M**
A	rises	falls
B	rises	falls then rises
C	rises then falls	rises
D	rises then falls	falls then rises

(Total 1 mark)

3. Two points on a progressive wave differ in phase by $\frac{\pi}{4}$ radian. The distance between them is 0.50 m. The frequency of the oscillations is 10 Hz. The maximum speed of the wave is

A 2.50 m s^{-1}

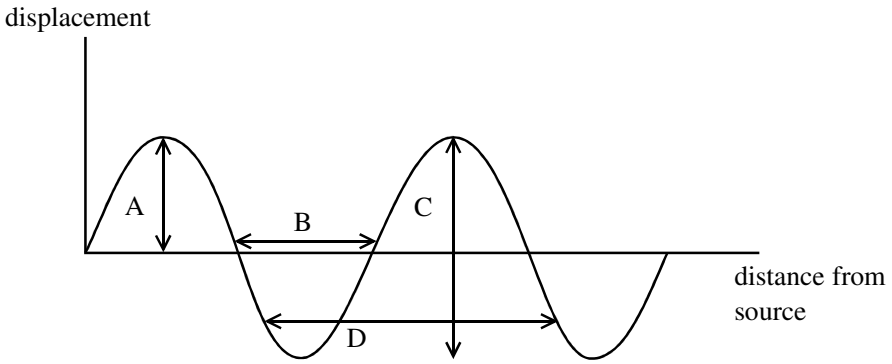
B 5.00 m s^{-1}

C 12.5 m s^{-1}

D 40.0 m s^{-1}

(Total 1 mark)

4. A loudspeaker emits a sound wave of wavelength 0.66 m. The diagram shows how displacement varies with distance from the loudspeaker at one instant of time.



(a) Which letter indicates the wavelength of the sound wave?

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(1)

(b) Sound travels at 330 m s^{-1} in air. Calculate the period of the wave.

.....

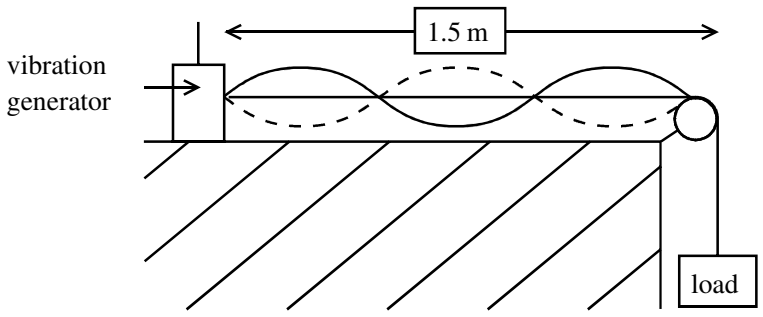
.....

Period = ...

(3)

(Total 4 marks)

5. The following apparatus is set up. When the frequency of the vibrator is 60 Hz, the standing wave shown in the diagram is produced.



(a) What is the wavelength of this standing wave?

Wavelength = ...

(1)

(b) The frequency of the vibrator is altered until the standing wave has two more nodes. Calculate the new frequency.

Frequency = ...

(2)

(Total 3 marks)

6. It has been suggested that tigers use infrasound – low frequency sounds inaudible to humans – to keep rivals away from their territory and to attract mates.

Sound is a longitudinal wave. Describe how sound travels through the air.

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(3)

State what is meant by frequency.

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.....

.....

(1)

The frequency range of the sound produced by the tigers extends down to 18 Hz. Calculate the wavelength in air for sounds of this frequency. Speed of sound in air = 330 m s^{-1}.

.....

.....

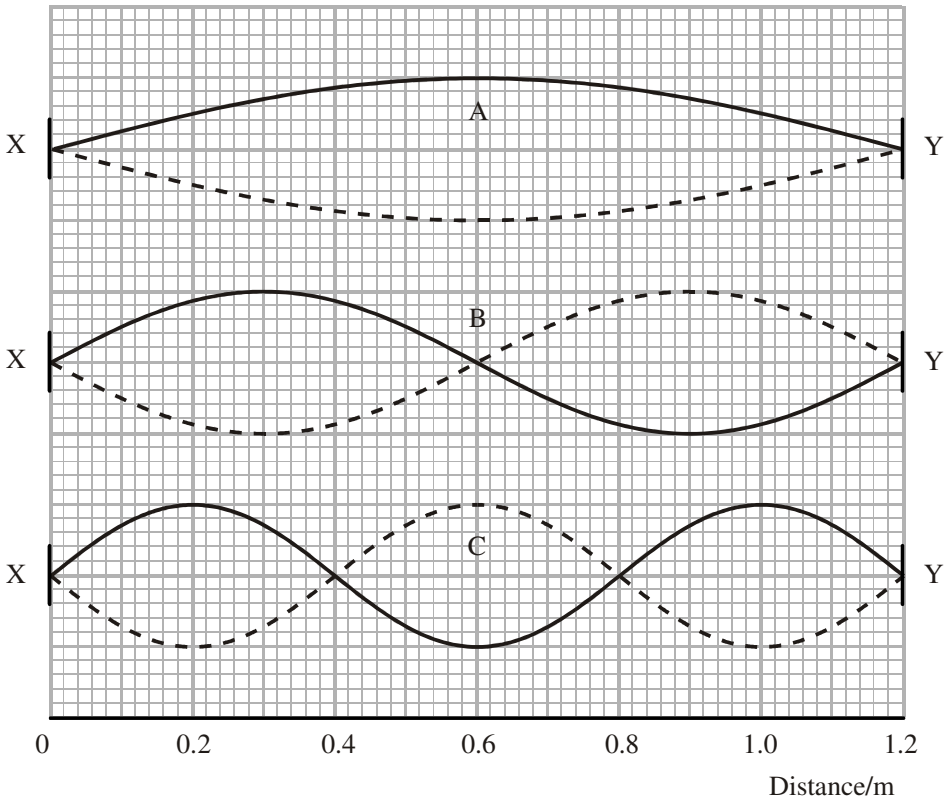
.....

Wavelength = ...

(2)

(Total 6 marks)

7. (a) The diagram shows three possible stationary waves on a string of length 1.20 m stretched between fixed points X and Y.



(i) Wave A has a frequency of 110 Hz.

Complete the table below to show the wavelengths and frequencies of the three waves.

Wave	Wavelength / m	Frequency / Hz
A		110
B		
C		

(3)

(ii) Each of the waves has nodes at X and Y. Explain why these points must be nodes.

.....

.....

(1)

(b) There is a similarity between the behaviour of the string in part (a) and that of the electron in a hydrogen atom. Electron states can be represented by stationary waves which have to fit inside the atom.

Stationary waves with greater numbers of nodes represent electrons in higher energy levels. Explain why this is the case.

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.....

.....

(2)
(Total 6 marks)

8. (a) Explain what is meant by the term **transverse wave.** You may wish to illustrate your answer with the help of a simple diagram.

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.....

.....

(3)

(b) State two differences between a stationary wave and a progressive wave.

Difference 1 .....

.....

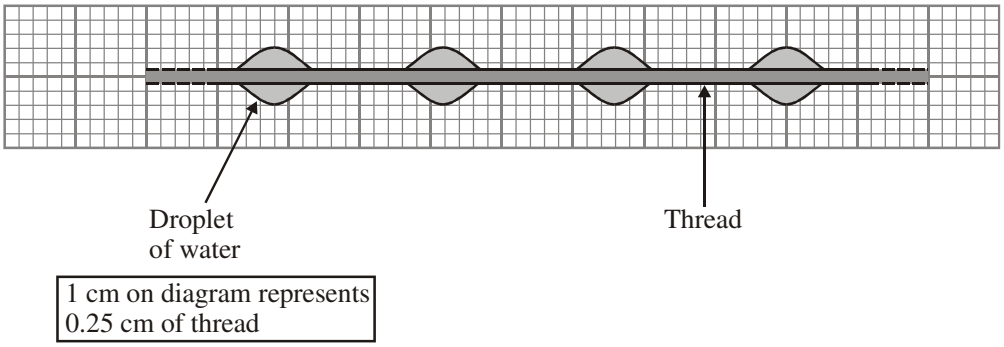
Difference 2 .....

.....

(2)

(c) Spiders are almost completely dependent on vibrations transmitted through their webs for receiving information about the location of their prey. The threads of the web are under tension. When the threads are disturbed by trapped prey, progressive transverse waves are transmitted along the sections of thread and stationary waves are formed.

Early in the morning droplets of moisture are seen evenly spaced along the thread when prey has been trapped.



(i) Explain why droplets form only at these points.

.....

.....

(1)

(ii) The speed of a progressive transverse wave sent by trapped prey along a thread is 9.8 cm s^{-1}. Use the diagram to help you determine the frequency of the stationary wave.

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.....

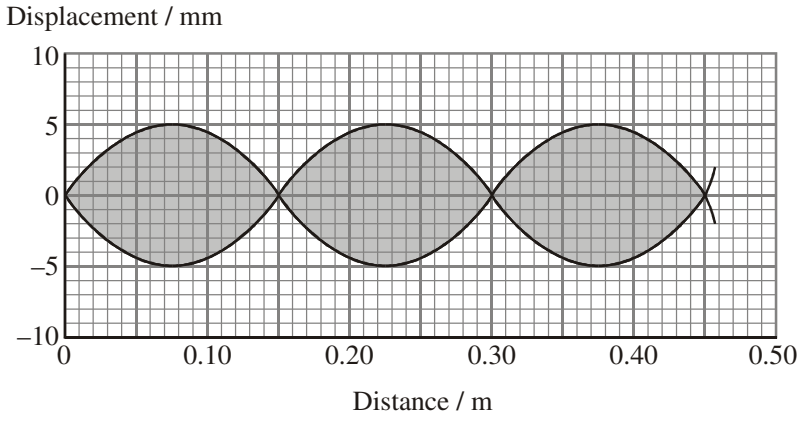
.....

Frequency = ...

(4)

(Total 10 marks)

9. A stationary wave is produced on a stretched string by a vibration generator attached to one end. The graph shows part of the wave. The two full lines represent the extreme positions of the string.



State the wavelength of this wave.

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(1)

Mark a letter A on the graph to label an antinode.

(1)

The stationary wave is formed by the superposition of two waves travelling along the string in

opposite directions. The frequency of the vibrator is 36.0 Hz. Calculate the speed of the travelling waves.

.....

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Wave speed = ...

(2)

State the phase relationship between the two travelling waves at an antinode.

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(1)

Determine the amplitude of each of the travelling waves.

.....

Amplitude = ...

(1)

(Total 6 marks)