9.1 Stationary Waves

Question Paper

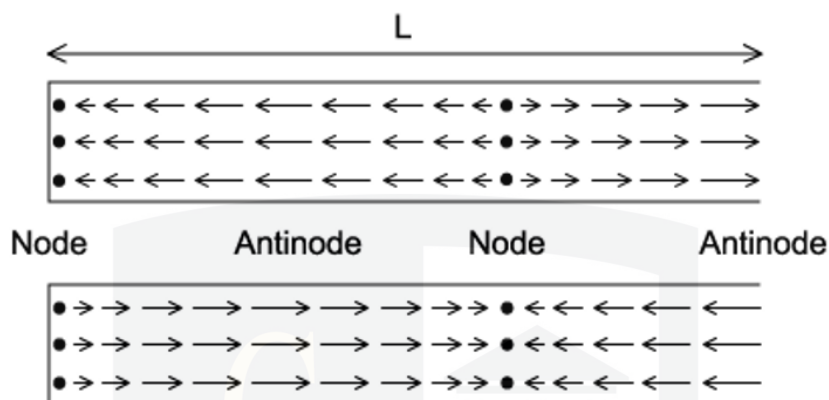|	
Course	CIE A Level Physics (9702) 2019-2021
Section	9. Superposition
Topic	9.1 Stationary Waves
Difficulty	Medium

Time allowed: 10

Score: /10

Percentage: /100

Question 1

A stationary wave was formed in a column. The diagram below shows the movement of the air particles.

The first diagram shows the displacement and the second is the displacement half a cycle later.

Which position will the pressure change by the most significant amount, and what is the length, L of the column in terms of wavelength, λ?

	length L	maximum pressure change
A	$\dfrac{3}{4}\lambda$	antinode
B	$\dfrac{3}{4}\lambda$	node
C	$\dfrac{3}{2}\lambda$	antinode
D	$\dfrac{3}{2}\lambda$	node

[1 mark]

Question 2

Two loudspeakers emitting sound of the same frequency produces a stationary wave. This is shown in the diagram

Speaker 1   X   Y   Speaker 2

←————————————— 1.5 m —————————————→
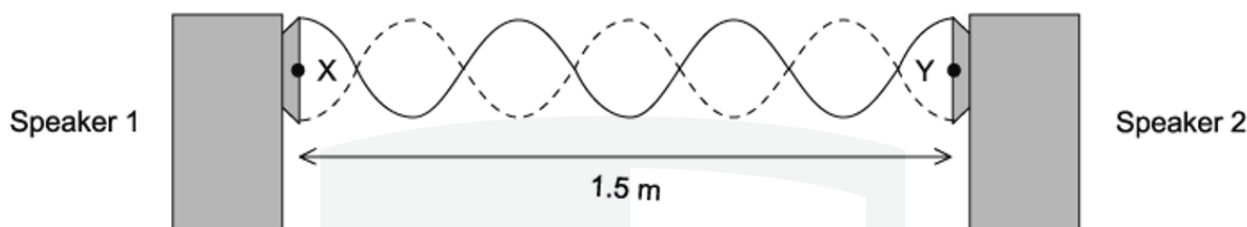
The microphone is moved between X and Y for a distance of 1.5 m. There were six nodes and seven antinodes observed.

What is the wavelength of the sound?

A 0.21 m   **B** 0.25 m   **C** 0.43 m   **D** 0.50 m

[1 mark]

Question 3

A stationary sound wave produced in a musical instrument, this instrument has the pipes open at one end and closed at the other.

If the length of the pipe was 10 m what it is the lowest frequency of sound when the speed of sound is 320 m s^{-1}?

A 32 Hz   **B** 16 Hz   **C** 8 Hz   **D** 4 Hz

[1 mark]

Question 4

A stationary sound wave produced in a tube has a series of nodes. The distance between the first node and the sixth node is 30 cm
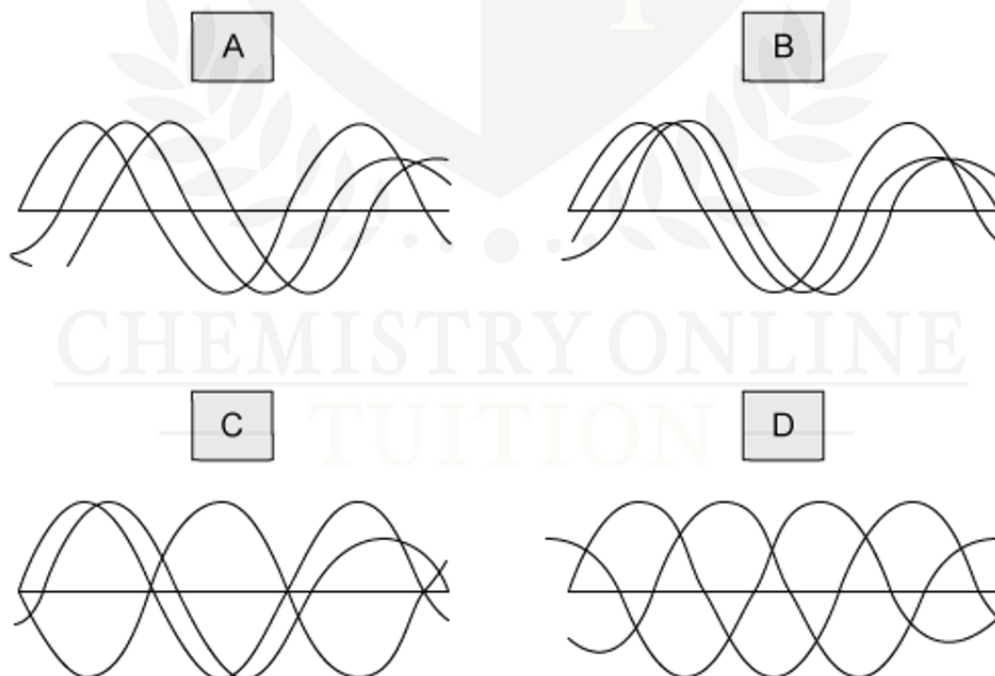
What is the wavelength of the wave?

A 12.0 cm   **B** 10.0 cm   **C** 6.0 cm   **D** 5.0 cm

[1 mark]

Question 5

Each of the diagrams below show three waves; each of the waves have the same amplitude and frequency but have different phases.
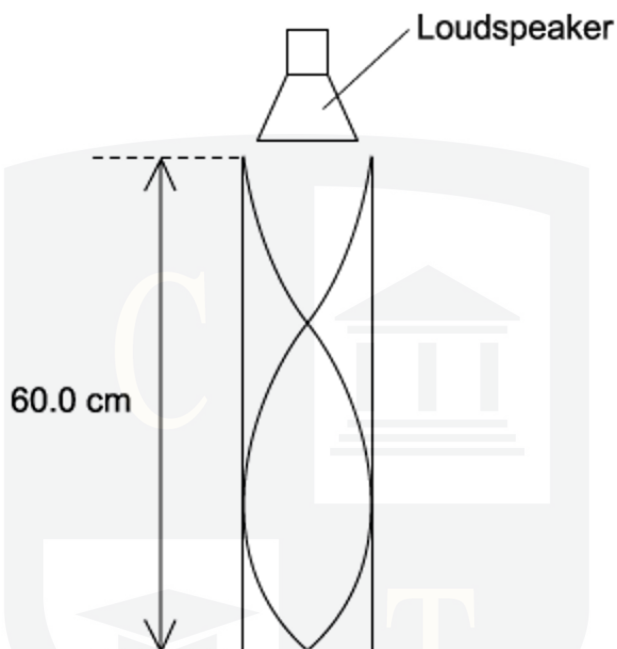
The waves are added together to give a resultant wave. In which case would the resultant wave be zero?

[1 mark]

Question 6

The diagram below shows sound wave produced in a column by a loudspeaker. The speed of sound in air is 330 m s^{-1}
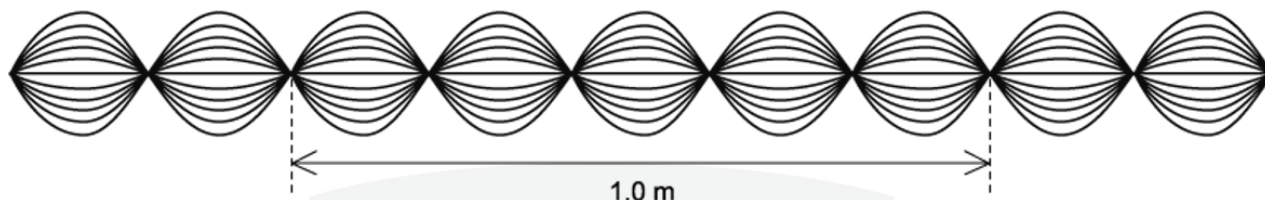

What is the frequency of the wave?

A 1650 Hz **B** 830 Hz **C** 550 Hz **D** 413 Hz

[1 mark]

Question 7

The diagram below shows a wave pattern over time

1.0 m

What is the correct description of the wave?

    A   the wave is transverse, has a wavelength of 40 cm and is stationary

    B   the wave is transverse, has a wavelength of 40 cm and is progressive

    C   the wave is transverse, has a wavelength of 20 cm and is stationary

    D   the wave is longitudinal, has a wavelength of 20 cm and is stationary

[1 mark]

Question 8

Headphones that have noise reduction can cancel out external noise by producing their own waves.

They are fitted with a microphone that detects the external sound frequency. The loudspeaker then produces a wave with the same frequency but different phase.
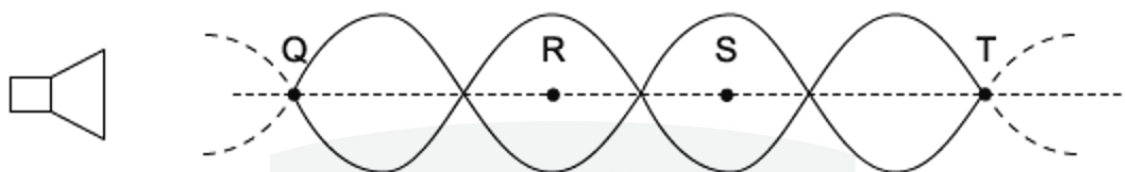
What would the phase difference needed to cancel out the external sound?

A 360°   **B** 270°   **C** 180°   **D** 90°

[1 mark]

Question 9

The pattern produced when two waves are produced by superposition of sound waves from a loudspeaker reflected by a metal sheet.

Q, R, S and T are four points on the line through the centre of these waves.

Which of the following statements is correct?

   A   a node is a quarter of a wavelength from an adjacent antinode

   B   the stationary waves oscillate at right angles to the line QT

   C   an antinode is formed at the surface of the metal sheet

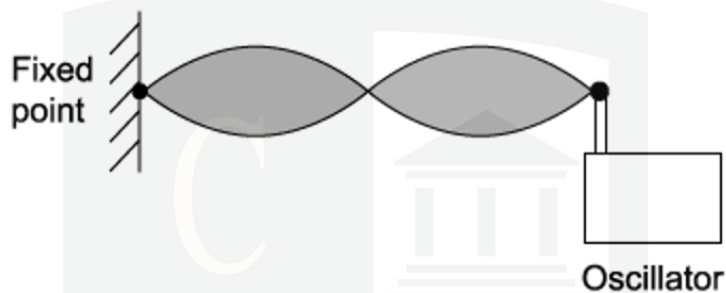   **D**   the oscillations at R are in phase with those at S

[1 mark]

Question 10

A student was investigating the speed of a transverse wave on a stretched spring. They found that by adjusting the tension on the spring, they were able to change the speed.

The wave pattern produced is shown in the diagram the frequency of the oscillator was set to 650 Hz

What needs to be changed to maintain the same wave pattern when the frequency is increased to 750 Hz?

    A   increase the speed of the wave on the string

    B   increase the wavelength of the wave on the string

    C   decrease the wavelength of the wave on the string

    D   decrease the speed of the wave on the string

[1 mark]