WJEC (Wales) Physics A-level

SP2.5c - Determination of the Speed of Sound Using Stationary Waves

Practical Flashcards

What forms at the closed end of a tube when a stationary wave is formed?

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When a stationary wave is formed in a tube, a node will form at the closed end.

What is a node?

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A node is a point of zero displacement in a standing wave. Nodes occur where two waves that are in antiphase and destructively interfere such that they completely cancel each other out.

What forms at the open end of a tube when a stationary wave is formed?

What forms at the open end of a tube when a stationary wave is formed?

When a stationary wave is formed in a tube, an antinode will form at the open end.

What is an antinode?

What is an antinode?

An antinode is a point of maximum displacement in a standing wave. Antinodes occur where two waves that are in phase constructively interfere to form a maximum.

Describe the waveform of a stationary wave at its fundamental frequency in a tube with an open and closed end.

Describe the waveform of a stationary wave at its fundamental frequency in a tube with an open and closed end.

When oscillating at its fundamental frequency, there will be one node at the closed end and one antinode at the open end.

How do you know when the tube is resonating?

How do you know when the tube is resonating?

The sound will be at its loudest when resonance is taking place.

What is the general form of the tube length required for resonance to occur?

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$$\frac{2n+1}{4}\lambda$$

Where n = 0, 1, 2, 3 … (any integer value)

What is the speed of sound in air?

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The speed of sound in air is approximately 340m/s.

How can the mean wavelength be calculated?

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Calculate the wavelength of the sound using as many resonant lengths, for different tuning fork frequencies, as possible. Sum these values and divide by the number of wavelengths used to produce the mean wavelength.

Why must the external temperature remain constant in this experiment?

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The speed of sound can vary depending on the temperature of the air. The temperature of the air is therefore a control variable in this experiment.

What equation shows the relationship between wavelength and tube length when resonance first occurs?

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Tube Length + End Correction = $\lambda/4$

$L + e = \lambda/4$

Why must a small end correction be included in your calculations?

Why must a small end correction be included in your calculations?

The small end correction is needed to account for the location of the sound source (in our case a tuning fork) above the tube.

How can the wavelength of sound be calculated from its speed and frequency?

How can the wavelength of a sound be calculated from its speed and frequency?

Wavelength = Speed / Frequency

$\lambda = c/f$

What equation links the tube length to the wave speed and frequency when resonance first occurs?

What equation links the tube length to the wave speed and frequency when resonance first occurs?

$$L = c/4f - e$$

This is obtained by combining:

$$L + e = \lambda/4 \quad \text{and} \quad \lambda = c/f$$

What should your graph of L against 1/f look like?

What should your graph of L against 1/f look like?

The graph should have the equation:

$$L = c/4f - e$$

This means it should consist of a straight line with a positive, constant gradient.

How can the speed of sound be obtained from a graph of L against 1/f?

How can the speed of sound be obtained from a graph of L against 1/f?

The graph will have a gradient of c/4. This means the speed of sound is given by multiplying the gradient by 4.

How can the value for the end correction be obtained from a graph of L against 1/f?

How can the value for the end correction be obtained from a graph of L against 1/f?

The graph will have the equation:

$$L = c/4f - e$$

This means that ‘e’ is equal to the -1 times the y-intercept.