AQA Physics A-level

RP01 - Stationary Waves on a String

Practical Flashcards

What is a stationary wave?

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A stationary wave is a wave that stores, but does not transfer, energy.

How do stationary waves form on a piece of string?

How do stationary waves form on a piece of string?

Two waves, with the same wavelength, travelling in opposite directions, interfere with each other. When this occurs, they undergo superposition, and a stationary wave is formed.

What is a node?

What is a node?

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 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 arrangement of nodes and antinodes when the string is vibrating at its fundamental frequency.

Describe the arrangement of nodes and antinodes when the string is vibrating at its fundamental frequency.

At its fundamental frequency, a standing wave will have one central antinode and a single node at each end.

What piece of apparatus can be used to generate a wave in a piece of string?

What piece of apparatus can be used to generate a wave in a piece of string?

A vibration generator, driven by a signal generator.

What piece of apparatus can be used to alter the length of string that is oscillating?

What piece of apparatus can be used to alter the length of string that is oscillating?

A bridge (a triangular prism shaped object) can be moved along the length of the string to alter the length of the oscillating region.

Why should the signal generator be operated for a several minutes before use?

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The signal generator needs time for the frequency to stabilise.

In this experiment, the string is tied to a clamp stand. To carry out this experiment safely, what must you add to the stand?

In this experiment, the string is tied to a clamp stand. To carry out this experiment safely, what must you add to the stand?

A counterweight or g-clamp should be used to produce a counteracting moment that prevents the stand from toppling over.

How does the length of the string affect the frequency of the first harmonic?

How does the length of the string affect the frequency of the first harmonic?

There is an inverse relationship between string length and the frequency of the first harmonic. As the string length increases, the frequency decreases.

How does the string’s mass per unit length affect the frequency of the first harmonic?

How does the string's mass per unit length affect the frequency of the first harmonic?

As the mass per unit length increases, the frequency of the first harmonic decreases.

How does the tension in the string affect the frequency of the first harmonic?

How does the tension in the string affect the frequency of the first harmonic?

As the tension in the string increases, the frequency of the first harmonic increases.

What equation is used to calculate the frequency of a string's first harmonic?

What equation is used to calculate the frequency of a string's first harmonic?

$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

How can the tension in a string be varied?

How can the tension in a string be varied?

The tension in a string can be varied by attaching a mass hanger to the end of it. As masses are added to the end of it, the tension will increase.

What safety precautions should be taken when using mass hangers?

What safety precautions should be taken when using mass hangers?

Never stand directly under a mass hanger - if it falls it may cause injury. It is good practice to place a padded bucket below the hanger.

If 3 masses, each of mass 100 grams are added to a mass hanger of mass 100 grams, what is the tension produced in the string?

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Total Mass = 400g = 0.4kg

Tension = 0.4kg x 9.81N/kg = 3.924 N

How can you measure the mass per unit length of a piece a string?

How can you measure the mass per unit length of a piece a string?

Measure the mass of a suitably long piece of string using a mass balance and then divide this by the string's length.

What is the advantage of using a long piece of string when measuring the mass per unit length?

What is the advantage of using a long piece of string when measuring the mass per unit length?

The longer the piece of the string, the lower the percentage uncertainty in the measurement.

Assuming all other factors remain constant, what is the effect of changing the frequency to double that of the first harmonic?

Assuming all other factors remain constant, what is the effect of changing the frequency to double that of the first harmonic?

Changing the frequency to two times the frequency of the first harmonic, will result in the string resonating in its second harmonic.

What equation is used to determine the speed of a wave from its wavelength and frequency?

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$$v = f\lambda$$

Wave Speed = Frequency x Wavelength

When vibrating in its fundamental mode, what is the wavelength relative to the length of the oscillating string?

When vibrating in its fundamental mode, what is the wavelength relative to the length of the oscillating string?

$$\lambda = 2L$$

Wavelength = 2 x Length

How can wave speed be calculated from the string's tension and mass per unit length?

How can wave speed be calculated from the string’s tension and mass per unit length?

$$v = \sqrt{\frac{T}{\mu}}$$

When plotting a graph of 1/f against L for a wave's fundamental frequency, how can the wave speed be determined?

When plotting a graph of 1/f against L for a wave's fundamental frequency, how can the wave speed be determined?

The gradient of the graph will be 1/fL

The wave speed is given by 2fL (for the fundamental mode) and so is given by 2/gradient