Measuring the speed of waves in solids Worksheet

Miss Walrond
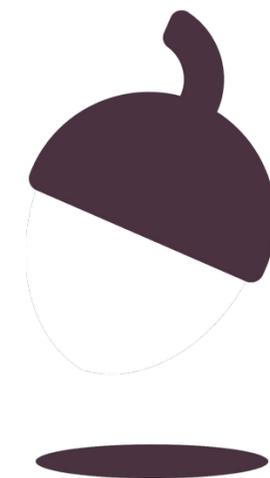
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Q1.

Describe an experiment that could be performed to measure the speed of a wave on a string using a vibration generator.

You should include:

- The variables you will measure
- How you will measure these variables
- How you will improve accuracy
- How you will improve reliability
- An equation   **[5]**

Answers

Q1.

Check your answers for the following points:

- Change the frequency and record the frequency from the vibration generator.
- Measure the length of 3 or more waves using a ruler to increase accuracy.
- Divide the length of the waves, by the number of waves to obtain the average wavelength.
- Repeat the length measurement to improve reliability.
- Calculate the wavelength using wave speed = frequency × wavelength.

In lesson questions

Independent Task: Measuring the speed of waves on a string.

1. Write down the purpose of the vibration generator.

2. Copy and complete the table below

Method	Reason
Measure the length of multiple waves using a ruler.	
Divide the length by the number of waves.	

Independent Task - Copy and complete the table of data

Frequency (Hz)	Length of 3 waves (cm)				Wavelength (cm)	Wave speed (cm/s)
	1	2	3	average		
1.50	7.5	7.4	7.5	7.5	2.5	3.8
1.80	6.2	6.2	6.3			
2.10	5.4	5.5	5.3			
2.40	4.6	5.6	4.6			
2.70	4.2	4.1	4.1			

The speed of waves on a string

Complete the sentences:

As the frequency increases the wavelength …..

This is because the wave speed is ….

Worked Example - Examination question

P waves and S waves are different.
P waves are longitudinal and S waves are transverse. Look at the diagram of a model of a wave made with a slinky spring.

The wave is made by moving the spring up and down with a frequency of 1.2 Hz.
Look at the diagram.
i. Calculate the speed of the wave.

direction of movement of wave

spring moves up and down

0.22 m

1.60 m
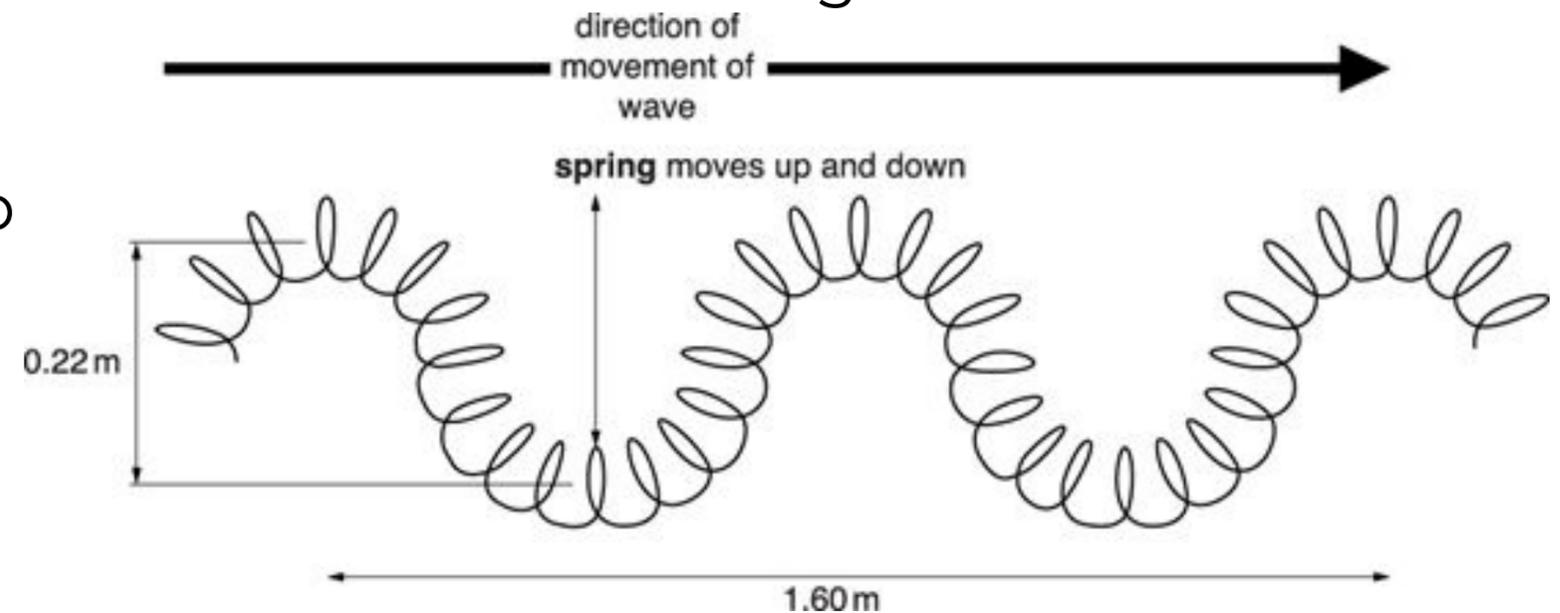
Answer …………………………………….. m/s   **[2]**

Answers as discussed in the next slide have not been seen or verified by OCR.

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Worked Example - Examination question

P waves and S waves are different.
P waves are longitudinal and S waves are transverse. Look at the diagram of a model of a wave made with a slinky spring.

The wave is made by moving the spring up and down with a frequency of 1.2 Hz.

ii. What is the amplitude of the wave?

Choose from

0.11 m   0.22 m   0.80 m   1.60 m   1.82 m   [1]
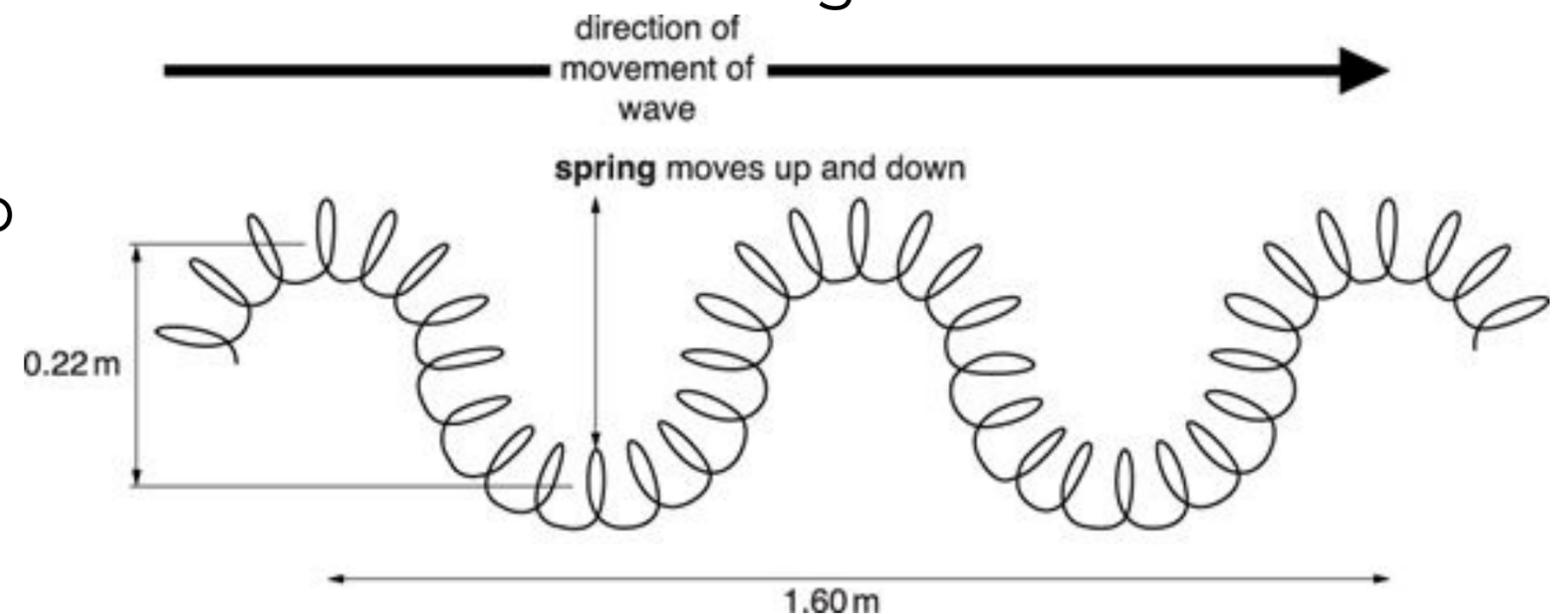
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Independent Task - Examination question

In the classroom a teacher demonstrates waves using a rope.

Look at the diagram of the wave.
i.   The frequency of the wave is 2 Hz.

What does this statement mean?   **[2]**
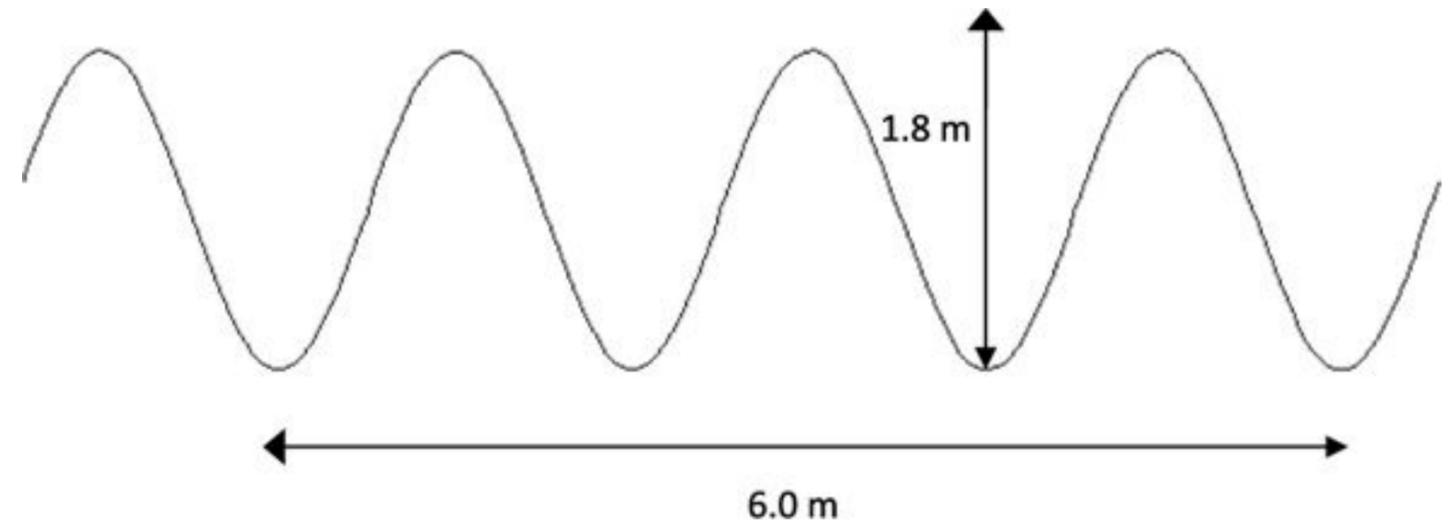
ii. How many seconds will it take this wave to travel 12 m?
Show your working.   **[3]**

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Answers

Independent Task: Measuring the speed of waves on a string.

1. Write down the purpose of the vibration generator.

   The vibration generator produces the **transverse** waves on the string.

2. Copy and complete the table below

Method	Reason
Measure the length of multiple waves using a ruler.	**This improves the accuracy our length measurement**
Divide the length by the number of waves.	**This allows us to calculate the mean wavelength.**

Review - Independent Task - Copy and complete the table of data

Frequency (Hz)	Length of 3 waves (cm)				Wavelength (cm)	Wave speed (cm/s)
	1	2	3	average		
1.50	7.5	7.4	7.5	7.5	2.5	3.8
1.80	6.2	6.2	6.3	**6.2**	**2.1**	**3.8**
2.10	5.4	5.5	5.3	**5.5**	**1.8**	**3.8**
2.40	4.6	5.6	4.6	**4.6**	**1.5**	**3.6**
2.70	4.2	4.1	4.1	**4.1**	**1.4**	**3.8**

Review - The speed of waves on a string

As the frequency increases the wavelength **decreases.**

This is because the wave speed is **constant.**

Review: Independent Task - Examination question

In the classroom a teacher demonstrates waves using a rope.

Look at the diagram of the wave.
i. The frequency of the wave is 2 Hz.

What does this statement mean?   **[2]**
Two waves pass the same point [1]
each second [1]
ii. How many seconds will it take this wave to travel 12 m?
Show your working.   **[3]**
Use of **velocity = frequency × wavelength**
V = 2 × 2 = 4 m/s
Then, 12 / 4 = 3 seconds

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