Properties of Waves

Monday, 16 June 2025

Answer the following questions:

1. State what is transferred by waves.
   Energy is transferred by waves.
2. State the definition of a longitudinal wave.
   A longitudinal wave is a wave where the oscilla 

   el to the direction of energy transfer
3. State the definition of a transverse wave.
   A transverse wave is a wave where the oscillations are perpendicular to the direction of energy transfer
4. State the formula to calculate the speed of an object.
   Speed = Distance/time
5. What happens when you hit a drum, why can we hear it.
   When you hit a drum, it makes a noise because the sound waves vibrating parallel to the energy transfer, which is to the ears.

Strech: Describe the difference between vector and scalar quantities.
Scalar quantities have size (magnitude) only, vector quantities have size and direction.

Do Now

Properties of Waves

P3.3.3

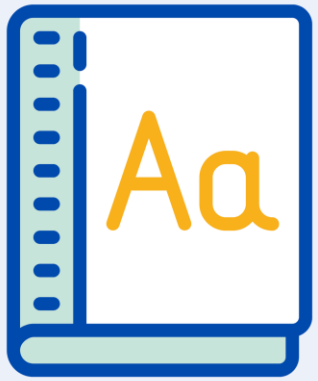
Science
Mastery

Lesson Objectives

Following this lesson, students will be able to:

- Label the key features on a transverse wave
- Calculate the frequency and time period of a wave.
- Compare sound waves in terms of pitch and volume.

Key Words:



wavelength **amplitude** **pitch**

frequency **period**

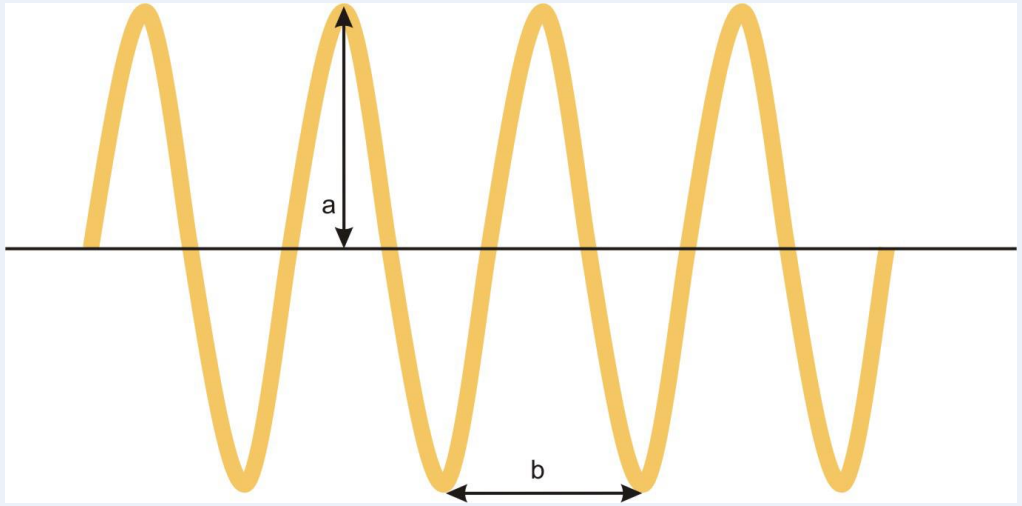
Properties of Waves

Waves have certain **properties.** Below is a transverse wave.

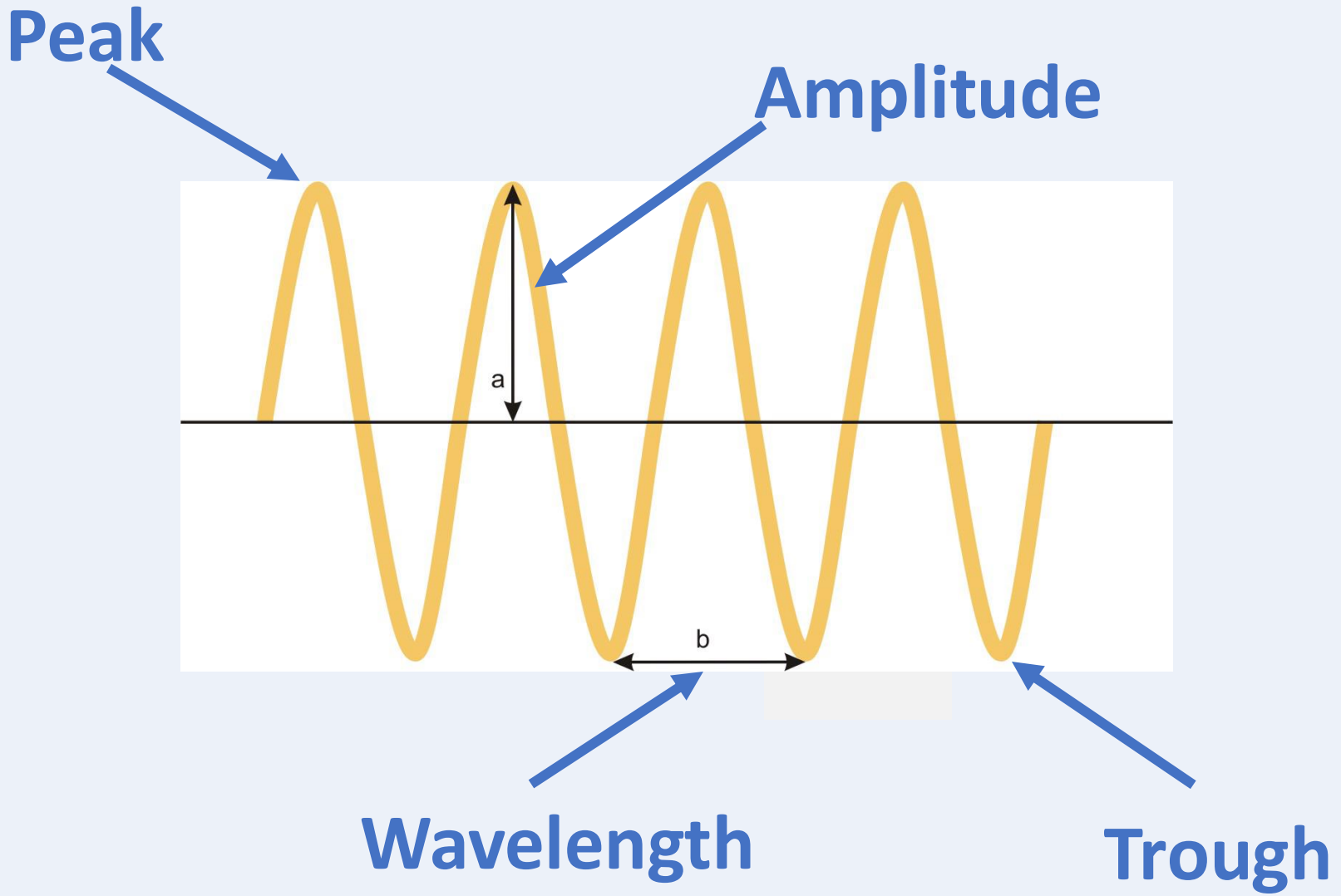
How can you tell it's a traverse wave?

The oscillations are perpendicular to the direction of the energy transfer

Peak – maximum point of the wave
Trough – minimum point of the wave
Wavelength - the distance from one point on one wave to the identical point on the next wave. The unit is metres (m)
Amplitude - the maximum distance of a point on the wave from its rest position



Label the wave



MWB: Quick check

1. What is the term used to describe the maximum point of a wave?

   Peak

2. How do you define the minimum point of a wave?

   Trough

3. What is the distance called from one point on a wave to the identical point on the next wave?

   Wavelength

4. What is its unit of wavelength?

   Meters (m)

5. How would you describe the maximum distance of a point on the wave from its rest position?

   Amplitude

Check for understanding

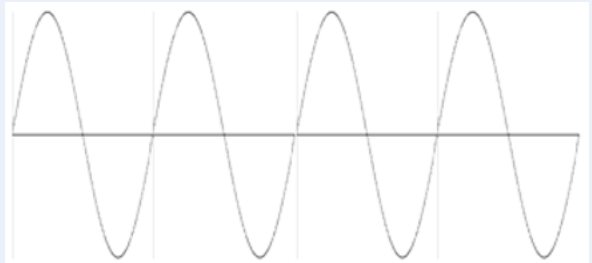
Properties of Waves

How can we change sound?

The **pitch** of a sound depends on the **frequency.** The higher the frequency, the higher the pitch.

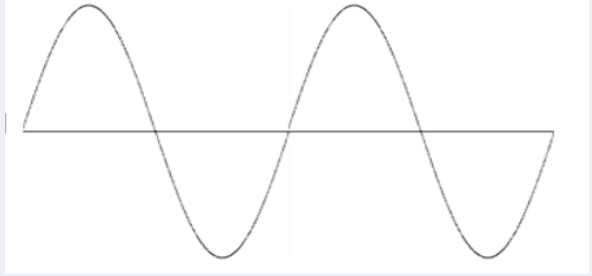
How loud a sound is dependent on the **amplitude**. The higher the amplitude, the louder the sound.

A



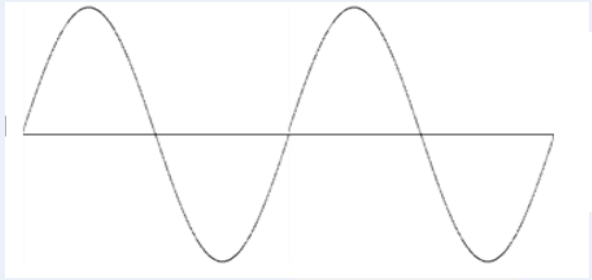
Higher pitch

B



Lower pitch

C



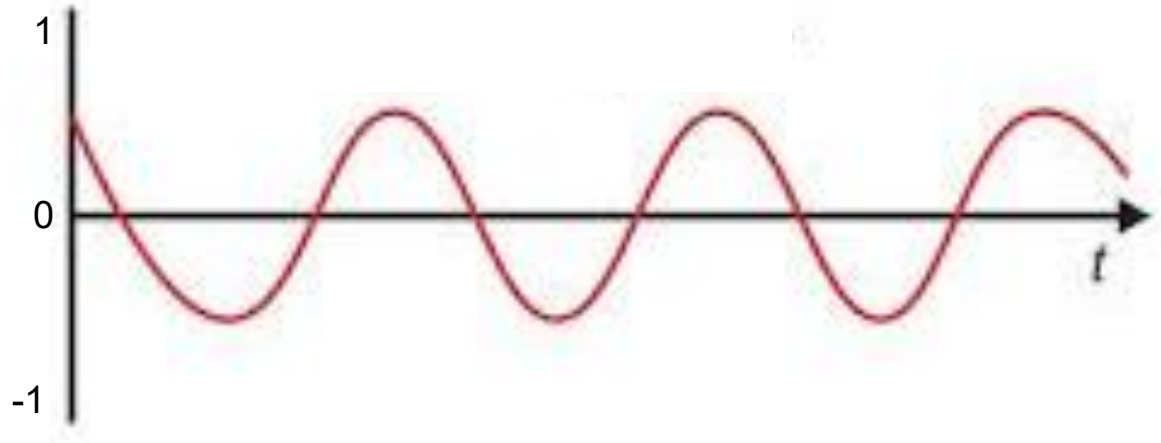
Louder volume

D

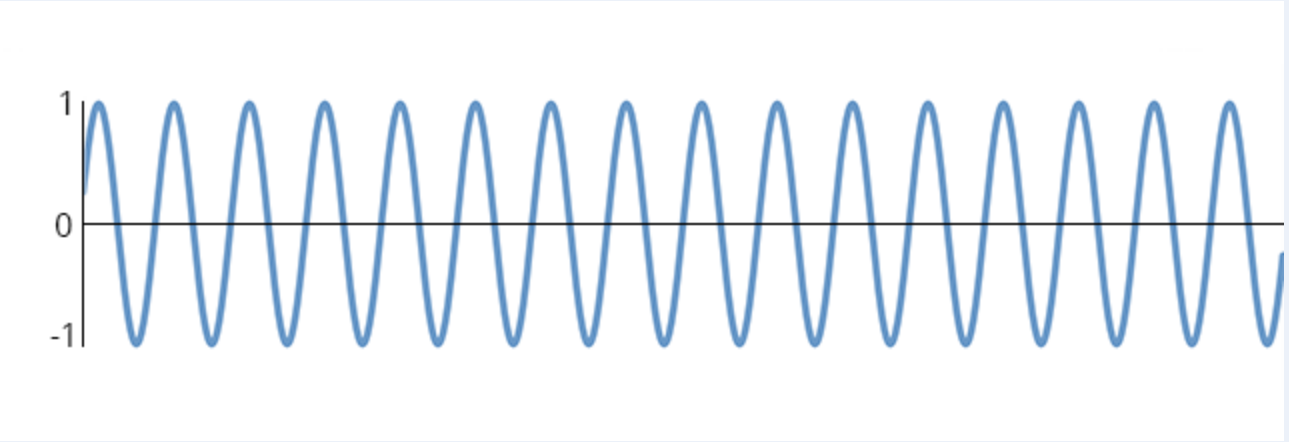
Quieter volume

Hinge question

1



2



Explain the difference between Wave A and wave B

Graph 1 has a lower pitch than graph 2 because it has a lower frequency.

Graph 1 also has a lower volume than graph 2 because it has half the amplitude.

Check for understanding

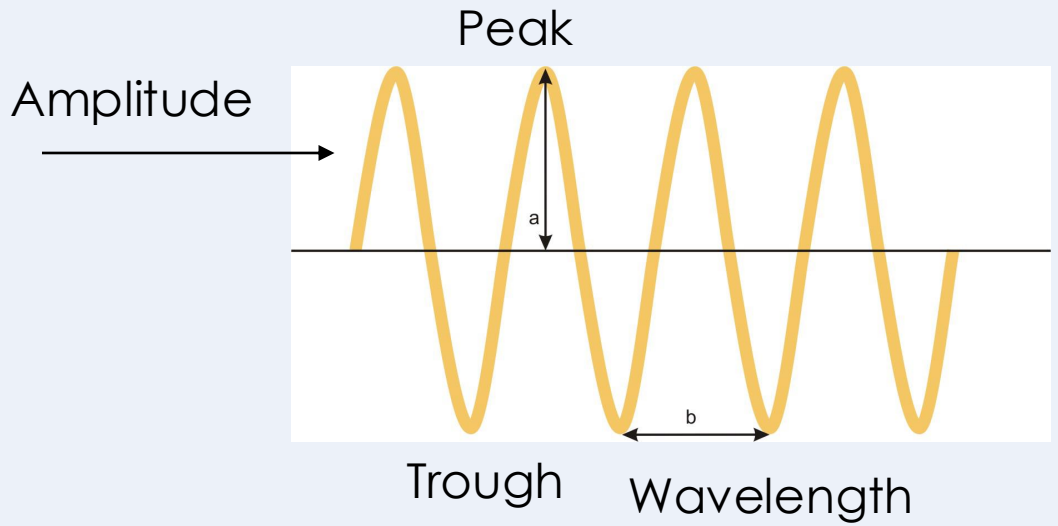
Properties of Waves

Waves have certain **properties**

Frequency, f – The number of waves that pass a point each second. The unit is Hertz (Hz)
Period, T – The length of time it takes one wave to pass a given point. The unit is seconds (s)

Therefore, to calculate frequency use the equation:

$$\text{Frequency (Hz)} = \frac{\text{No. of waves}}{\text{Time period (s)}}$$



Calculating Frequency

Frequency is the number of waves passing a point per second.

I DO: What is the frequency if 5 waves pass a point in 5 seconds?

Frequency = number of waves per second

Frequency = 5 waves in 5 seconds

Frequency = $\frac{5}{5}$

Frequency = 1 Hz

We DO: What is the frequency if 10 waves pass a point in 2 seconds?

Frequency = 10 waves in 2 seconds

Frequency = $\frac{10}{2}$

Frequency = 5 Hz

MWB: Calculating Frequency

Frequency is the number of waves passing a point per second.

What is the frequency if 15 waves pass a point in 2.5 seconds?

Frequency = number of waves per second

Frequency = 15 waves in 2.5 seconds

Frequency = $\frac{15}{2.5}$

Frequency = 6 Hz

What is the frequency if 40 waves pass a point in 20 seconds?

Frequency = 40 waves in 20 seconds

Frequency = $\frac{40}{20}$

Frequency = 2 Hz

Check for understanding

YOU DO: Frequency

Calculate the frequency.

*Hint – time must be in **seconds!***

1) 1 wave in 1 second.
2) 2 waves in 1 second.
3) 2 waves in 2 seconds.
4) 20 waves in 5 seconds.
5) 10 waves in 5 seconds.
6) 10 waves in half a minute.
7) 20 waves in 40 seconds.
8) 50 waves in 2 seconds.

Stretch:

9) 10 waves pass in 50 seconds. What is the frequency?
10) 15,000 waves pass in 3 seconds. What is the frequency?
11) 120 waves pass per minute. What is the frequency?
12) 1800 waves pass in 2 minutes.

Activity

Calculate the frequency.

1) 1 wave in 1 second.
2) 2 waves in 1 second.
3) 2 waves in 2 seconds.
4) 20 waves in 5 seconds.
5) 10 waves in 5 seconds.
6) 10 waves in half a minute.
7) 20 waves in 40 seconds.
8) 50 waves in 2 seconds.

Stretch:

9) 10 waves pass in 50 seconds. What is the frequency?
10) 15,000 waves pass in 3 seconds. What is the frequency?
11) 120 waves pass per minute. What is the frequency?
12) 1800 waves pass in 2 minutes.

Activity

Calculating Frequency

Sometimes you will not be told how many waves pass a point; therefore, we use this equation to calculate the frequency

$$\boldsymbol{Frequency} = \frac{\mathbf{1}}{\boldsymbol{Time\ Period}} \qquad f = \frac{1}{T}$$

I DO: What is the frequency if it takes two seconds for a wave to pass a point?

Time Period = 2 seconds

$$\boldsymbol{Frequency} = \frac{\mathbf{1}}{\boldsymbol{Time\ Period}}$$

$$\boldsymbol{Frequency} = \frac{\mathbf{1}}{\mathbf{2}}$$

Frequency = 0.5 Hz

Calculating Frequency

We can also calculate frequency using this equation:

$$\boldsymbol{Frequency = \frac{1}{Time\ Period}} \qquad \boldsymbol{f = \frac{1}{T}}$$

MWB: What is the frequency if it takes 8 seconds for a wave to pass a point?

Time Period = 8 seconds

$$\boldsymbol{Frequency = \frac{1}{Time\ Period}}$$

$$\boldsymbol{Frequency = \frac{1}{8}}$$

Frequency = 0.125 Hz

Check for understanding

YOU DO: Time period

Answer the following questions, showing all working.

Hint – rearrange the equation:

$$f = \frac{1}{T}$$

1) A wave has a frequency of 40 Hz, what is the time period?
   f=1/T
   40=1/T
   T=1/40=0.025s
2) A wave has a time period of 0.5 s, what is the frequency?
   f=1/T
   f=1/0.5
   f=2Hz
3) A wave has a frequency of 67 Hz, what is the time period?
   f=1/T
   67=1/T
   T=1/67=0.015s
4) A wave has a time period of 0.22 s, what is the frequency?
   f=1/T
   f=1/0.22
   f=4.5Hz

Activity

Choose the correct keyword in each case:

A)The number of waves that pass a point each second. The unit is Hertz (Hz)

- ✓ Frequency
- Wavelength
- Peak
- Period

B) The distance from one point on one wave to the identical point on the next wave. The unit is metres (m)

- Amplitude
- ✓ Wavelength
- Peak
- Period

C) The maximum distance of a point on the wave from its rest position

- Period
- Trough
- Peak
- ✓ Amplitude

Check for understanding

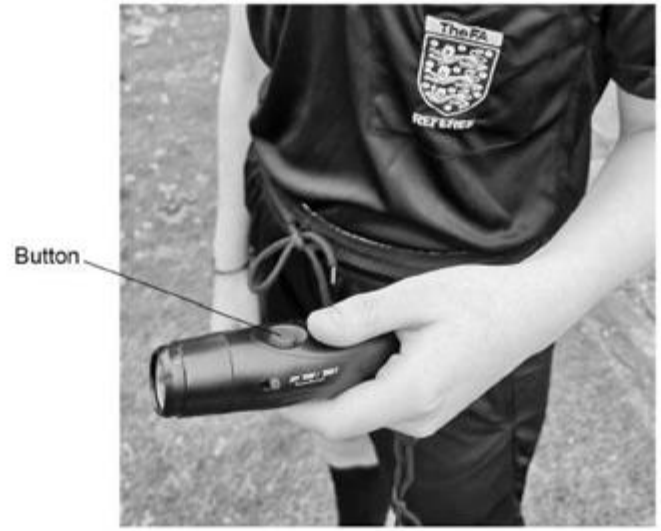
Answer exam style questions

Activity

Q1.

Figure 1 shows an electronic whistle used by a referee in a football match.

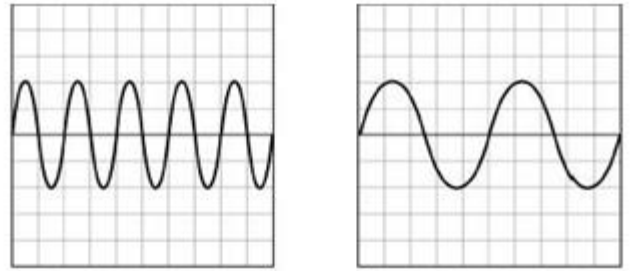
Figure 1



When the button is pressed the whistle emits sound waves that travel through the air.

(a) What is transferred by the sound waves as they travel through the air?

Tick (✓) **one** box.



Wave **A** Wave **B**

(b) Complete the sentences to describe a difference and a similarity between the two waves.

Choose answers from the box.

amplitude	frequency	wavelength	period

Difference

Wave **A** has a greater _____ than wave **B**.

Similarity

Wave **A** has the same _____ as wave **B**.

(2)

(c) Wave **A** has a frequency of 4.0 kHz.

Which of the following is the same as 4.0 kHz?

Tick (✓) **one** box.

Answers

Q1.

(a) energy

1

(b) frequency

1

amplitude

1

(c) 4000 Hz

1

(d)

$$T = \frac{1}{4000}$$

1

0.00025 (s)

allow ecf from question ***(d)***

1

(e) compression

1

rarefaction

either order

1

[8]

Activity

Q2.

(a) B

1

(b) A

1

(c) $\frac{2.5 \text{ (waves)}}{0.5 \text{ (s)}}$

1

5(.0)(Hz)

1

(d) longitudinal

1

(e) timing (from seeing the blocks bang together and hearing the sound)
or
risk of cancelling the timer

ignore human error unqualified

allow reaction time (of student B)

1

(f) student to stand further away (so there is a greater time lag to measure)

allow other correct methods, eg using echoes

1

[7]

Activity

Answer the questions below.

1. How do light and sound travel?

- ☐ A. Light and sound move instantly from one place to another
- ☑ B. Light and sound travel as waves
- ☐ C. Light and sound travel as particles

2. Which is the correct definition of the frequency of a wave?

- ☐ A. The time taken for a wave to pass a point
- ☑ B. The number of waves that pass a point per second
- ☐ C. The distance from one point of a wave to the identical point on the next wave

3. Which of the correct definition of the amplitude of a wave?

- ☐ A. The distance from the peak of the wave to the trough of the wave
- ☑ B. The maximum displacement of a point on the wave from its rest position
- ☐ C. The distance from a point on one wave to the identical point on the next wave

Exit ticket

Feedback

Lesson P3.3.3	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link. Thank you!