AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.1.1

Transverse and longitudinal waves

Past-paper questions

Tier	**Foundation**
Question groups	**13**
Available paper years	**2003–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.6.1.1 Transverse and longitudinal waves

Question 01

June 2003 | 3451F | Original Q3 | Legacy

3 (a) In the box are the names of five waves.

infra red	**microwaves**	**ultrasonic**	**ultraviolet**	**X-rays**

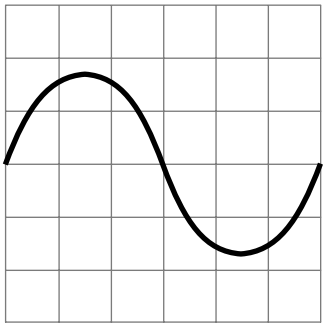
Which wave is used to:

(i) send information to a satellite, ...
(1 mark)

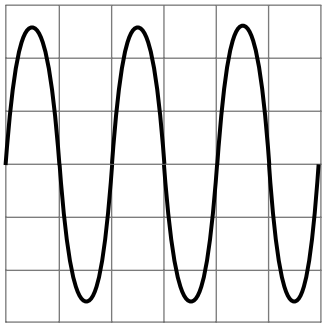
(ii) toast bread, ...
(1 mark)

(iii) clean a valuable ring? .....
(1 mark)

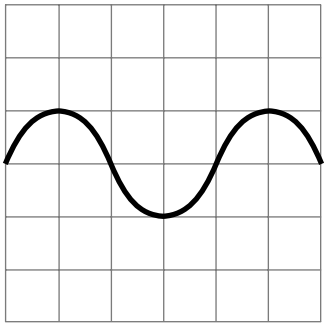
(b) The diagram shows four oscilloscope wave traces. The controls of the oscilloscope were the same for each wave trace.



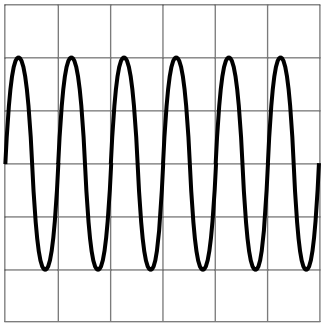
A



B



C



D

Which **one** of the waves traces, **A**, **B**, **C** or **D**, has:

(i) the largest amplitude, ...
(1 mark)

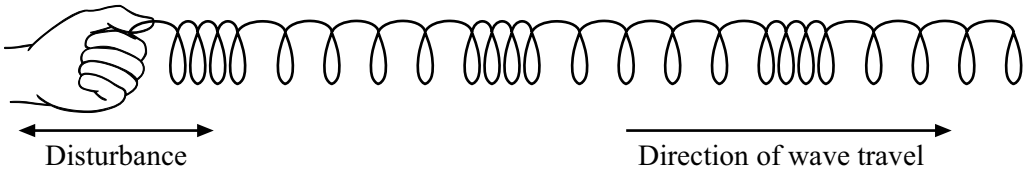
(ii) the lowest frequency? .....
(1 mark)

4.6.1.1 Transverse and longitudinal waves

Question 01 · continued

MARGIN BLANK

(c) The diagram shows a longitudinal wave in a stretched spring.



Complete the sentence. You should put only **one** word in each space.

A longitudinal wave is one in which the ..... causing the wave is in the same ..... as that in which the wave moves.

(2 marks)

(d) Which **one** of the following types of wave is longitudinal? Draw a ring around your answer.

light wave **sound wave** **water wave**

(1 mark)

8

4.6.1.1 Transverse and longitudinal waves

Question 02

June 2003 | 3462F3 | Original Q3 | Legacy

3 (a) In the box are the names of five waves.

infra red	**microwaves**	**ultrasonic**	**ultraviolet**	**X-rays**

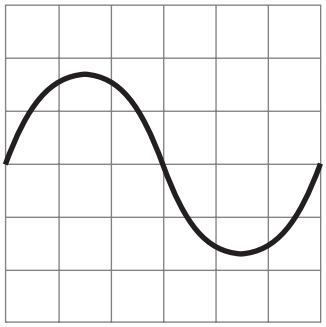
Which wave is used to:

(i) send information to a satellite, ...
(1 mark)

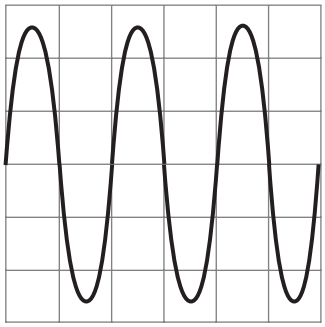
(ii) toast bread, ...
(1 mark)

(iii) clean a valuable ring? .....
(1 mark)

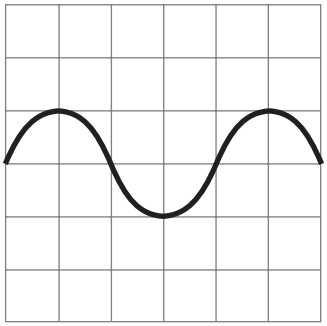
(b) The diagram shows four oscilloscope wave traces. The controls of the oscilloscope were the same for each wave trace.



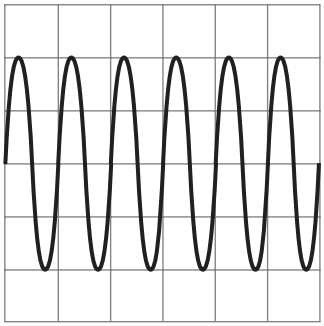
A



B



C



D

Which **one** of the waves traces, **A**, **B**, **C** or **D**, has:

(i) the largest amplitude, ...
(1 mark)

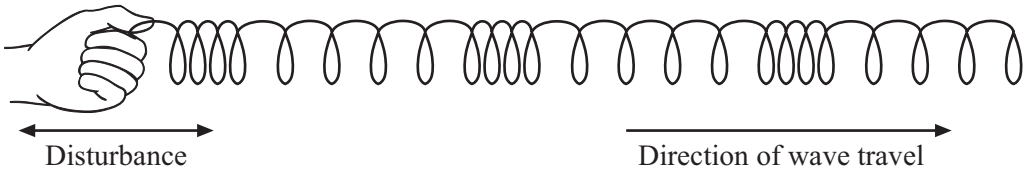
(ii) the lowest frequency? .....
(1 mark)

4.6.1.1 Transverse and longitudinal waves

Question 02 · continued

MARGIN BLANK

(c) The diagram shows a longitudinal wave in a stretched spring.



Complete the sentence. You should put only **one** word in each space.

A longitudinal wave is one in which the ..... causing the wave is in the same ..... as that in which the wave moves.

(2 marks)

(d) Which **one** of the following types of wave is longitudinal? Draw a ring around your answer.

light wave **sound wave** **water wave**

(1 mark)

8

4.6.1.1 Transverse and longitudinal waves

Question 03

June 2006 | 3451 | Original Q13 | Legacy

13 (a) The diagram shows water waves made by a wave machine in a swimming pool.



In 10 seconds 5 complete waves go past a person standing in the pool.

Calculate the frequency of the water waves and give the unit.

Show how you work out your answer.

.....

Frequency = ...

(2 marks)

(b) Water waves are transverse waves.

Give **one** other example of a transverse wave.

.....

(1 mark)

(c) How is a transverse wave different from a longitudinal wave? You may draw a diagram to help you with your answer.

.....

.....

.....

.....

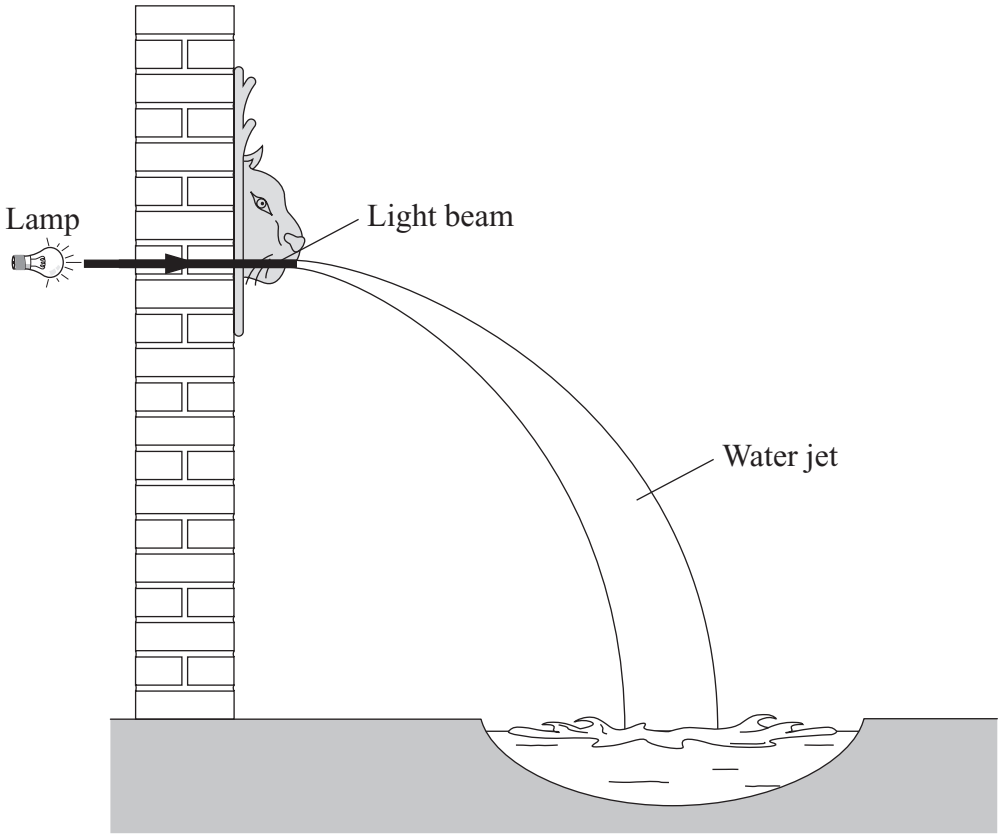
(2 marks)

4.6.1.1 Transverse and longitudinal waves

Question 03 · continued

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(d) The diagram shows a garden fountain. The fountain features a light beam that is totally internally reflected by the water jet.



(i) Draw the path of the light beam through the water jet. *(1 mark)*

(ii) Complete the following sentence by crossing out the **two** lines in the box that are wrong.

For light to be totally internally reflected the angle between the light ray and the normal must be

smaller than
equal to
bigger than

the critical angle.

(1 mark)

7

4.6.1.1 Transverse and longitudinal waves

Question 04

June 2006 | 3462 | Original Q11 | Legacy

11 (a) The diagram shows water waves made by a wave machine in a swimming pool.



In 10 seconds 5 complete waves go past a person standing in the pool.

Calculate the frequency of the water waves and give the unit.

Show how you work out your answer.

.....

Frequency = ...

(2 marks)

(b) Water waves are transverse waves.

Give **one** other example of a transverse wave.

.....

(1 mark)

(c) How is a transverse wave different from a longitudinal wave? You may draw a diagram to help you with your answer.

.....

.....

.....

.....

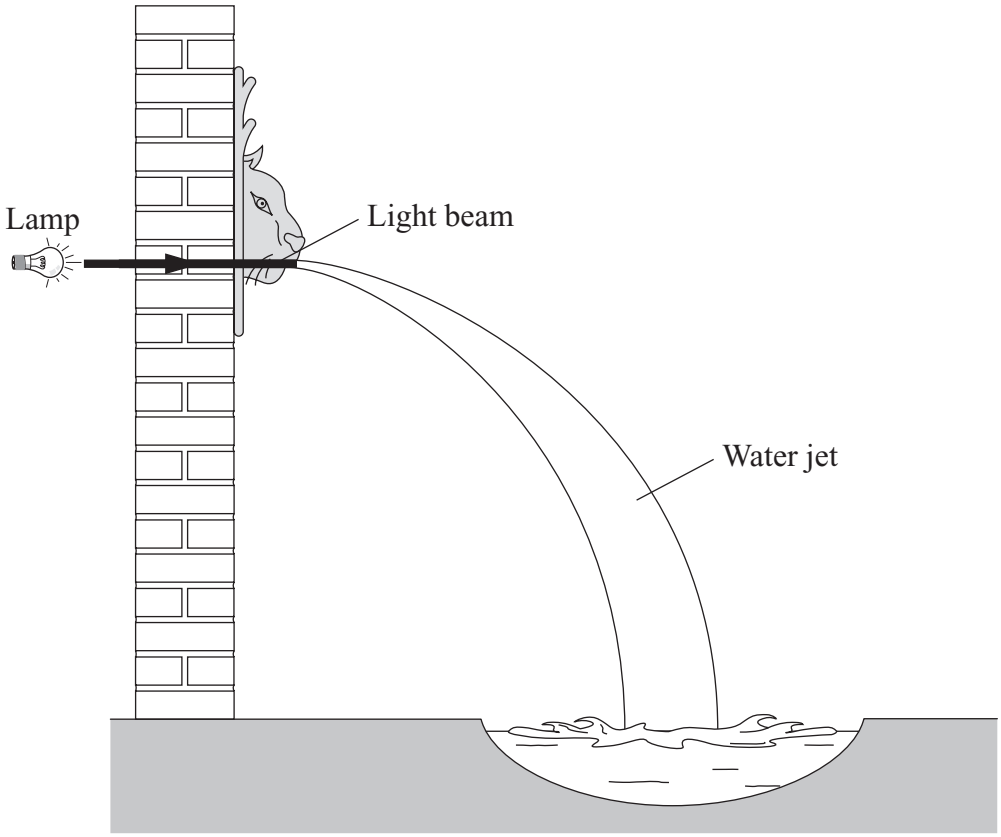
(2 marks)

4.6.1.1 Transverse and longitudinal waves

Question 04 · continued

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(d) The diagram shows a garden fountain. The fountain features a light beam that is totally internally reflected by the water jet.



(i) Draw the path of the light beam through the water jet. *(1 mark)*

(ii) Complete the following sentence by crossing out the **two** lines in the box that are wrong.

For light to be totally internally reflected the angle between the light ray and the normal must be

smaller than
equal to
bigger than

the critical angle.

(1 mark)

7

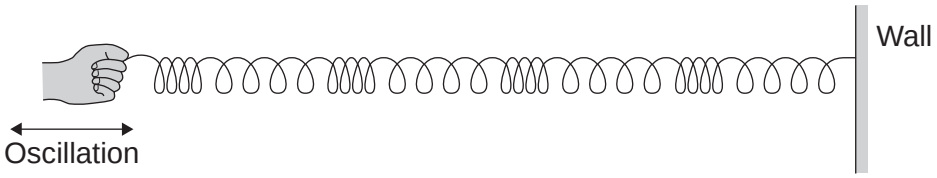
4.6.1.1 Transverse and longitudinal waves

Question 05

June 2012 | PH1FP | Original Q6 | Legacy

6 **Diagram 1** shows a longitudinal wave being produced in a stretched spring.

Diagram 1



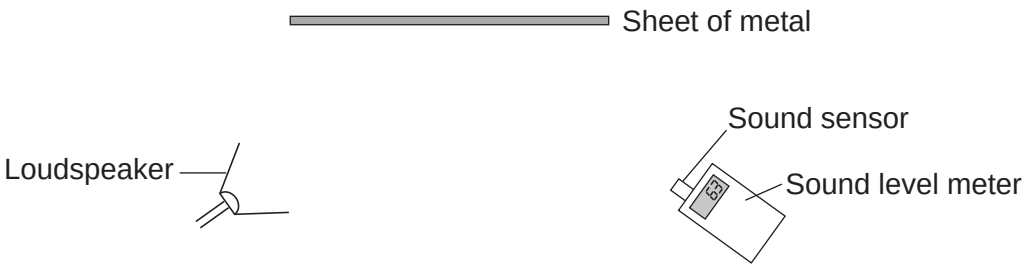
6 (a) A longitudinal wave has areas of compression and areas of rarefaction.

Mark with the letter **C**, **one** area of compression shown in **Diagram 1**.

(1 mark)

6 (b) **Diagram 2** shows the apparatus a teacher uses to demonstrate that sound can be reflected.

Diagram 2



6 (b) (i) Using a ruler, draw on **Diagram 2** to show how sound from the loudspeaker is reflected by the sheet of metal to the sound sensor.

(2 marks)

6 (b) (ii) The teacher replaced the sheet of metal with a sheet of glass.

When he did this, the reading on the sound level meter went down.

Suggest why.

.....

.....

(1 mark)

4.6.1.1 Transverse and longitudinal waves

Question 05 · continued

6 (b) (iii) The teacher changed the output from the loudspeaker to increase the amplitude of the sound wave produced.

What effect, if any, does this increase of amplitude have on the loudness of the sound?

Draw a ring around the correct answer.

makes the sound quieter	**does not change the loudness of the sound**	**makes the sound louder**

(1 mark)

6 (b) (iv) The loudspeaker produces a sound wave at a frequency of 850 Hz. The wavelength of the sound wave is 0.4 m.

Calculate the speed of the sound wave.

Use the correct equation from the Physics Equations Sheet.

Show clearly how you work out your answer.

.....

.....

.....

Speed = ... m/s

(2 marks)

6 (c) Music concerts are sometimes performed in sports halls. The concerts can be spoilt because of the sound reflected from the floor and walls.

What word is used to describe a reflected sound?

.....

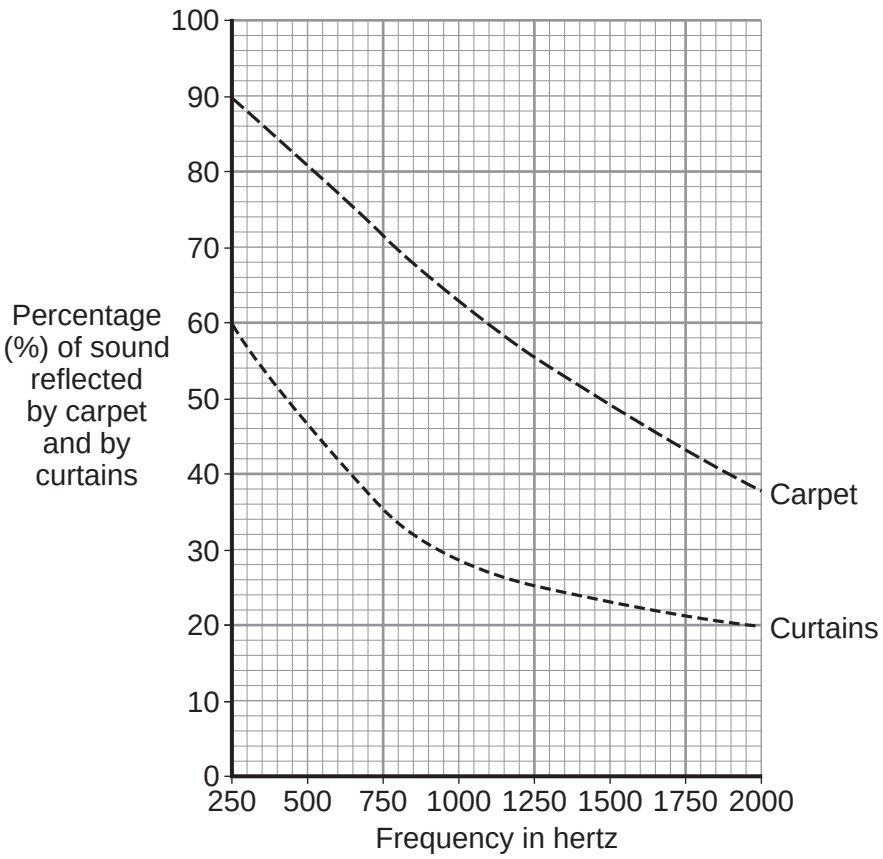
(1 mark)

Question 6 continues on the next page

4.6.1.1 Transverse and longitudinal waves

Question 05 · continued

6 (d) The graph shows how the percentage of sound reflected from the floor and from the walls of a large room can be reduced by carpets and by curtains.



6 (d) (i) Over which range of frequencies do curtains reduce the percentage of sound reflected the most?

Tick (✓) **one** box.

from 250 Hz to 750 Hz ☐

from 750 Hz to 1250 Hz ☐

from 1250 Hz to 1750 Hz ☐

(1 mark)

4.6.1.1 Transverse and longitudinal waves

Question 05 · continued

6 (d) (ii) The manager of a sports hall plans to use the hall for regular music concerts. He has enough money to buy either carpet or curtains, but not both.

To improve the sound an audience hears, it would be better to hang curtains on the walls rather than laying a carpet over the floor.

Use the data in the graph to explain why.

.....

.....

.....

.....

(2 marks)

11

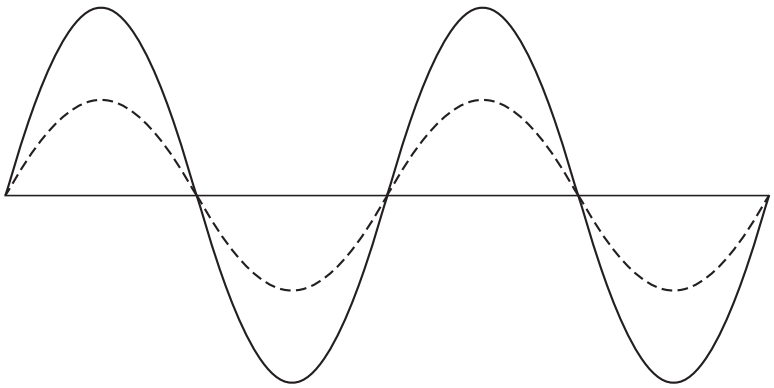
Turn over for the next question

4.6.1.1 Transverse and longitudinal waves

Question 06

4 (a) **Diagram 1** shows two waves.

Diagram 1



4 (a) (i) Name **one** wave quantity that is the same for the two waves.

.....

(1 mark)

4 (a) (ii) Name **one** wave quantity that is different for the two waves.

.....

(1 mark)

4 (a) (iii) The waves in **Diagram 1** are transverse.

Which **one** of the following types of wave is **not** a transverse wave?

Draw a ring around the correct answer.

gamma rays **sound** **visible light**

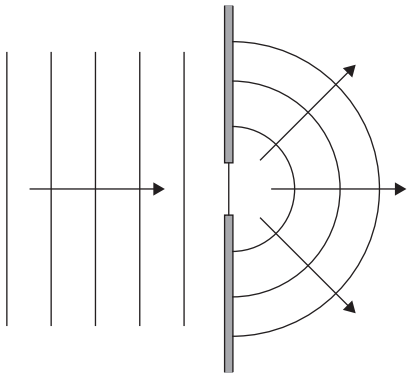
(1 mark)

4.6.1.1 Transverse and longitudinal waves

Question 06 · continued

4 (b) **Diagram 2** shows water waves in a ripple tank moving towards and passing through a gap in a barrier.

Diagram 2



4 (b) (i) The water waves spread out after passing through the gap in the barrier.

What name is given to the process causing the waves to spread out?

.....

(1 mark)

4 (b) (ii) Every second, 8 waves pass through the gap in the barrier. The waves have a wavelength of 0.015 metres.

Calculate the speed of the water waves and give the unit.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Speed = ...

(3 marks)

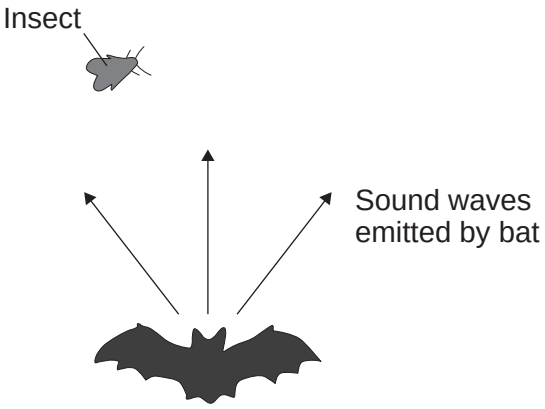
7

4.6.1.1 Transverse and longitudinal waves

Question 07

6 Bats use the reflection of high pitched sound waves to determine the position of objects. **Figure 10** shows a bat and an insect flying in front of the bat.

Figure 10



6 (a) What determines the pitch of a sound wave?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
amplitude	
frequency	
speed	

6 (b) State the name given to reflected sound waves.

[1 mark]

_____

4.6.1.1 Transverse and longitudinal waves

Question 07 · continued

6 (c) The bat emits sound waves with a range of wavelengths.

Some of the sound waves will be diffracted by the insect.

Complete the following sentences to explain why.

[2 marks]

Diffraction is caused by the sound waves _____ as they pass the insect.

The most diffraction happens when the wavelength of the sound wave is

_____ the size of the insect.

6 (d) The bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

_____

Speed = _____ m/s

6 (e) Sound waves are longitudinal. Describe a longitudinal sound wave.

[2 marks]

_____

_____

_____

_____

8

4.6.1.1 Transverse and longitudinal waves

Question 08

June 2018 | 8463/2F | Original Q12

1 2 P-waves and S-waves are two types of seismic wave caused by earthquakes.

1 2 . 1 Which **one** of the statements about P-waves and S-waves is correct?

Tick **one** box.

[1 mark]

P-waves and S-waves are transverse. ☐

P-waves and S-waves are longitudinal. ☐

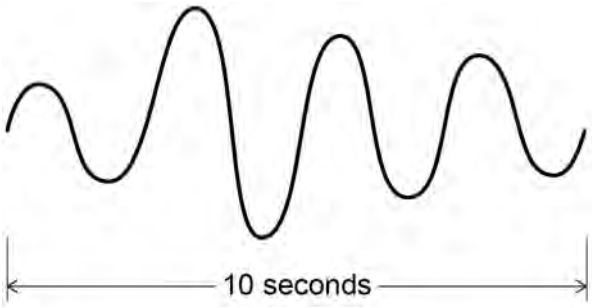
P-waves are transverse and S-waves are longitudinal. ☐

P-waves are longitudinal and S-waves are transverse. ☐

Seismometers on the Earth's surface record the vibrations caused by seismic waves.

Figure 16 shows the vibration recorded by a seismometer for one P-wave.

Figure 16



1 2 . 2 Calculate the frequency of the P-wave shown in **Figure 16**.

[1 mark]

Frequency = _____ Hz

4.6.1.1 Transverse and longitudinal waves

Question 08 · continued

12.3 Write down the equation which links frequency, wavelength and wave speed.

[1 mark]

12.4 The P-wave shown in **Figure 16** is travelling at 7200 m/s.

Calculate the wavelength of the P-wave.

[3 marks]

Wavelength = _____ m

12.5 Explain why the study of seismic waves provides evidence for the structure of the Earth's core.

[2 marks]

8

4.6.1.1 Transverse and longitudinal waves

Question 09

June 2022 | 8463/2F | Original Q7

0 7 Sound travels as longitudinal waves.

0 7 . 1 Complete the sentences.

Choose the answers from the box.

[2 marks]

amplitude	**frequency**	**speed**	**wavelength**

The distance between the centre of one compression of a sound wave and the centre of the next compression is called the _____ .

The number of waves passing a point each second is called the _____ .

0 7 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

opposite	**perpendicular**	**parallel**

In a longitudinal wave, the oscillations are _____ to the direction of energy transfer.

Question 7 continues on the next page

4.6.1.1 Transverse and longitudinal waves

Question 09 · continued

0 7 . 3 A sound wave has a frequency of 8.0 kHz.

Which of the following is the same as 8.0 kHz?

[1 mark]

Tick (✓) **one** box.

- 0.0080 Hz ☐
- 8.0 Hz ☐
- 8000 Hz ☐
- 800 000 Hz ☐

0 7 . 4 Calculate the period of a sound wave with a frequency of 8.0 kHz.

Use the Physics Equations Sheet.

[2 marks]

Period = _____ s

4.6.1.1 Transverse and longitudinal waves

Question 09 · continued

0 7 . 5 Calculate the wavelength of a sound wave with a frequency of 6600 Hz.

speed of sound = 330 m/s

Use the equation:

$$\text{wavelength} = \frac{\text{speed}}{\text{frequency}}$$

Choose the unit from the box.

[3 marks]

kg	m	N

Wavelength = _____ Unit _____

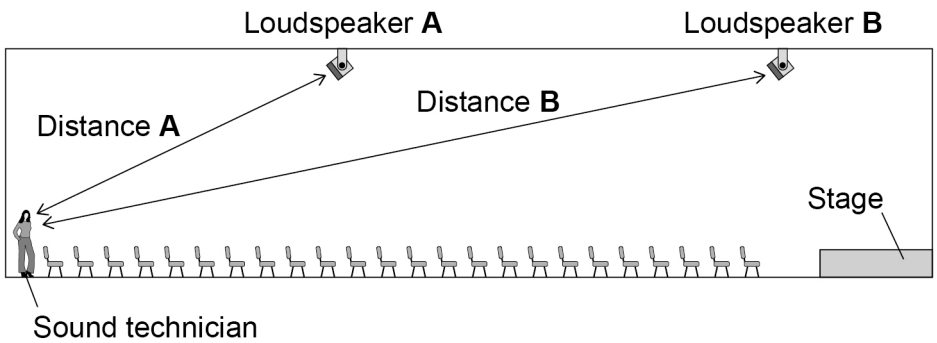
Question 7 continues on the next page

4.6.1.1 Transverse and longitudinal waves

Question 09 · continued

Figure 14 shows the arrangement of two loudspeakers at a concert venue.

Figure 14



The loudspeakers in **Figure 14** are tested by playing the same song through both loudspeakers.

A sound technician listens to the song.

Use the Physics Equations Sheet to answer questions **07.6** and **07.7**.

0 7 . 6 Write down the equation which links distance (*s*), speed (*v*) and time (*t*).

[1 mark]

0 7 . 7 Distance **A** on **Figure 14** is 13.2 m.

speed of sound = 330 m/s

Calculate the time taken for the sound to travel from loudspeaker **A** to the technician.

[3 marks]

Time taken = _____ s

4.6.1.1 Transverse and longitudinal waves

Question 09 · continued

0 7 . 8 The sound from each loudspeaker travels at the same speed.

For the sound technician to hear the song clearly, the sound from loudspeaker **B** should be emitted slightly before the sound from loudspeaker **A**.

Explain why.

[3 marks]

16

Turn over for the next question

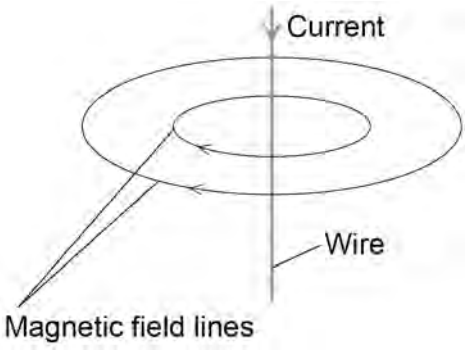
4.6.1.1 Transverse and longitudinal waves

Question 10

June 2023 | 8463/2F | Original Q3

0 3 **Figure 5** shows the magnetic field pattern produced when there is a current in a wire.

Figure 5



0 3 . 1 What do the arrows on the magnetic field lines represent?

[1 mark]

0 3 . 2 How could the strength of the magnetic field be increased?

[1 mark]

Tick (✓) **one** box.

Change the direction of the current in the wire ☐

Increase the current in the wire ☐

Increase the temperature of the wire ☐

4.6.1.1 Transverse and longitudinal waves

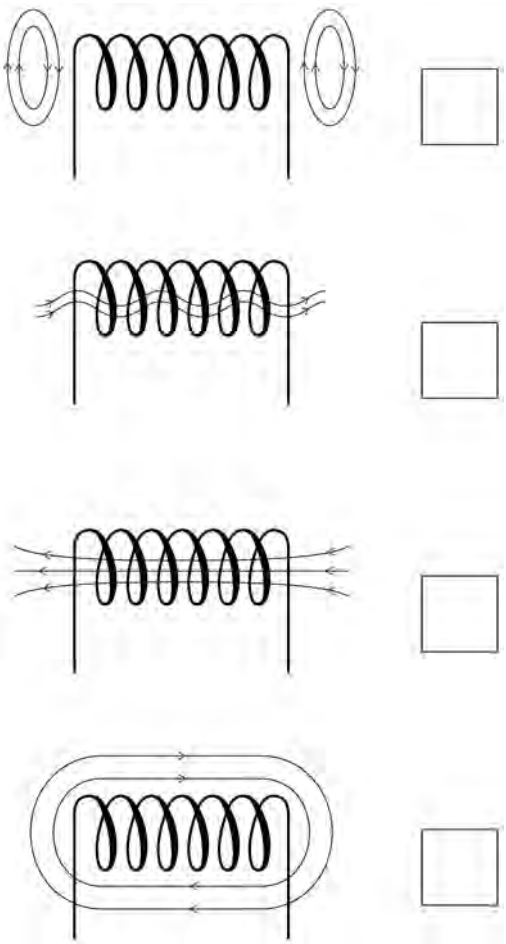
Question 10 · continued

0 3 . 3 The wire is coiled to make a solenoid.

Which diagram in **Figure 6** shows the magnetic field pattern produced when there is a current in the solenoid?

[1 mark]

Figure 6



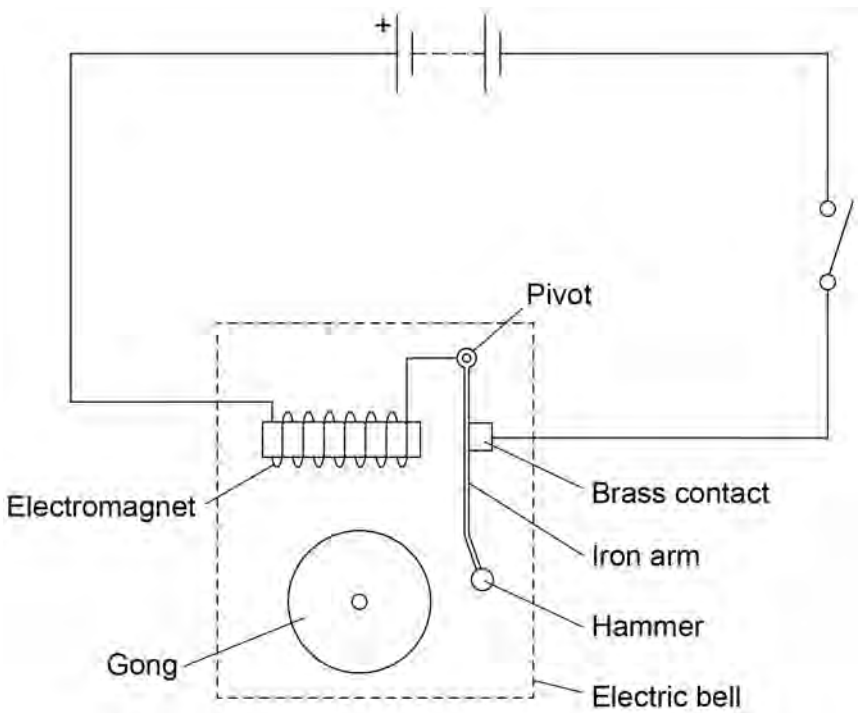
Question 3 continues on the next page

4.6.1.1 Transverse and longitudinal waves

Question 10 · continued

Figure 7 shows the parts of an electric bell.

Figure 7

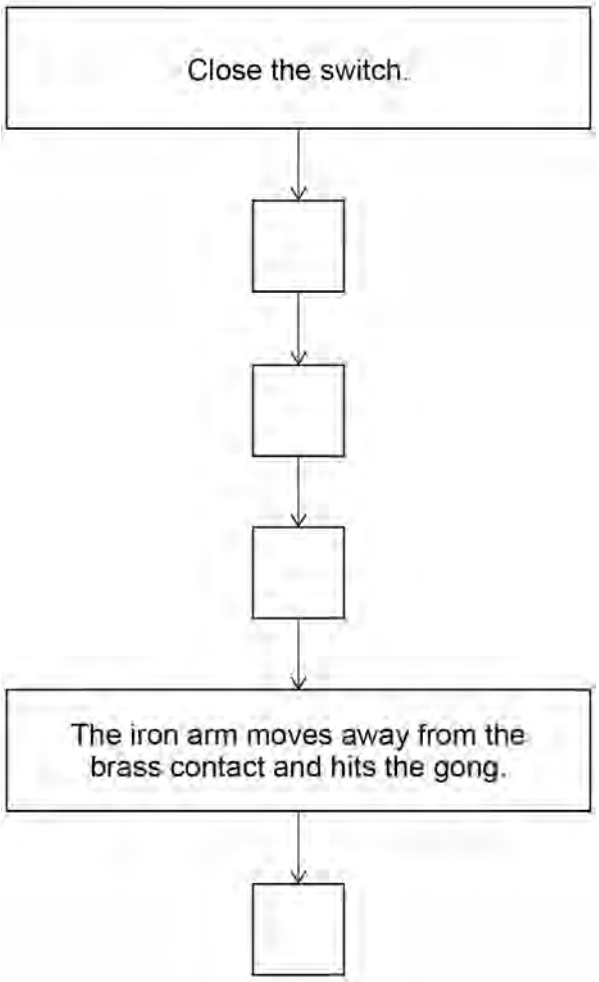


4.6.1.1 Transverse and longitudinal waves

Question 10 · continued

0 3 . 4 **Figure 8** shows an incomplete sequence of how the bell works.

Figure 8



Write **one** letter in each box to show the correct sequence.

Use each letter once.

[2 marks]

A A magnetic field is created around the electromagnet.

B A resultant force acts on the iron arm causing it to move towards the electromagnet.

C The iron arm returns to its original position.

D There is a current in the circuit.

4.6.1.1 Transverse and longitudinal waves

Question 10 · continued

0 3 . 5 Which of the following would increase the resultant force on the iron arm?

[1 mark]

Tick (✓) **one** box.

Decrease the distance between the electromagnet and the iron arm ☐

Decrease the number of cells in the circuit ☐

Decrease the number of turns on the electromagnet ☐

0 3 . 6 The iron arm of the bell vibrates with a frequency of 6.25 Hz.

Calculate the period of the iron arm.

Use the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

[2 marks]

Period = _____ s

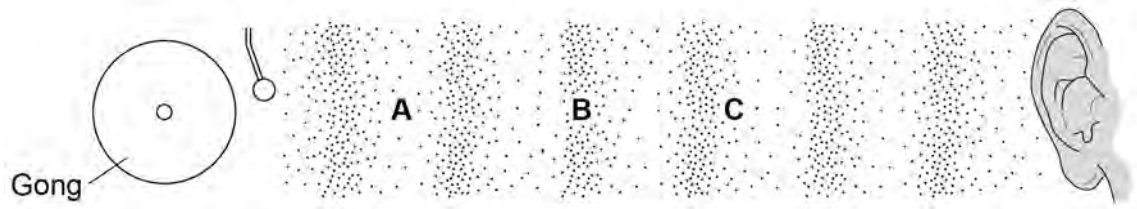
4.6.1.1 Transverse and longitudinal waves

Question 10 · continued

0 3 . 7 The sound waves produced by the bell are longitudinal waves.

Figure 9 shows the position of the air particles at one point in time as the sound waves travel through the air.

Figure 9



Which letter represents an area of compression?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

9

Turn over for the next question

4.6.1.1 Transverse and longitudinal waves

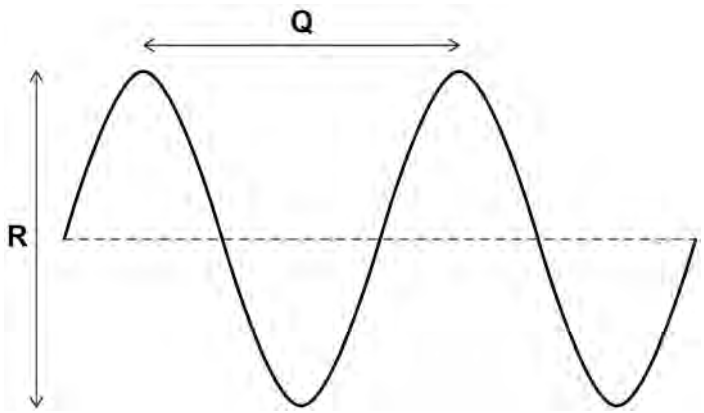
Question 11

June 2023 | 8463/2F | Original Q5

0 5 Electromagnetic waves are transverse.

Figure 13 represents a transverse wave.

Figure 13



0 5 . 1 Which of the following gives the wavelength of the transverse wave?

[1 mark]

Tick (✓) **one** box.

wavelength = $\frac{Q}{2}$ ☐

wavelength = Q ☐

wavelength = 2 Q ☐

0 5 . 2 Which of the following gives the amplitude of the transverse wave?

[1 mark]

Tick (✓) **one** box.

amplitude = $\frac{R}{2}$ ☐

amplitude = R ☐

amplitude = 2 R ☐

4.6.1.1 Transverse and longitudinal waves

Question 11 · continued

0 5 . 3 Microwaves are electromagnetic waves used for mobile phone communications.

Which other type of electromagnetic wave is also used for communications?

[1 mark]

Tick (✓) **one** box.

Radio waves ☐

Ultraviolet ☐

X-rays ☐

0 5 . 4 Microwaves from a mobile phone take 0.000 009 s to reach a mobile phone mast.

speed of microwaves = 300 000 000 m/s

Calculate the distance between the mobile phone and the mobile phone mast.

Use the equation:

distance = speed × time

[2 marks]

Distance = _____ m

0 5 . 5 Mobile phone communications is only one of the uses for microwaves.

Give **one** other use of microwaves.

[1 mark]

6

4.6.1.1 Transverse and longitudinal waves

Question 12

June 2023 | 8463/2F | Original Q9

0 9 Infrared waves are transverse waves.

0 9 . 1 Complete the sentence.

[1 mark]

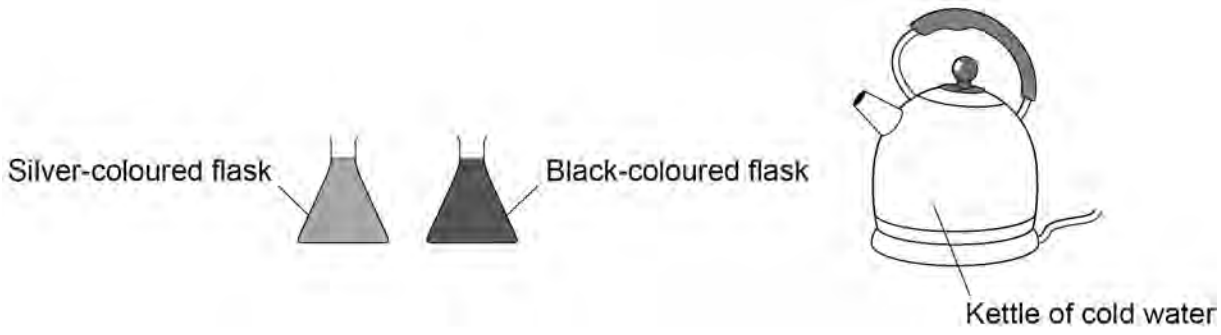
In a transverse wave, the direction of oscillation is _____

to the direction of energy transfer by the wave.

A student investigated how the colour of a surface affects the rate at which the surface emits infrared radiation.

Figure 23 shows some of the equipment used.

Figure 23



4.6.1.1 Transverse and longitudinal waves

Question 12 · continued

0 9 . 2 The student wrote the following hypothesis:

‘The black-coloured flask will emit more infrared radiation than the silver-coloured flask during 10 minutes of cooling.’

Describe a method to test this hypothesis.

[6 marks]

Question 9 continues on the next page

4.6.1.1 Transverse and longitudinal waves

Question 12 · continued

0 9 . 3 When will the flasks emit infrared radiation at the greatest rate?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

During the 1st minute ☐

During the 5th minute ☐

During the 9th minute ☐

Reason _____

_____

Question 12 · continued

Another student investigated the absorption of infrared radiation by different surface colours.

The student filled four hollow metal cubes with cold water.

Each cube was the same size but had a different surface colour.

The cubes were then placed the same distance from an infrared heater.

After 10 minutes, the student measured the temperature increase of the water inside each cube.

0 9 . 4 What was the dependent variable in this investigation?

[1 mark]

0 9 . 5 **Table 2** shows the results.

Table 2

Surface colour of the cube	Temperature increase after 10 minutes in °C
Matt white	3.0
Shiny white	2.0
Matt black	6.5
Shiny black	4.0

Give **two** conclusions that can be made from the results in **Table 2**.

[2 marks]

1

2

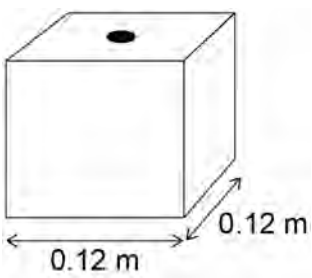
4.6.1.1 Transverse and longitudinal waves

Question 12 · continued

Figure 24 shows one of the cubes. The cube is filled with water.

The weight of the water exerts a pressure on the bottom of the cube.

Figure 24



Use the Physics Equations Sheet to answer questions **09.6** and **09.7**.

0 9 . 6 Which equation correctly links area, force and pressure?

[1 mark]

Tick (✓) **one** box.

pressure = force × area^2 ☐

pressure = force × area ☐

pressure = $\frac{\text{force}}{\text{area}}$ ☐

pressure = $\frac{\text{area}}{\text{force}}$ ☐

4.6.1.1 Transverse and longitudinal waves

Question 12 · continued

0 9 . 7 The water pressure at the bottom of the cube is 1500 Pa.

Calculate the force of the water on the bottom of the cube.

[4 marks]

Force = _____ N

17

Turn over for the next question

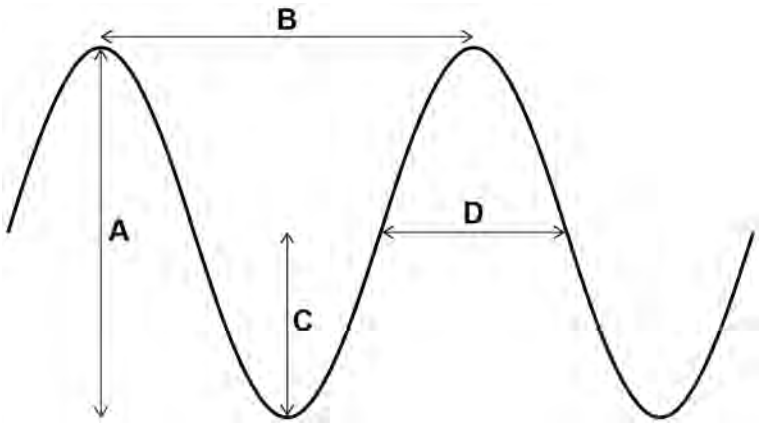
4.6.1.1 Transverse and longitudinal waves

Question 13

June 2024 | 8463/2F | Original Q4

0 4 **Figure 7** represents a transverse wave.

Figure 7



0 4 . 1 Which arrow represents the amplitude of the wave?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 4 . 2 Which arrow represents the wavelength of the wave?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

4.6.1.1 Transverse and longitudinal waves

Question 13 · continued

0 4 . 3 A wave has a frequency of 5000 Hz.

Calculate the period of the wave.

Use the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

[2 marks]

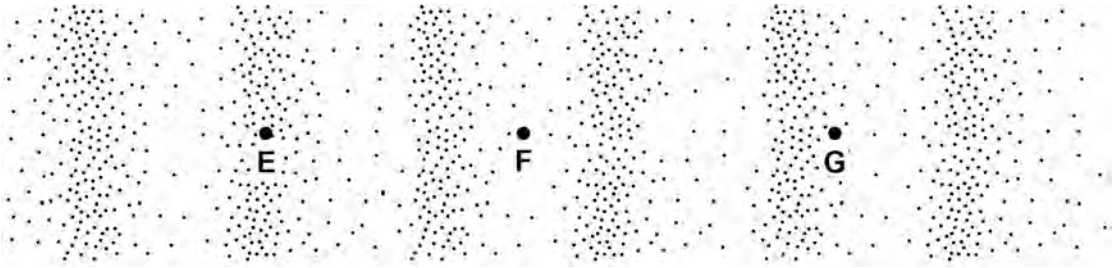
Period = _____ s

0 4 . 4 Give **one** example of a transverse wave that can travel through a vacuum.

[1 mark]

0 4 . 5 **Figure 8** represents a longitudinal wave.

Figure 8



Which point is at the centre of a rarefaction?

[1 mark]

Tick (✓) **one** box.

E ☐ **F** ☐ **G** ☐

4.6.1.1 Transverse and longitudinal waves

Question 13 · continued

0 4 . 6 A sound wave has a frequency of 750 Hz.

speed of sound in air = 330 m/s

Calculate the wavelength of the sound wave.

Use the equation:

$$\text{wavelength} = \frac{\text{wave speed}}{\text{frequency}}$$

[2 marks]

Wavelength = _____ m

0 4 . 7 Describe a method that could be used to determine the speed of sound in air.

[4 marks]

4.6.1.1 Transverse and longitudinal waves

Question 13 · continued

0 4 . 8 When a sound wave moves from air into water, the speed of the wave increases.

The frequency of the sound wave does **not** change.

Complete the sentence.

Choose the answer from the box.

[1 mark]

decreases	**stays the same**	**increases**

When a sound wave moves from air into water its

wavelength _____.

13

Turn over for the next question