4.2 Travelling Waves

Question Paper

Course	DP IB Physics
Section	4. Waves
Topic	4.2 Travelling Waves
Difficulty	Easy

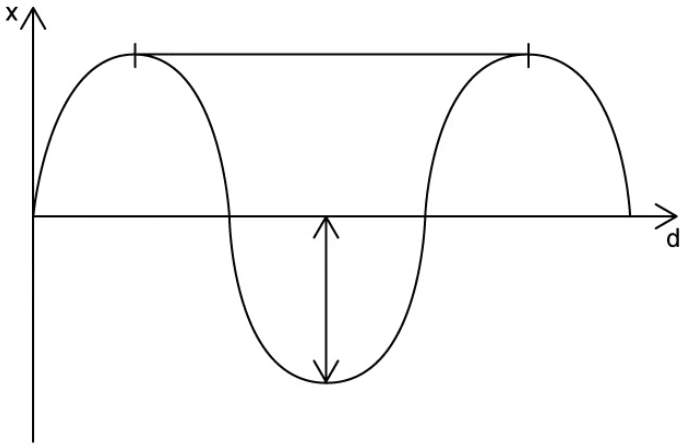
Time allowed: 70

Score: /58

Percentage: /100

Question 1a

The displacement-distance graph shows a travelling wave.



(a)
Label the diagram with the correct wave features

[2]

[2 marks]

Question 1b

(b)
Match the key word to its correct definition

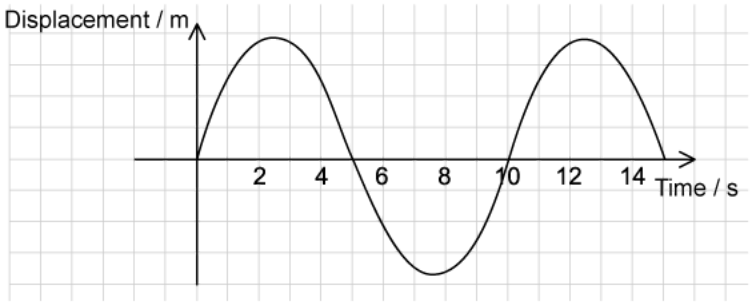
Period	Time taken for a point on a wave to undergo one complete oscillation
Amplitude	Number of complete oscillations per second
Frequency	Distance travelled by a wave per unit time
Wavelength	Maximum displacement of a wave from its equilibrium position
Wave speed	Distance between the same point on two consecutive waves

[5]

[5 marks]

Question 1c

The diagram shows a displacement-time graph for an oscillating object.



(c)

Determine the time period *T* for this oscillation

[1]

[1 mark]

Question 1d

The oscillation shown in part (c) has a wavelength λ of 5 m.

(d)
Calculate:

(i)
The frequency *f* of the oscillation

[2]

(ii)
The wave speed c

[2]

[4 marks]

Question 2a

(a)
Complete the following sentences by circling the correct words:

In a **transverse / longitudinal** wave the oscillations are perpendicular to the direction energy transfer.

In a **transverse / longitudinal** wave the oscillations are parallel to the direction energy transfer.

Transverse / Longitudinal waves do not require a medium through which to propagate.

A rarefaction is an area of **high / low** pressure in **transverse / longitudinal** waves.

Radio waves and the vibrations on a guitar string are examples of **transverse / longitudinal** waves.

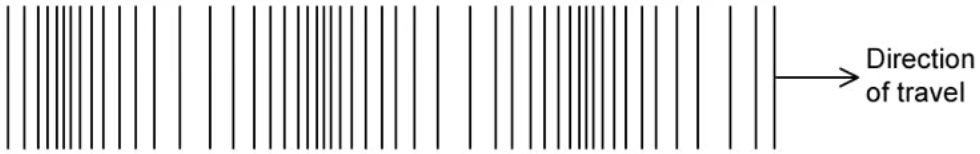
Sound travelling through air is an example of a **transverse / longitudinal** wave.

[6]

[6 marks]

Question 2b

The diagram shows a longitudinal wave.



(b)

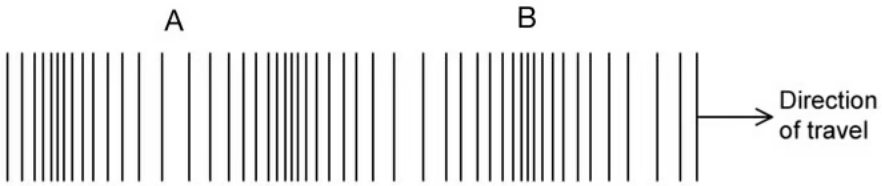
Mark on the diagram one complete wavelength and label it λ

[1]

[1 mark]

Question 2c

The diagram shows a longitudinal wave.



(c)

Choose suitable words and phrases to complete the sentences.

closer together	further apart	compression	rarefaction
left and right	from left to right	low	high

Label A indicates a _____. This is an area of _____ pressure where the particles are _____.
Label B indicates a _____. This is an area of _____ pressure where the particles are _____.
The particles oscillate _____. The direction of motion and energy transfer is _____.

[6]

[6 marks]

Question 2d

(d)

Draw a line for each statement to identify whether it refers to a displacement-distance graph or a displacement-time graph.

Shows the period T of a wave	
Shows the wavelength λ of a wave	Displacement-time graph
Shows the motion of one particle with time	
Shows the motion of many particles in a fixed instant of time	Displacement-distance graph

[4]

[4 marks]

Question 3a

(a)

State the speed of microwaves in a vacuum.

[1]

[1 mark]

Question 3b

(b)

Calculate the frequency f of an infrared wave with a wavelength $\lambda = 2.5 \times 10^{-6}$ m s^{-1}.

[2]

[2 marks]

Question 3c

(c)

Order the electromagnetic waves by wavelength λ. Write a number from 1 to 7 in the column with 1 being the longest wavelength and 7 being the shortest wavelength.

Electromagnetic Wave	Order of wavelength λ
Visible light	
X-rays	
Infrared	
Gamma rays	7
Radio waves	
Ultraviolet	
Microwaves	

[3]

[3 marks]

Question 3d

(d)

State the longest and shortest wavelengths λ for visible light.

[2]

[2 marks]

Question 4a

(a)
Define a longitudinal wave.

[1]

[1 mark]

Question 4b

(b)
Define a transverse wave.

[1]

[1 mark]

Question 4c

(c)
Give three examples of transverse waves.

[3]

[3 marks]

Question 4d

(d)
State an electromagnetic wave with a frequency higher than visible light.

[1]

[1 mark]

Question 5a

(a)
State the lowest and highest frequencies that are detectable to the human ear.

[2]

[2 marks]

Question 5b

(b)
Complete the following sentences by adding the correct words into the gaps:

These words can be used once, more than once, or not at all					
frequency	slow	fast	small		
high	volume	large	low	amplitude	pitch

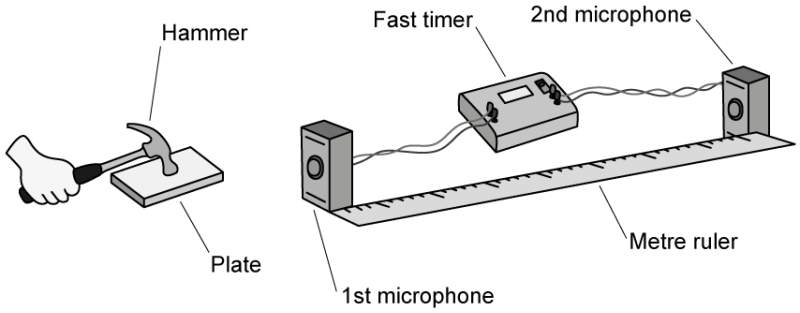
The frequency of a sound wave is related to its _____. Sounds with a _____ frequency have a high _____. Sounds with a _____ frequency have a low _____.
The amplitude of a sound wave is related to its _____. Sounds with a _____ amplitude have a high _____. Sounds with a _____ amplitude have a low _____.

[6]

[6 marks]

Question 5c

A fast timer was used to measure the time taken for a sound to travel between two microphones.



The microphones were placed 80 cm apart. The mean time interval was 2.5 ms.

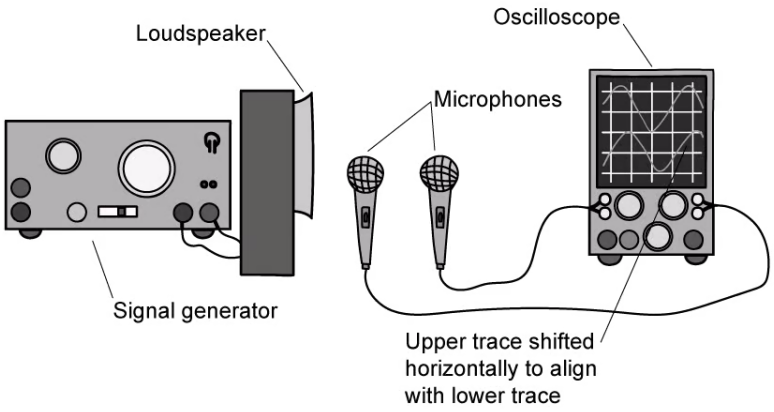
(c)
Calculate the speed of the sound

[4]

[4 marks]

Question 5d

A signal generator was set to produce a sound wave at 1 kHz. Two microphones detect the sound and show the traces on a double beam oscilloscope.



The second microphone was moved away from the first microphone until the oscilloscope traces aligned. The distance between the microphones at this point showed that the wavelength of the sound wave was 3.4 cm.

(d)
Calculate the speed of the sound

[3]

[3 marks]