

# 8.1 Waves: Transverse & Longitudinal

## Question Paper

Course	CIE A Level Physics (9702) 2019-2021
Section	8. Waves
Topic	8.1 Waves: Transverse & Longitudinal
Difficulty	Hard

**Time allowed:** 10

**Score:** /6

**Percentage:** /100

### Question 1

A wave has a speed of  $340 \text{ m s}^{-1}$  and a frequency of  $500 \text{ Hz}$

If two points on a wave are  $0.17 \text{ m}$  apart, what is the phase difference?

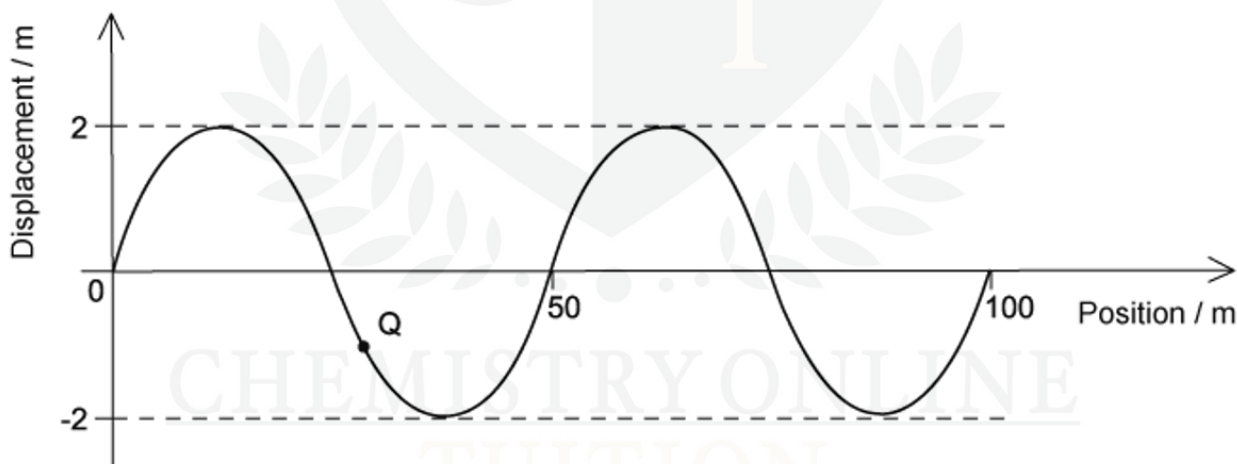
- A**  $\pi \text{ rad}$       **B**  $\frac{3\pi}{4} \text{ rad}$       **C**  $\frac{\pi}{4} \text{ rad}$       **D**  $\frac{\pi}{2} \text{ rad}$

[1 mark]

### Question 2

The graph shows a sinusoidal wave in water, travelling at a speed of  $8.0 \text{ m s}^{-1}$

The maximum speed of the particles in the wave is  $2\pi af$  where  $a$  is the amplitude and  $f$  is the frequency.



An object Q is floating on the water it has a mass of  $2.5 \times 10^{-3} \text{ kg}$

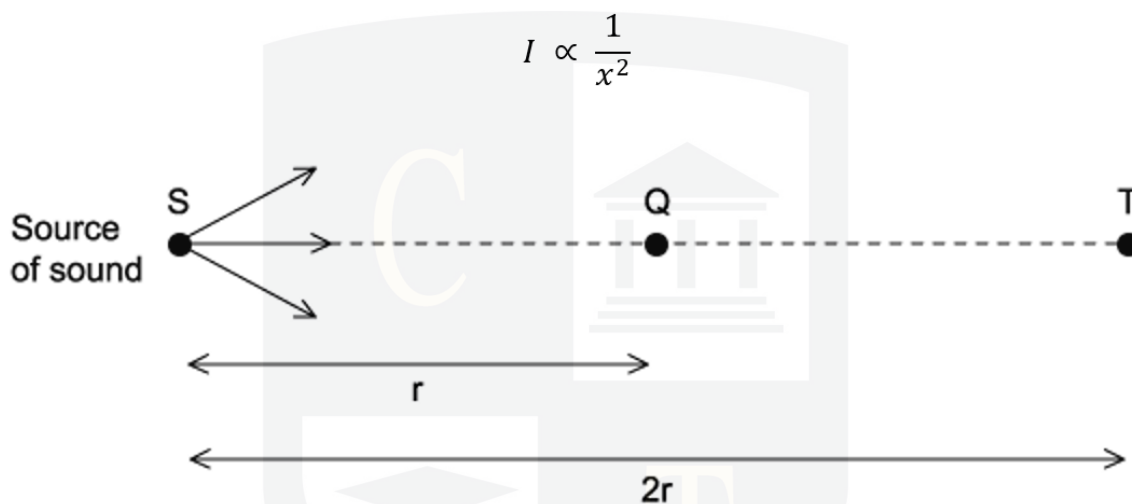
What is the maximum kinetic energy of Q due to the wave? Assume the motion is vertical.

- A**  $4.1 \text{ mJ}$       **B**  $5.1 \text{ mJ}$       **C**  $39 \text{ mJ}$       **D**  $64 \text{ mJ}$

[1 mark]

### Question 3

The intensity  $I$  of a sound at point Q is inversely proportional to the square of the distance  $x$  of Q from the source of the sound. This can be shown by the equation



Molecules of air at Q are a distance  $r$  from S and oscillate with amplitude  $8.0 \mu\text{m}$ . Point T is a distance  $2r$  from S.

What is the amplitude of oscillation of air molecules at T?

- A**  $4.0 \mu\text{m}$       **B**  $2.0 \mu\text{m}$       **C**  $2.8 \mu\text{m}$       **D**  $1.4 \mu\text{m}$

[1 mark]

#### Question 4

All electromagnetic waves travel at speed  $c$  in a vacuum with a frequency  $f$  and wavelength  $\lambda$ .

Which row in the table describes the wavelength and speed of electromagnetic waves with a frequency  $\frac{f}{2}$ ?

	speed in a vacuum	wavelength
<b>A</b>	$2c$	$2\lambda$
<b>B</b>	$c$	$2\lambda$
<b>C</b>	$c$	$\frac{\lambda}{2}$
<b>D</b>	$\frac{c}{2}$	$\frac{\lambda}{2}$

[1 mark]

#### Question 5

A light wave is incident normally on a surface of area  $S$  with an amplitude  $A$ . The power per unit area reaching the surface is  $P$ .

If the light is focused on a smaller area of  $\frac{1}{3}S$ , and the amplitude of wave is doubled to  $2A$  what is the power per unit area?

- A**  $6P$
- B**  $12P$
- C**  $18P$
- D**  $36P$

[1 mark]

### Question 6

The equation below shows the speed of  $v$  waves in deep water

$$v^2 = \frac{g\lambda}{2\pi}$$

Where  $g$  is the acceleration of free fall and  $\lambda$  is the wavelength of the waves. The wavelength  $\lambda$  and the frequency  $f$  of the wave were measured.

If the graph was to give a straight line through the origin which of the following graphs should be plotted?

- A  $f$  against  $\lambda^2$
- B  $f^2$  against  $\lambda$
- C  $f$  against  $\frac{1}{\lambda}$
- D  $f^2$  against  $\frac{1}{\lambda}$

[1 mark]

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