

Topic Specific Questions : Waves : General

Jan 2002 to June 2008

- 3 A progressive wave in a stretched string has a speed of 20 m s^{-1} and a frequency of 100 Hz . What is the phase difference between two points 25 mm apart?

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

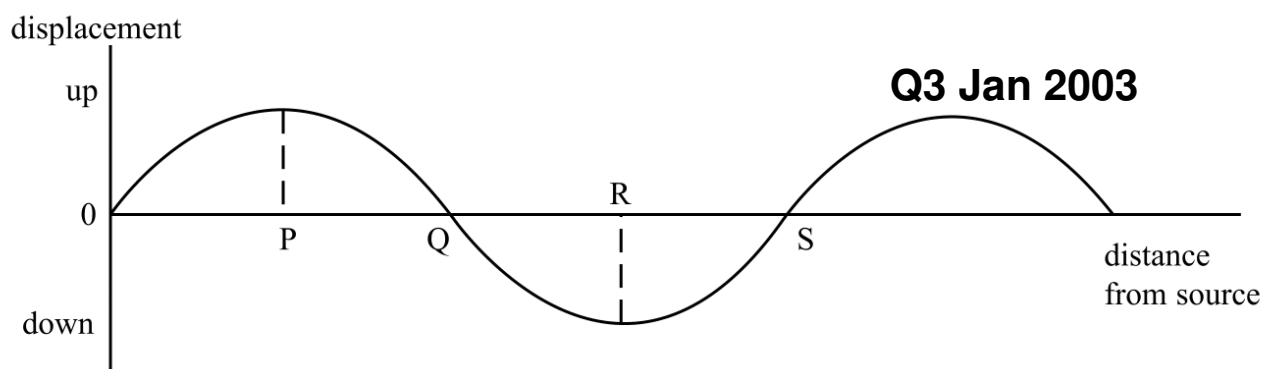
Q3 Jan 2002

- 2 A wave motion has period T , frequency f , wavelength λ and speed v . Which one of the following equations is **incorrect**?

- A $1 = Tf$
- B $T = \frac{v}{\lambda}$
- C $\lambda = \frac{v}{f}$
- D $Tv = \lambda$

Q2 Jun 2002

3



The graph shows, at a particular instant, the variation of the displacement of the particles in a transverse progressive water wave, of wavelength 4 cm , travelling from left to right. Which one of the following statements is **not** true?

- A The distance $PS = 3 \text{ cm}$.
- B The particle velocity at Q is a maximum.
- C The particle at S is moving downwards.
- D Particles at P and R are in phase.

- 4 The audible range of a girl's hearing is 30 Hz to 16 500 Hz. If the speed of sound in air is 330 m s^{-1} , what is the shortest wavelength of sound in air which the girl can hear?

A $\frac{30}{330} \text{ m}$

B $\frac{16\,500}{330} \text{ m}$

C $\frac{330}{16\,500} \text{ m}$

D $\frac{330}{30} \text{ m}$

Q4 Jan 2003

- 6 A uniform wire fixed at both ends is vibrating in its fundamental mode. Which one of the following statements is **not** correct for all the vibrating particles?

A They vibrate in phase.

B They vibrate with the same amplitude.

C They vibrate with the same frequency.

D They vibrate at right angles to the wire.

Q6 Jan 2003

- 4 A wave of frequency 5 Hz travels at 8 km s^{-1} through a medium. What is the phase difference, in radians, between two points 2 km apart?

A 0

B $\frac{\pi}{2}$

C π

D $\frac{3\pi}{2}$

Q4 Jun 2003

- 5 A source emits light of wavelength 600 nm as a train of waves lasting $0.01 \mu\text{s}$. How many complete waves are sent out?

speed of light = $3 \times 10^8 \text{ m s}^{-1}$

A 5×10^6

B 18×10^7

C 5×10^9

D 5×10^{22}

Q5 Jun 2003

- 2 Which line, **A** to **D**, in the table shows correct relationships for the respective wavelengths, λ_L , λ_S , and frequencies, f_L , f_S , of light waves and sound waves?

| | wavelengths | frequencies |
|----------|---------------------------|---------------|
| A | $\lambda_L \ll \lambda_S$ | $f_L \gg f_S$ |
| B | $\lambda_L \ll \lambda_S$ | $f_L \ll f_S$ |
| C | $\lambda_L \gg \lambda_S$ | $f_L \gg f_S$ |
| D | $\lambda_L \gg \lambda_S$ | $f_L \ll f_S$ |

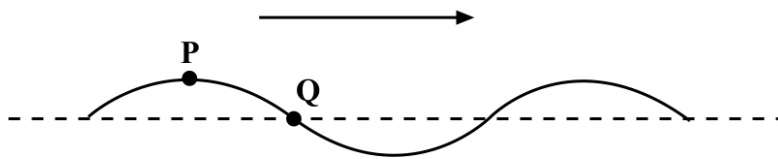
Q2 Jan 2005

- 3 Two points on a progressive wave differ in phase by $\frac{\pi}{4}$. The distance between them is 0.5 m, and the frequency of the oscillation is 10 Hz. What is the minimum speed of the wave?
- A 0.2 m s^{-1}
 B 10 m s^{-1}
 C 20 m s^{-1}
 D 40 m s^{-1}

Q3 Jan 2005

- 3 The diagram shows a snapshot of a wave on a rope travelling from left to right.

Q3 Jun 2005



At the instant shown, point **P** is at maximum displacement and point **Q** is at zero displacement. Which one of the following lines, **A** to **D**, in the table correctly describes the motion of **P** and **Q** in the next half-cycle?

| | P | Q |
|----------|------------------|------------------|
| A | falls then rises | rises |
| B | falls then rises | rises then falls |
| C | falls | falls |
| D | falls | rises then falls |

- 4 The speed of sound in water is 1500 m s^{-1} . For a sound wave in water having frequency 2500 Hz, what is the minimum distance between two points at which the vibrations are $\frac{\pi}{3}$ rad out of phase?
- A 0.05 m
 B 0.10 m
 C 0.15 m
 D 0.20 m

Q4 Jun 2005

- 3 By approximately how many times is the wavelength of audible sound waves greater than the wavelength of light waves?

- A 10^2
 B 10^6
 C 10^{10}
 D 10^{14}

Q4 Jan 2006

- 4 A loudspeaker produces sound waves in air of wavelength 0.68 m and speed 340 m s^{-1} . How many cycles of vibration does the loudspeaker diaphragm make in 10 ms?

- A 5
 B 10
 C 50
 D 100

Q4 Jan 2007

- 3 A wave motion has period T , frequency f , wavelength λ and speed c . Which one of the following equations is **incorrect**?

- A $T = \frac{c}{\lambda}$
 B $1 = Tf$
 C $\lambda = \frac{c}{f}$
 D $Tc = \lambda$

Q3 Jun 2007

- 4 In a transverse progressive wave of frequency 400 Hz, the least distance between two adjacent points which have a phase difference of $\frac{\pi}{2}$ rad is 0.40 m. What is the speed of the wave?

- A 160 m s^{-1}
 B 320 m s^{-1}
 C 640 m s^{-1}
 D 1280 m s^{-1}

Q4 Jun 2007

- 3 The displacement (in mm) of the vibrating cone of a large loudspeaker can be represented by the equation $x = 10 \cos(150t)$, where t is the time in s. Which line, **A** to **D**, in the table gives the amplitude and frequency of the vibrations.

Q3 Jan 2008

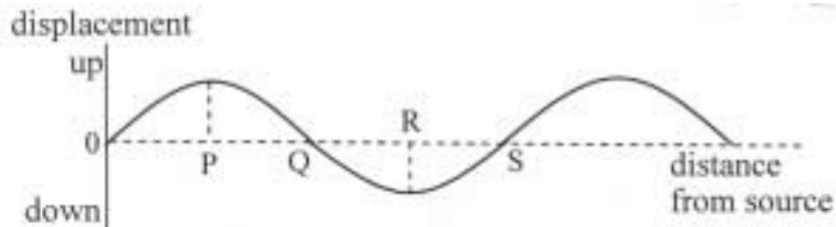
| | amplitude/mm | frequency/Hz |
|----------|--------------|--------------------|
| A | 5 | $\frac{10}{2\pi}$ |
| B | 10 | 150 |
| C | 10 | $\frac{150}{2\pi}$ |
| D | 20 | $\frac{150}{2\pi}$ |

- 4 A wave of frequency 5 Hz travels at 8 km s^{-1} through a medium. What is the phase difference between two points 2 km apart?

- A zero
 B $\frac{\pi}{2}$ rad
 C π rad
 D $\frac{3\pi}{2}$ rad

Q4 Jan 2008

3



The graph shows, at a particular instant, the variation of the displacement of the particles in a transverse progressive water wave, of wavelength 4 cm, travelling from left to right. Which one of the following statements is **not** true?

- A Particles at P and R are in a phase.
- B The velocity of the particle at Q is a maximum.
- C The particle at S is moving downwards.
- D The distance PS = 3 cm.

Q3 Jun 2008

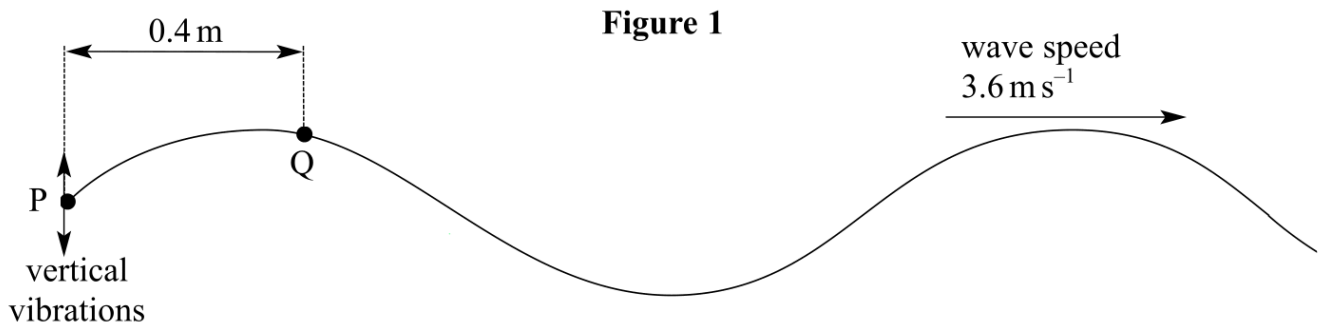
4 Which one of the following statements is **not** correct?

Progressive longitudinal waves can

- A show interference effects.
- B be diffracted.
- C superpose to form a stationary wave.
- D be polarised.

Q4 Jun 2008

- 2 Progressive waves are generated on a rope by vibrating vertically the end, P, in simple harmonic motion of amplitude 90 mm, as shown in **Figure 1**. The wavelength of the waves is 1.2 m and they travel along the rope at a speed of 3.6 m s^{-1} . Assume that the wave motion is not damped.



- (a) Point Q is 0.4 m along the rope from P. Describe the motion of Q in as much detail as you can and state how it differs from the motion of P. Where possible, give quantitative values in your answer.

You may be awarded additional marks to those shown in brackets for the quality of written communication in your answer.

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(5 marks)

- (b) Calculate the maximum speed of point P.

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(3 marks)