Topic Specific Questions : Waves : General

Jan 2002 to June 2008

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

A zero

B $\frac{\pi}{4}$ rad

C $\frac{\pi}{2}$ rad

D π 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 $1 = Tf$

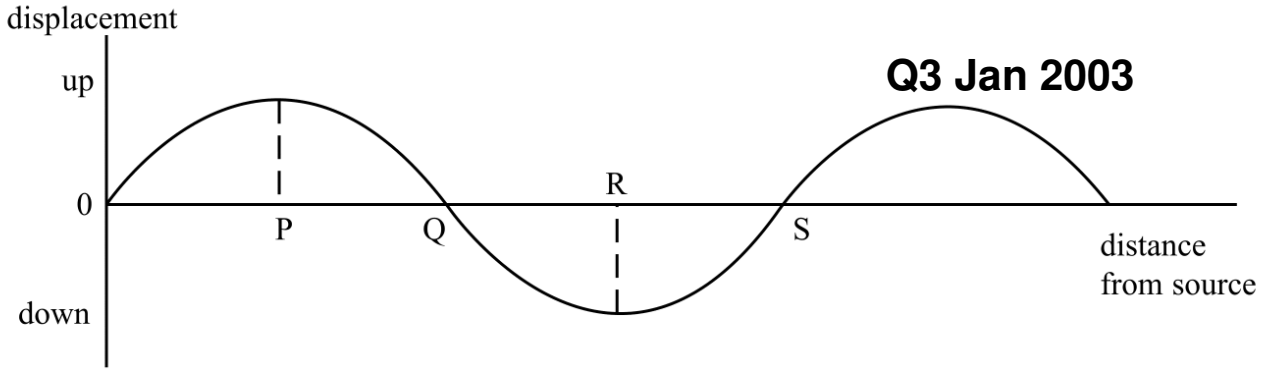
B $T = \frac{v}{\lambda}$

C $\lambda = \frac{v}{f}$

D $Tv = \lambda$

Q2 Jun 2002

3



Q3 Jan 2003

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 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?

Q4 Jan 2003

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

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

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

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

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?

Q6 Jan 2003

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.

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?

Q4 Jun 2003

A 0

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

C π

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

5 A source emits light of wavelength 600 nm as a train of waves lasting 0.01μs. How many complete waves are sent out?
speed of light = 3×10^8 m s^{-1}

Q5 Jun 2003

A 5×10^6
B 18×10^7
C 5×10^9
D 5×10^{22}

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?

Q2 Jan 2005

	wavelengths	**frequencies**
A	$\lambda_L << \lambda_S$	$f_L >> f_S$
B	$\lambda_L << \lambda_S$	$f_L << f_S$
C	$\lambda_L >> \lambda_S$	$f_L >> f_S$
D	$\lambda_L >> \lambda_S$	$f_L << f_S$

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?

Q3 Jan 2005

A $0.2\ \text{m s}^{-1}$

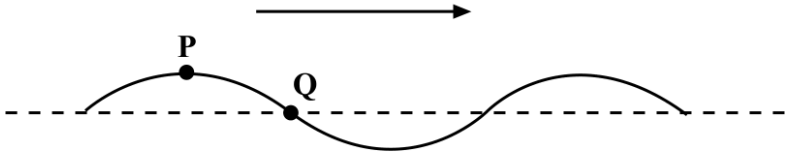
B $10\ \text{m s}^{-1}$

C $20\ \text{m s}^{-1}$

D $40\ \text{m s}^{-1}$

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 $1500\ \text{m s}^{-1}$. 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?

Q4 Jun 2005

A 0.05 m
B 0.10 m
C 0.15 m
D 0.20 m

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

Q4 Jan 2006

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

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?

Q4 Jan 2007

A 5
B 10
C 50
D 100

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

Q3 Jun 2007

A $T = \frac{c}{\lambda}$

B $1 = Tf$

C $\lambda = \frac{c}{f}$

D $Tc = \lambda$

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?

Q4 Jun 2007

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

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?

Q4 Jan 2008

A zero

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

C π rad

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

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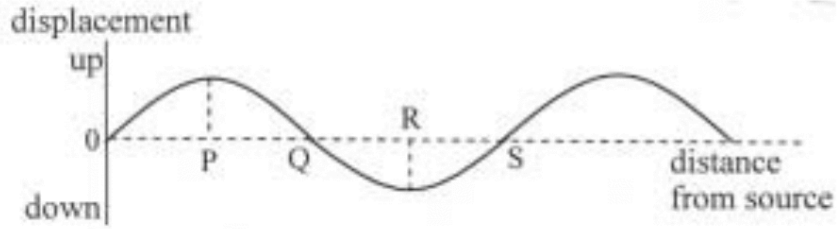


The graph shows, at a particular instant, the variation of the displacement of the particles in a transverse progressive water wave, of wavelength 4 cm, travelling from left to right. Which one of the following statements is **not** true?

Q3 Jun 2008

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.

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

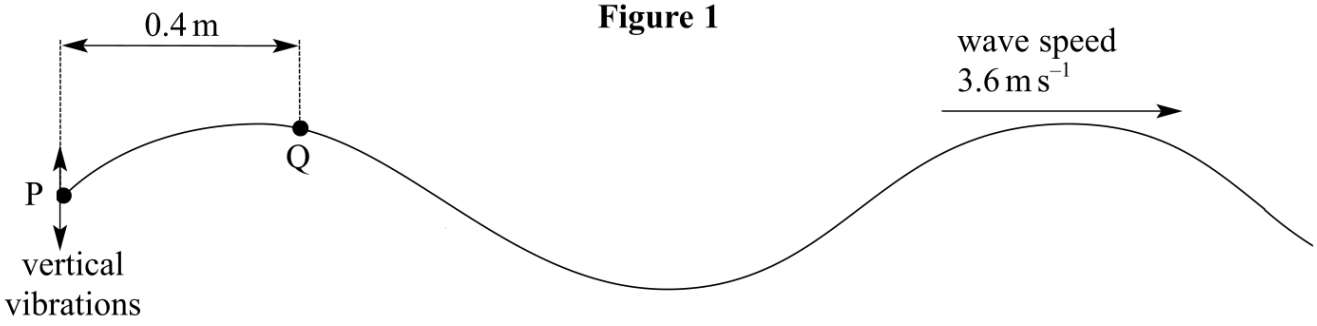
Progressive longitudinal waves can

Q4 Jun 2008

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

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.

Figure 1



(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)