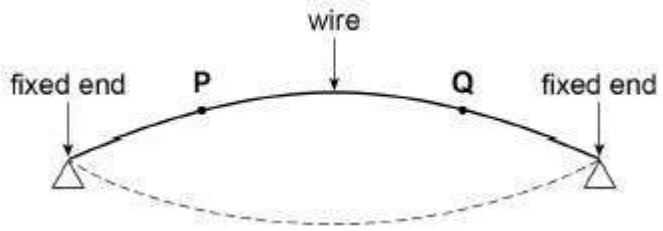
Interference

TOPIC QUESTIONS

Level	AS Level
Subject	Physics
Exam Board	AQA
Paper Type	Multiple Choice

Time Allowed : 30min

1. A uniform wire, fixed at both ends, is plucked in the middle so that it vibrates at the first harmonicas shown.



What is the phase difference between the oscillations of the particles at **P** and **Q**?

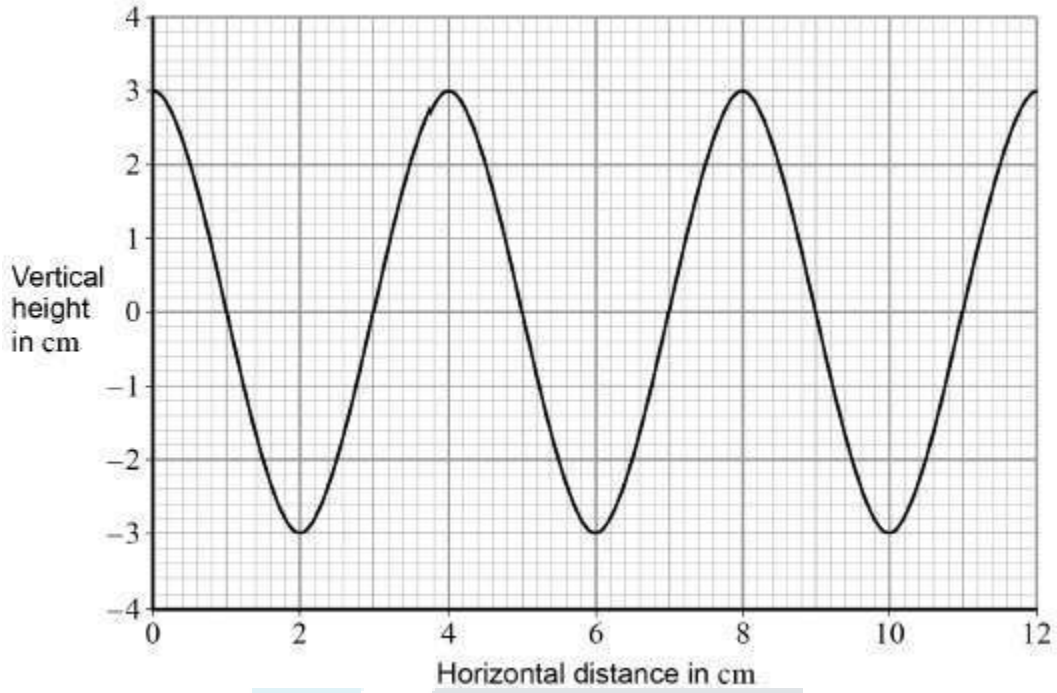
A zero

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

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

D $\frac{3\pi}{4}$ rad

2. The graph shows how the vertical height of a travelling wave varies with distance along the pathof the wave.



The speed of the wave is 20cm s^{-1}.

What is the period of the wave?

A 0.1s

B 0.2s

C 5.0s

D 10.0s

3. What is the phase difference between two points 0.16 m apart on a progressive sound wave of frequency 256 Hz?

speed of sound = 330 m s^{-1}

A $\frac{\pi}{8}$ **B** $\frac{\pi}{6}$

C $\frac{\pi}{4}$

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

4. The frequency of the first harmonic of a standing wave on a wire is f. The length of the wire and tension in the wire are both doubled.

What is the frequency of the first harmonic as a result?

A $\frac{f}{\sqrt{2}}$

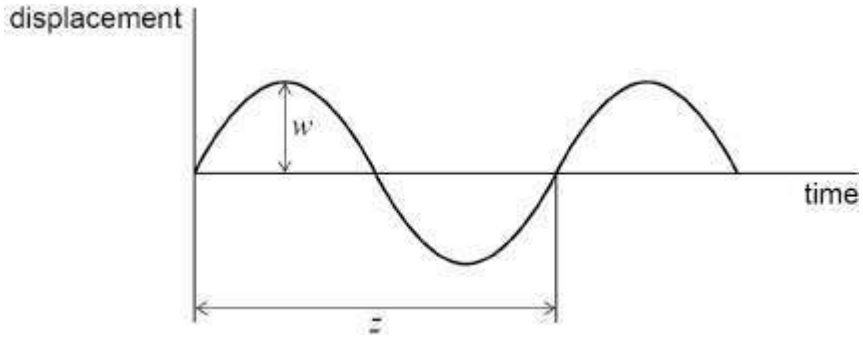
B f

C $\sqrt{2}f$

D $2f$

5. A wave travels along a water surface.

The variation with time of the displacement of a water particle at the surface is shown.



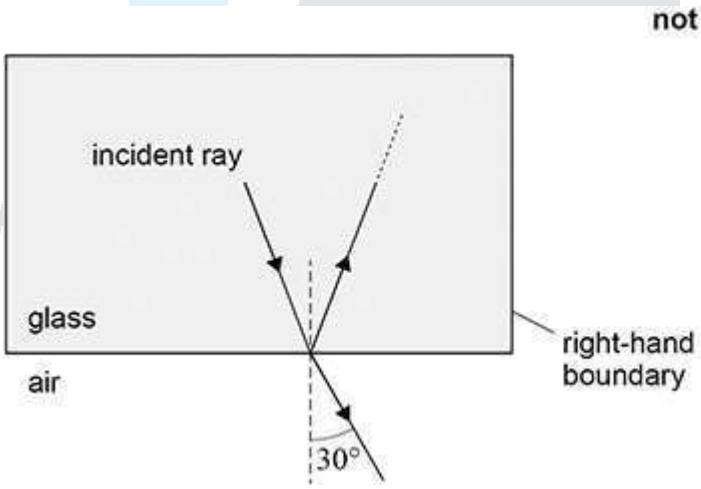
What properties of the wave are represented by w and z?

	w	*z*
A	phase	frequency
B	amplitude	wavelength
C	wavelength	phase
D	amplitude	period

6. A ray of light is incident on the internal boundary of a rectangular glass block in air.

Part of the light refracts out of the block at an angle of 30°.

Some of the remaining light reflects within the block to become incident on the right-hand boundary. refractive index of glass = 1.48



What is the angle of incidence of the ray at the right-hand boundary?

A 20°

B 42°

C 48°

D 70°

7. In a Young's double-slit experiment, monochromatic light is incident on two narrow slits and theresulting interference pattern is observed on a screen.

Which change **decreases** the fringe separation?

A decreasing the separation between the two slits

B increasing the distance between the slits and the screen

C using monochromatic light of higher frequency

D using monochromatic light of longer wavelength

8. A diffraction grating is illuminated normally.

The second-order maximum for light of wavelength 650 nm occurs at the same angle as thethird-order maximum for light of wavelength λ.

What is λ?

A 217 nm

B 325 nm

C 433 nm

D 975 nm

9. Light of wavelength λ is incident normally on two parallel slits of separation s. Fringes of spacing
w are seen on a screen at a distance D from the slits.

Which row gives another arrangement that produces a fringe spacing of w?

	Wavelength	Slit separation	Distance between slits and screen
A	2λ	$2s$	$2D$
B	2λ	$4s$	$2D$
C	2λ	$2s$	$4D$
D	4λ	$2s$	$2D$

10. A narrow beam of monochromatic light is incident normally to a diffraction grating. The first-orderdiffracted beam makes an angle of 20° with the normal to the grating.

What is the highest order visible with this grating at this wavelength?

A 2

B 3

C 4

D 5

11. Two points on a progressive wave are one-eighth of a wavelength apart. The distance between themis 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}

12. Which of the following waves **cannot** be polarised?

A radio

B ultrasonic

C microwave

D ultraviolet

13. Which of the following is correct for a stationary wave?

A Between two nodes the amplitude of the wave is constant.

B The two waves producing the stationary wave must always be 180° out of phase.

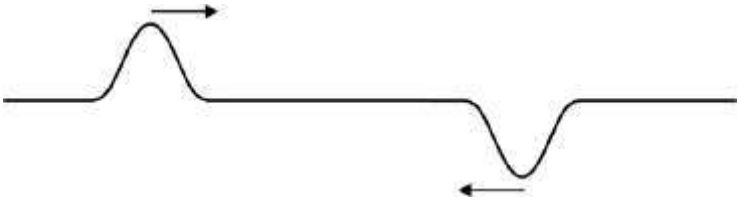
C The separation of the nodes for the second harmonic is double the separation ofnodes for the first harmonic.

D Between two nodes all parts of the wave vibrate in phase.

14. Sound waves cross a boundary between two media X and Y. The frequency of the waves in X is 400 Hz. The speed of the waves in X is 330 m s^{-1} and the speed of the waves in Y is 1320 m s^{-1}. Whatare the correct frequency and wavelength in Y?

	Frequency / Hz	Wavelength / m
A	100	0.82
B	400	0.82
C	400	3.3
D	1600	3.3

15. The diagram shows two pulses on a string travelling towards each other.

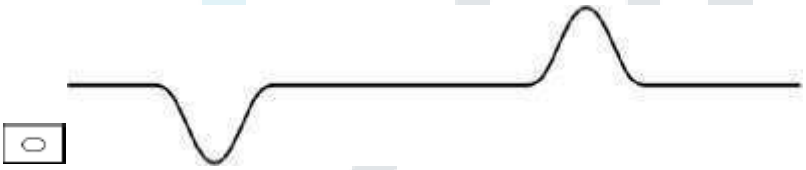


Which of the following diagrams shows the shape of the string when the pulses have passedthrough each other?

A

B

C



D

16. Electrons and protons in two beams are travelling at the same speed. The beams are diffracted byobjects of the same size.

Which correctly compares the de Broglie wavelength λ_e of the electrons with the de Broglie wavelength λ_p of the protons and the width of the diffraction patterns that are produced by thesebeams?

	comparison of deBroglie wavelength	diffraction pattern	
A	$\lambda_e > \lambda_p$	electron beam width > proton beam width	⬭
B	$\lambda_e < \lambda_p$	electron beam width > proton beam width	⬭
C	$\lambda_e > \lambda_p$	electron beam width < proton beam width	⬭
D	$\lambda_e < \lambda_p$	electron beam width < proton beam width	⬭

17. A diffraction pattern is formed by passing monochromatic light through a single slit. If the width ofthe single slit is reduced, which of the following is true?

	Width of central maximum	Intensity of central maximum	
A	unchanged	decreases	⬭
B	increases	increases	⬭
C	increases	decreases	⬭
D	decreases	decreases	⬭

18. A light source emits light which is a mixture of two wavelength, λ_1 and λ_2. When the light is incident on a diffraction grating it is found that the fifth order of light of wavelength λ_1 occurs at the same angle as the fourth order for light of wavelength λ_2. If λ_1 is 480 nm what is λ_2?

A 400 nm

B 480 nm

C 600 nm

D 750 nm

19. When comparing X-rays with UV radiation, which statement is correct?

A X-rays have a lower frequency.

B X-rays travel faster in a vacuum.

C X-rays do not show diffraction and interference effects.

D Using the same element, photoelectrons emitted using X-rays have the greater maximum kinetic energy.

20. Monochromatic light may be characterised by its speed, frequency and wavelength. Which of the following quantities change when monochromatic light passes from air into glass?

A Speed only.

B Speed and wavelength only.

C Speed and frequency only.

D Wavelength and frequency only.