Stationary Waves

TOPIC QUESTIONS

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

Time Allowed : 30min

1. Two points on a progressive wave are out of phase by 0.41

rad.What is this phase difference?

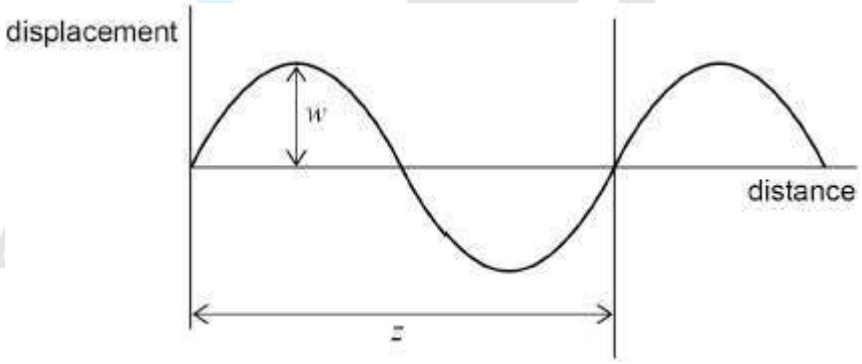
A 23°

B 47°

C 74°

D 148°

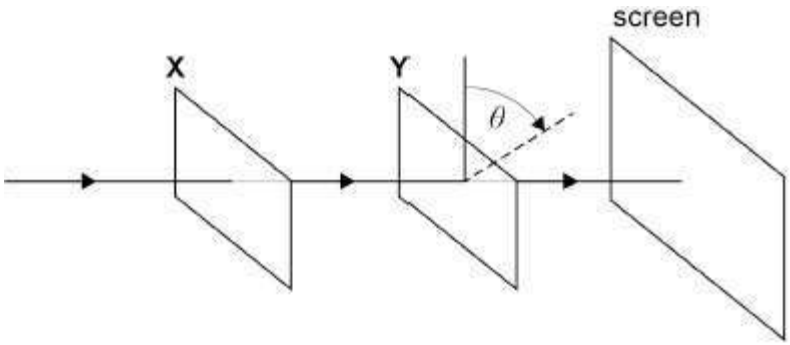
2. A wave travels across the surface of water.
The diagram shows how the displacement of water particles at the surface varies with distance.



Which row correctly describes both w and z?

	w	z
A	amplitude	wavelength
B	half-amplitude	period
C	half-amplitude	wavelength
D	amplitude	period

3. Unpolarised light travels through two polarising filters **X** and **Y** and is then incident on a screen. When **X** and **Y** are arranged as shown, there is a maximum intensity on the screen.
X is held stationary but **Y** is rotated in a plane at right angles to the beam so that θ increases.



What are the next three values of θ, in rad, for which the beam hits the screen with maximum intensity?

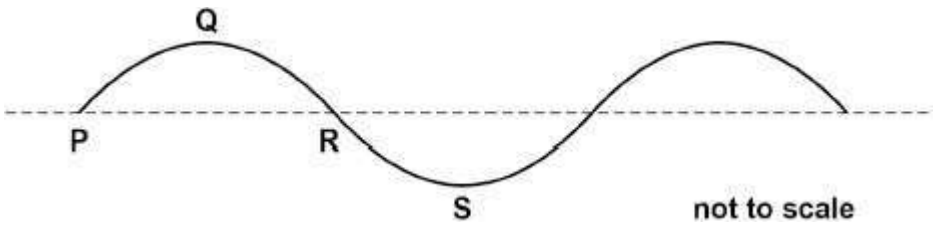
A $\frac{\pi}{2}, \frac{2\pi}{2}, \frac{3\pi}{2}$

B $\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}$

C $\pi, 2\pi, 3\pi$

D $2\pi, 4\pi, 6\pi$

4. The diagram shows the cross-section of a progressive transverse wave travelling at 24 cm s^{-1} on water. The amplitude of the wave is 2.0 cm and the frequency is 4.0 Hz.



Which statement is correct?

A The phase difference between particles at **P** and **S** is $\frac{\pi}{2}$rad.

B The distance between **P** and **R** is 6.0 cm.

C The particle velocity at **Q** is a maximum.

D Particles at **P** and **R** are in phase.

5. Stationary waves are set up on a rope of length 1.0 m fixed at both ends.

Which statement is **not** correct?

A The first harmonic has a wavelength of 2.0 m.

B The midpoint of the rope is always stationary for even-numbered harmonics.

C A harmonic of wavelength 0.4 m can be set up on the rope.

D There are five nodes on the rope for the fifth harmonic.

6. The speed of light decreases by 40% when it travels from air into a transparent medium.

What is the refractive index of the medium?

A 0.6

B 1.4

C 1.7

D 2.5

7. A monochromatic light wave travels from glass into air.

Which row shows what happens to the wavelength, speed and photon energy?

	Wavelength	Speed	Photon energy
A	increases	increases	increases
B	does not change	decreases	does not change
C	does not change	decreases	increases
D	increases	increases	does not change

8. Monochromatic light is incident normally on a diffraction grating that has 4.50×10^5 lines m^{-1}. The angle between the second-order diffraction maxima is 44°.

What is the wavelength of the light?

A 208 nm

B 416 nm

C 772 nm

D 832 nm

9. In a Young's double-slit experiment, the spacing of the double slits is s and the distance betweenthe slits and the screen on which fringes are formed is D. When monochromatic light of wavelength λ is incident on the slits the distance between adjacent fringes on the screen is w.

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

	Spacing of double slits	Distance between the slits and the screen	Wavelength of the light
A	$4s$	$2D$	2λ
B	$2s$	$4D$	2λ
C	$2s$	$2D$	4λ
D	$2s$	$2D$	2λ

10. Monochromatic electromagnetic radiation of wavelength 5.8×10^{-7} m is incident normally on adiffraction grating with 3.0×10^{5} lines per metre.

What is the highest order maximum produced?

A 5

B 6

C 10

D 13

11. Which one of the following provides direct experimental evidence that light is a transverse wavemotion rather than a longitudinal wave motion?

A Two light waves that are coherent can be made to interfere.

B Light can be diffracted.

C Light can be polarised.

D The intensity of light from a point source falls off inversely as the square of the distance from the source.

12. The sound quality of a portable radio is improved by adjusting the orientation of the aerial. Which statement is a correct explanation of this improvement?

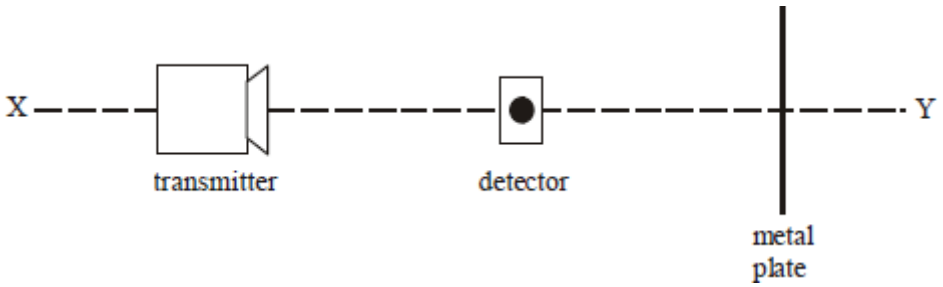
A The radio waves from the transmitter are polarised.

B The radio waves from the transmitter are unpolarised.

C The radio waves become polarised as a result of adjusting the aerial.

D The radio waves become unpolarised as a result of adjusting the aerial.

13. A microwave transmitter is used to direct microwaves of wavelength 30 mm along a line XY. A metalplate is positioned at right angles to XY with its mid-point on the line, as shown.



When a detector is moved gradually along XY, its reading alternates between maxima andminima. Which one of the following statements is **not** correct?

A The distance between two minima could be 15 mm.

B The distance between two maxima could be 30 mm.

C The distance between a minimum and a maximum could be 30 mm.

D The distance between a minimum and a maximum could be 37.5 mm.

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

A 10^{2}

B 10^{6}

C 10^{10}

D 10^{14}

15. A stationary wave is formed by two identical waves of frequency 300 Hz travelling in opposite directions along the same line. If the distance between adjacent nodes is 0.60 m, what is thespeed of each wave?

A 180 m s^{-1}

B 250 m s^{-1+}

C 360 m s^{-1}

D 500 m s^{-1}

16. Monochromatic light of wavelength 490 nm falls normally on a diffraction grating that has 6×10^5 lines per metre. Which one of the following is correct?

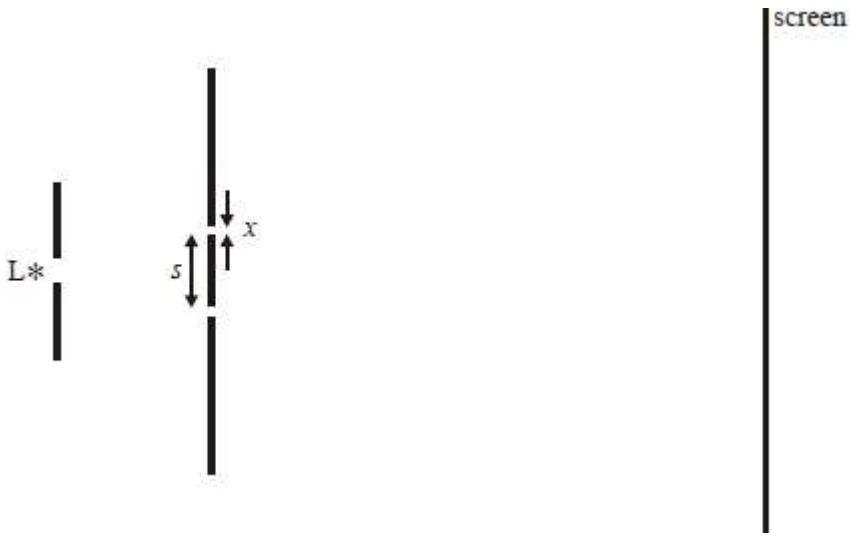
A The first order is observed at angle of diffraction of 17°.

B The second order is observed at angle of diffraction of 34°.

C The third and higher orders are not produced.

D A grating with more lines per metre could produce more orders.

17.



In a double slit system used to produce interference fringes, the separation of the slits is *s*

and thewidth of each slit is x. L is a source of monochromatic light. Which one of the following changes would **decrease** the separation of the fringes seen on the screen?

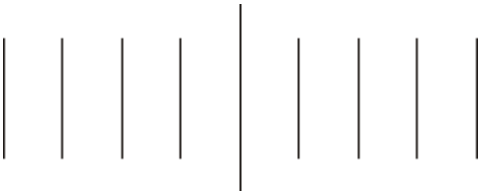
A moving the screen closer to the double slits

B decreasing the width, x, of each slit, but keeping s constant

C decreasing the separation, s, of the slits

D exchanging L for a monochromatic source of longer wavelength

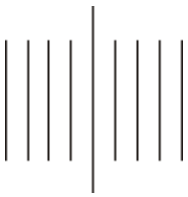
18.



The diagram above shows the first four diffraction orders each side of the zero order when a beam of monochromatic light is incident normally on a diffraction grating of slit separation *d*. All the angles of diffraction are small. Which one of the patterns, A to D, drawn on the same scale, is

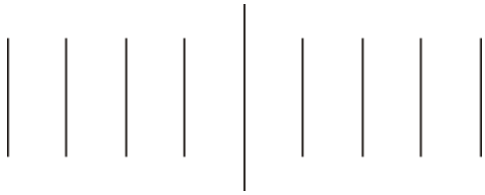
obtained when the grating is exchanged for one with a slit separation $\frac{d}{2}$?

A

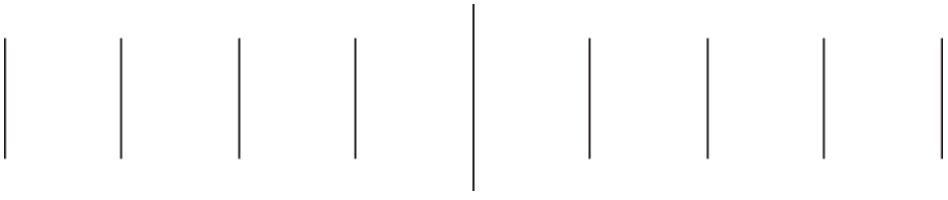


B

C



D



19. Interference maxima produced by a double source are observed at a distance of 1.0 m from thesources. In which one of the following cases are the maxima closest together?

A red light of wavelength 700 nm from sources 4.0 mm apart

B sound waves of wavelength 20 mm from sources 50 mm apart

C blue light of wavelength 450 nm from sources 2.0 mm apart

D surface water waves of wavelength 10 mm from sources 200 mm apart

20. Light of wavelength λ is incident normally on a diffraction grating for which adjacent lines are adistance 3λ apart. What is the angle between the second order maximum and the straight-through position?

A 9.6°

B 20°

C 42°

D There is no second order maximum