Longitudinal & Transverse Waves

TOPIC QUESTIONS

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

Time Allowed : 30min

1. A sonar transmitter on a ship produces pulses of sound waves.Each pulse of sound waves contains 12 complete oscillations.

The frequency of these waves is 8.0 kHz and the speed of sound in seawater is 1.5×10^3 m s^{-1}.

What is the length of one pulse in seawater?

A 0.188 m

B 2.25 m

C 2.25×10^3 m

D 1.44×10^5 m

2. The frequency of the first harmonic of a wire fixed at both ends is 300 Hz.The tension in the wire is now doubled.

What is the frequency of the first harmonic after this change?

A 150 Hz

B 210 Hz

C 420 Hz

D 600 Hz

3. The fundamental frequency f is the lowest frequency heard when a stretched string is vibrating.

   The string is now lightly touched one third of the way along its length.

What is the lowest frequency heard?

A $\frac{f}{3}$

B $\frac{2f}{3}$

C f

D $3f$

4. Two points on a progressive wave have a phase difference of $\frac{\pi}{6}$ rad

   The speed of the wave is 340 m s^{-1}

What is the frequency of the wave when the minimum distance between the two points is 0.12 m?

A 240 Hz

B 470 Hz

C 1400 Hz

D 2800 Hz

5. Which statement is correct about the properties of an unpolarised electromagnetic wave as itpasses through a polariser?

A The wave remains unchanged.

B The wave does not pass through the polariser.

C The wave's electric field oscillates along the direction of travel.

D The intensity of the wave is reduced

6. Which characteristics of monochromatic light change when the light passes from air into glass?

A Speed, wavelength and frequency.

B Speed and frequency only.

C Speed and wavelength only.

D Wavelength and frequency only.

7. Which is a description of the pattern produced when monochromatic light passes through a verynarrow slit?

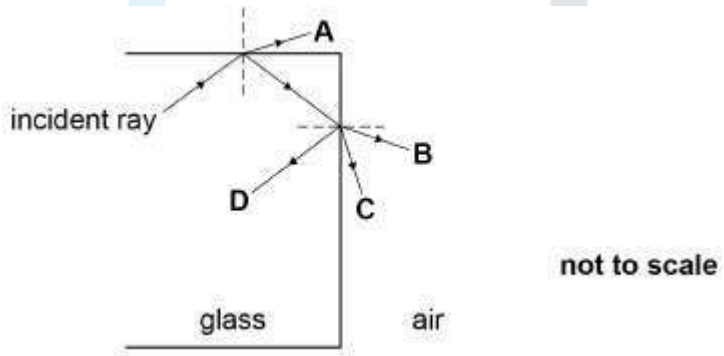
A A series of equally-spaced light and dark fringes.

B A narrow central maximum with wider side fringes.

C A few bright fringes that are widely spaced.

D A wide central maximum with narrower side fringes.

8. A ray of light is incident on a glass-air boundary of a rectangular block as shown.



The refractive index of this glass is 1.5
The refractive index of air is 1.0
The angle of incidence of the light at the first glass-air boundary is 44°

What is the path of the ray of light?

A

B

C

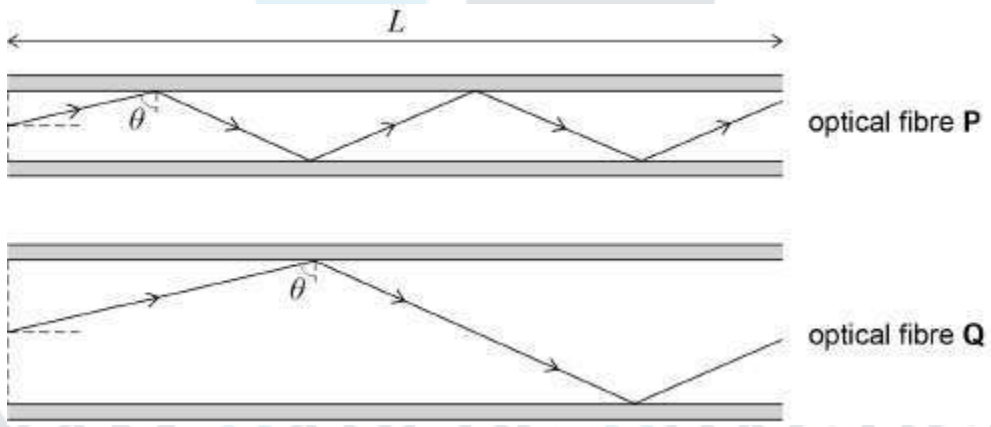
D

9. Rays of light are incident at the same angle θ on the core-cladding boundary of optical fibres **P** and **Q**.

The cores of **P** and **Q** have the same refractive index n.

P and **Q** are the same length L.

The core diameter of **P** is half that of **Q**.



The time for the ray to travel along optical fibre **P** is

$$\frac{nL}{c\sin\theta}$$

where c is the speed of light in a vacuum.

What is the time for the ray to travel along optical fibre **Q**?

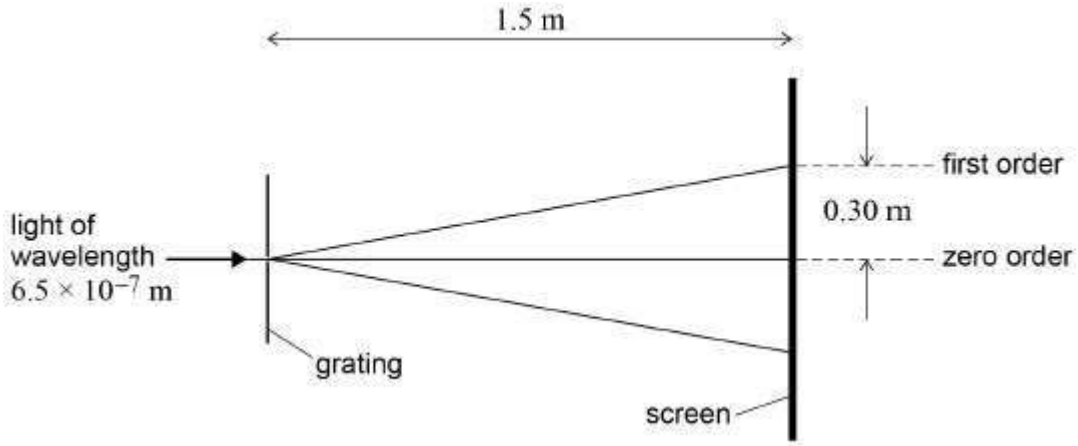
A $\frac{nL}{c\sin\theta}$

B $\frac{nL}{2c\sin\theta}$

C $\frac{2nL}{c\sin\theta}$

D $\frac{4nL}{c\sin\theta}$

10. A diffraction grating is illuminated normally with light of wavelength 6.5×10^{-7} m When a screen is 1.5 m from the grating, the distance between the zero and first-order maximaon the screen is 0.30 m



What is the number of lines per mm of the diffraction grating?

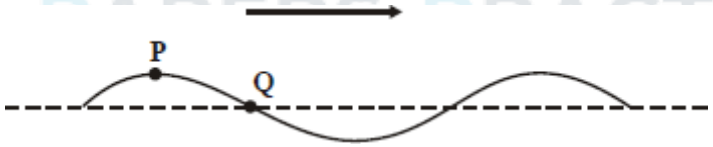
A 3.3×10^{-6}

B 3.3×10^{-3}

C 3.0×10^{2}

D 3.0×10^{5}

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



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** inthe 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

12. 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 0.20m

13. Which one of the following properties of light waves do polarising sunglasses depend on for theiraction?

Light waves may

A interfere constructively.

B interfere destructively.

C be polarised when reflected from a surface.

D be polarised by the lens in the eye.

14. 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	$\lambda_L << \lambda_s$	$f_L >> f_s$
B	$\lambda_L << \lambda_s$	$f_L << f_s$
C	$\lambda_L >> \lambda_s$	$f_L >> f_s$
D	$\lambda_L >> \lambda_s$	$f_L << f_s$

15. Two points on a progressive wave differ in phase by $\frac{\pi}{4}$. The distance between them is 0.5 m, andthe frequency of the oscillation is 10 Hz. What is the minimum speed of the wave?

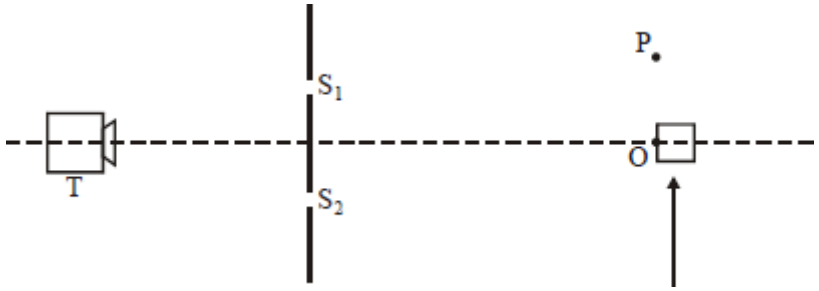
A $0.2\ m\ s^{-1}$

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

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

D 40 m s^{-1}

16. The diagram shows a microwave transmitter T which directs microwaves of wavelength eat two slits S_1 and S_2 formed by metal plates. The microwaves that pass through the two slits are detected by a receiver.



receive
rat O

When the receiver is moved to P from O, which is equidistant from S_1 and S_2, the signal received decreases from a maximum to a minimum. Which one of the following statements is a correct deduction from this observation?

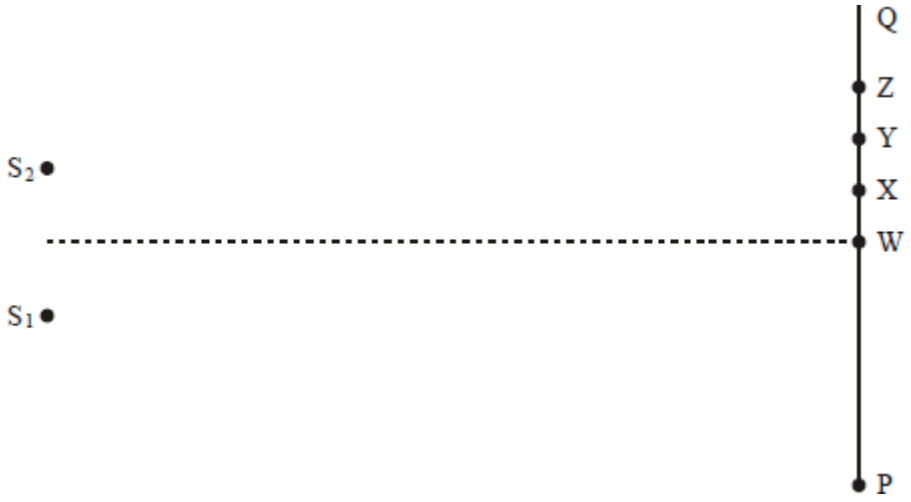
A The path difference $S_1O - S_2O = 0.5\,\lambda$

B The path difference $S_1O - S_2O = \lambda$

C The path difference $S_1P - S_2P = 0.5\,\lambda$

D The path difference $S_1P - S_2P = \lambda$

17.



Point sources of sound of the same frequency are placed at S_1 and S_2. When a sound detector is slowly moved along the line PQ, consecutive maxima of sound intensity are detected at W and Yand consecutive minima at X and Z. Which one of the following is a correct expression for the wavelength of the sound?

A $S_1X - S_1W$

B $S_1Y - S_1X$

C $S_1X - S_2X$

D $S_1Y - S_2Y$

18. In a Young's double slit interference experiment, monochromatic light placed behind a single slit illuminates two narrow slits and the interference pattern is observed on a screen placed some distance away from the slits. Which one of the following **decreases** the separation of the fringes?

A increasing the width of the single slit

B decreasing the separation of the double slits

C increasing the distance between the double slits and the screen

D using monochromatic light of higher frequency

19. Light of wavelength λ is incident normally on a diffraction grating of slit separation 4λ. What is theangle between the second order maximum and third order maximum?

A 14.5°

B 18.6°

C 48.6°

D 71.4°

20. Interference fringes, produced by monochromatic light, are viewed on a screen placed a distance *D*from a double slit system with slit separation *s*. The distance between the centres of two adjacentfringes (the fringe separation) is *w*. If both *s* and *D* are doubled, what will be the new fringe separation?

A $\frac{w}{4}$

B *w*

C 2*w*

D 4W