1 A progressive wave of frequency 150 Hz travels along a stretched string at a speed of 30 m s^{-1}.

What is the phase difference between two points that are 50 mm apart on the string?

A zero ⬭

B 90° ⬭

C 180° ⬭

D 360° ⬭

(Total 1 mark)

2 Which of the following statements about the behaviour of waves is **incorrect**?

A All waves can be diffracted. ⬭

B All waves can be made to undergo superposition. ⬭

C All waves can be refracted. ⬭

D All waves can be polarised. ⬭

(Total 1 mark)

3 Two radio transmitters emit waves at a frequency of 1.4 MHz. A stationary wave is set up between the two transmitters due to the superposition of the radio waves.

What is the minimum distance between two nodes in the stationary wave?

A 107 m ⬭

B 214 m ⬭

C 428 m ⬭

D 857 m ⬭

(Total 1 mark)

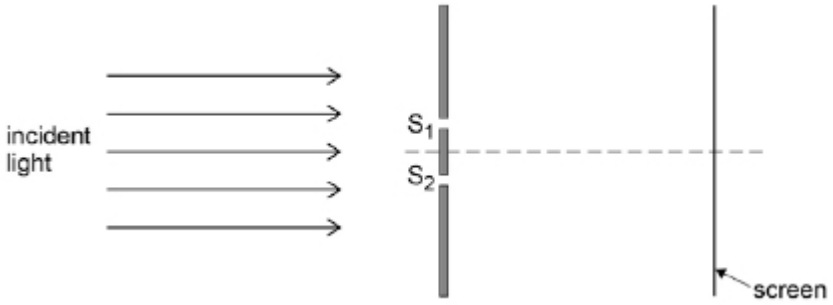
4 Two loudspeakers emit sound waves.

Which line in the table gives the correct frequency condition and the correct phase condition for the waves from the loudspeakers to be coherent?

	Frequency condition	Phase condition	
A	same frequency	variable phase difference	⬭
B	constant frequency difference	constant phase difference	⬭
C	constant frequency difference	in phase	⬭
D	same frequency	constant phase difference	⬭

(Total 1 mark)

5 When a parallel beam of monochromatic light is directed at two narrow slits, S_1 and S_2, interference fringes are observed on a screen.

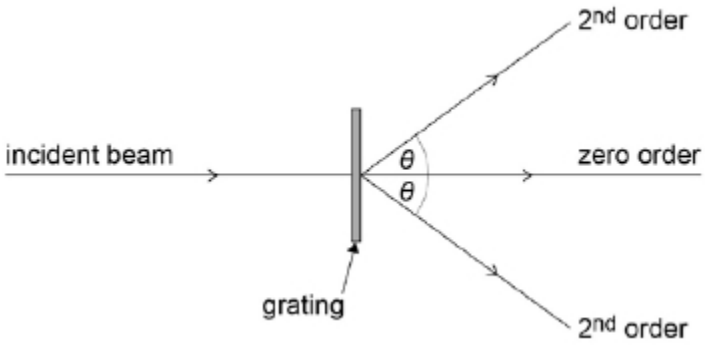


Which line in the table gives the changes that will increase the spacing of the fringes?

	Slit spacing	Distance from slits to screen	
A	halved	halved	⬭
B	halved	doubled	⬭
C	doubled	halved	⬭
D	doubled	doubled	⬭

(Total 1 mark)

6 A parallel beam of monochromatic light is directed normally at a plane transmission grating which has N slits per metre. The second order diffracted beam is at angle θ to the zero order transmitted beam.



The grating is then replaced by a plane transmission grating which has $2N$ slits per metre.

Which one of the following statements is correct?

A With the first grating, the first order beam is at angle 0.5θ to the zero order transmitted beam. ⬭

B With the second grating, the first order beam is at angle 0.5θ to the zero order transmitted beam. ⬭

C With the second grating, the first order beam is at angle θ to the zero order transmitted beam. ⬭

D With the second grating, the second order beam is at angle θ to the zero order transmitted beam. ⬭

(Total 1 mark)

7 A layer of liquid of refractive index 1.6 covers the horizontal flat surface of a glass block of refractive index 1.5. A ray of light strikes the boundary between them at an angle such that it travels along the boundary afterwards.

How does the ray strike the boundary?

A it travels in glass at an angle of 70° to the boundary ⬭

B it travels in glass at an angle of 20° to the boundary ⬭

C it travels in the liquid at an angle of 70° to the boundary ⬭

D it travels in the liquid at an angle of 20° to the boundary ⬭

(Total 1 mark)

8 Two points on a progressive wave are one-eighth of a wavelength apart. 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} ⬭

(Total 1 mark)

9 Which of the following waves **cannot** be polarised?

A radio ⬭

B ultrasonic ⬭

C microwave ⬭

D ultraviolet ⬭

(Total 1 mark)

10 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 ⬭

(Total 1 mark)

11 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 of nodes for the first harmonic. ⬭

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

(Total 1 mark)

12 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}. What are 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	⬭

(Total 1 mark)

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

A X-rays have a lower frequency. ⬭

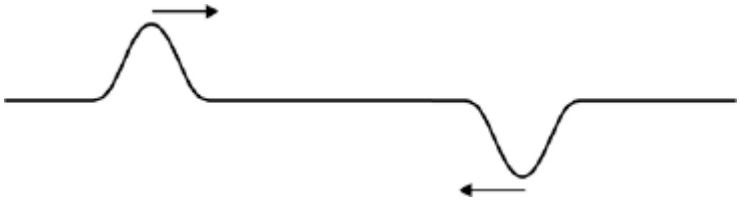
B X-rays travel faster in a vacuum. ⬭

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. ⬭

(Total 1 mark)

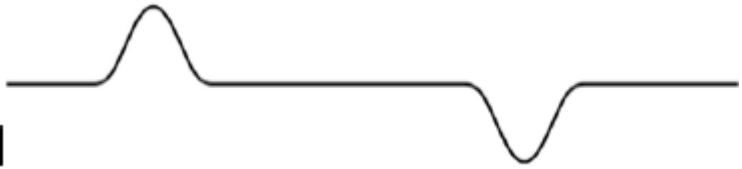
14 The diagram shows two pulses on a string travelling towards each other.



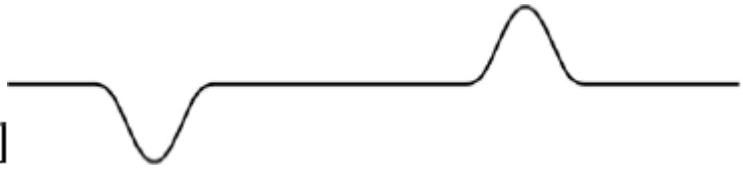
Which of the following diagrams shows the shape of the string when the pulses have passed through each other?

A ☐

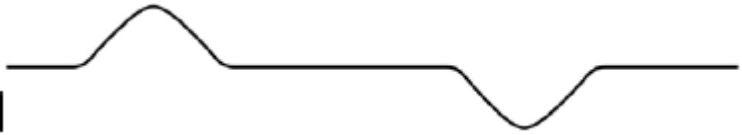
B ☐



C ☐



D ☐



(Total 1 mark)

15 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. ☐

(Total 1 mark)

16 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 $\frac{\pi}{3}$ ⬭

(Total 1 mark)

17 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 $2f$ ⬭

(Total 1 mark)

18 White light passes through a single narrow slit and illuminates a screen.

What is observed on the screen?

A a set of equally spaced white fringes ⬭

B a central maximum made up of a spectrum surrounded by white fringes ⬭

C a white central maximum surrounded by coloured fringes ⬭

D a single narrow white line ⬭

(Total 1 mark)

19 Which of the following is correct when total internal reflection occurs?

A the angle of incidence is less than the critical angle ⬭

B the light meets an optically less dense medium ⬭

C the light enters a medium with a higher refractive index ⬭

D the angles that the incident and refracted rays make with the normal are the same ⬭

(Total 1 mark)

20 What is the speed of light in glass of refractive index 1.42?

A 4.26×10^{7} m s^{-1} ⬭

B 2.11×10^{8} m s^{-1} ⬭

C 3.00×10^{8} m s^{-1} ⬭

D 4.73×10^{8} m s^{-1} ⬭

(Total 1 mark)

21 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.

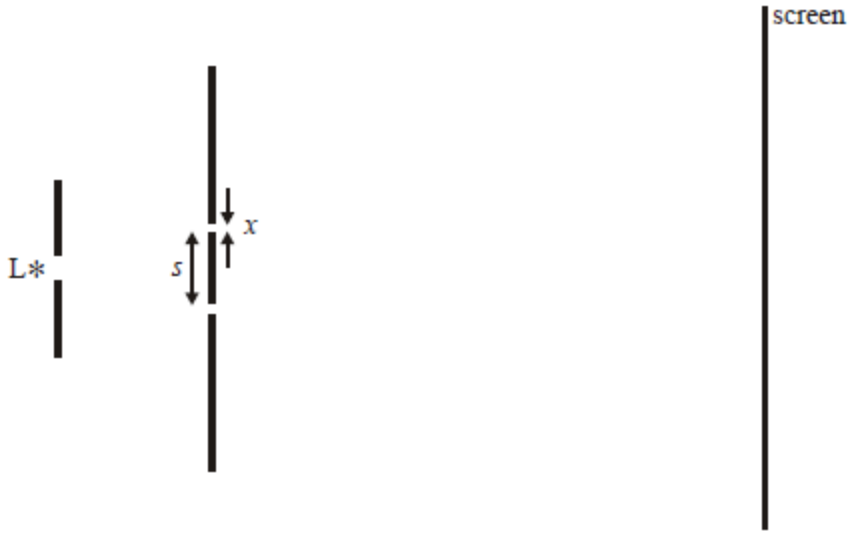
B The radio waves from the transmitter are unpolarised.

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.

(Total 1 mark)

22



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

(Total 1 mark)

23 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}

(Total 1 mark)

24 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 the speed of each wave?

A 180 m s^{-1}

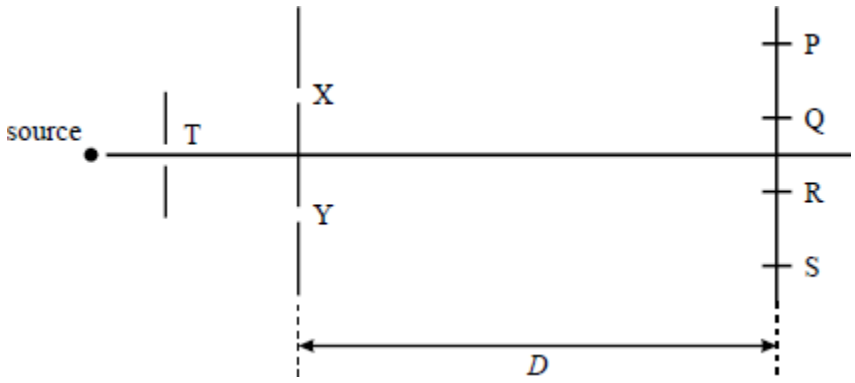
B 250 m s^{-1+}

C 360 m s^{-1}

D 500 m s^{-1}

(Total 1 mark)

25



Coherent monochromatic light of wavelength λ emerges from the slits X and Y to form dark fringes at P, Q, R and S in a double slit apparatus. Which one of the following statements is true?

A When the distance D is increased, the separation of the fringes increases.

B When the distance between X and Y is increased, the separation of the fringes increases.

C When the width of the slit T is decreased, the separation of the fringes decreases.

D There is a dark fringe at P because (YP − XP) is 2λ .

(Total 1 mark)

26 Using a diffraction grating with monochromatic light of wavelength 500 nm incident normally, a student found the 2nd order diffracted maxima in a direction at 30° to the central bright fringe. What is the number of lines per metre on the grating?

A 2×10^4

B 2×10^5

C 4×10^5

D 5×10^5

(Total 1 mark)

27 The least distance between two points of a progressive transverse wave which have a phase difference of $\frac{\pi}{3}$ rad is 0.050 m. If the frequency of the wave is 500 Hz, what is the speed of the wave?

A 25 m s^{-1}

B 75 m s^{-1}

C 150 m s^{-1}

D 1666 m s^{-1}

(Total 1 mark)

28 In a Young's double slits interference arrangement the fringe separation is s when the wavelength of the radiation is λ, the slit separation w and the distance between the slits and the plane of the observed fringes D. In which one of the following cases would the fringe separation also be s?

	wavelength	slit separation	distance between slits and fringes
A	2λ	$2w$	$2D$
B	2λ	$4w$	$2D$
C	2λ	$2w$	$4D$
D	4λ	$2w$	$2D$

(Total 1 mark)

29 Figures **1** and **2** each show a ray of light incident on a water-air boundary. **A, B, C** and **D** show ray directions at the interface.

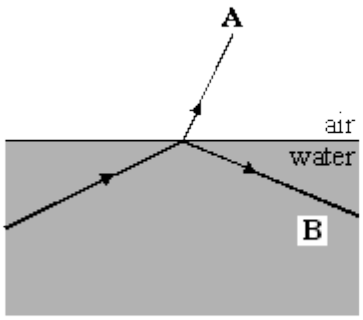


Figure 1

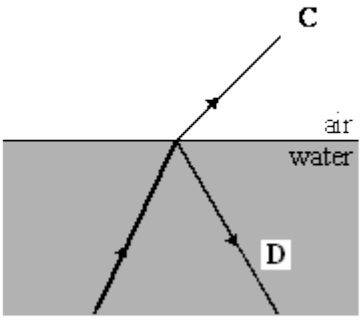


Figure 2

(a) Circle the letter below that corresponds to a direction in which a ray **cannot** occur.

A **B** **C** **D**

(1)

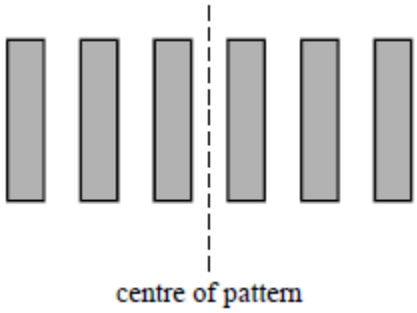
(b) Circle the letter below that corresponds to the direction of the faintest ray.

A **B** **C** **D**

(1)

(Total 2 marks)

30



A double slit interference experiment is performed using monochromatic light of wavelength λ. The centre of the observed pattern is a bright fringe. What is the path difference between two waves which interfere to give the third dark fringe from the centre?

A 0.5 λ

B 1.5 λ

C 2.5 λ

D 3.5 λ

(Total 1 mark)