

Waves

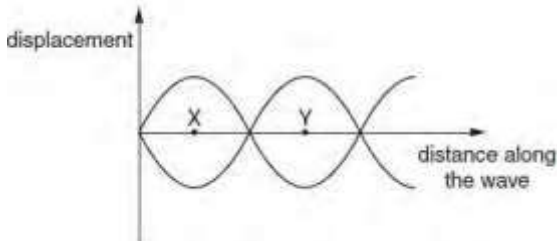
TOPIC QUESTIONS (2)

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

Time Allowed : 1Hour 10Min

EXAM PAPERS PRACTICE

1. The graph represents a stationary wave at two different times.



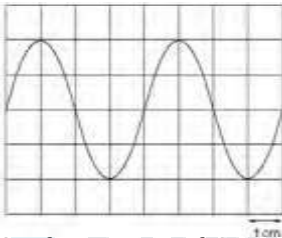
What does the distance XY represent?

- A** half the amplitude **B** half the frequency
C half the period **D** half the wavelength

2. Electromagnetic waves of wavelength λ and frequency f travel at speed c in a vacuum. Which of the following describes the wavelength and speed of electromagnetic waves of frequency $f/2$?

	wavelength	speed in a vacuum
A	$\lambda/2$	$c/2$
B	$\lambda/2$	c
C	2λ	c
D	2λ	$2c$

3. A sound wave is displayed on the screen of a cathode-ray oscilloscope. The time base of the c.r.o. is set at 2.5 ms / cm.



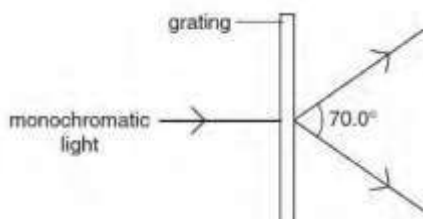
What is the frequency of the sound wave?

- A** 50 Hz **B** 100 Hz **C** 200 Hz **D** 400 Hz

4. When the light from two lamps falls on a screen, no interference pattern can be obtained. Why is this?

- A** The lamps are not point sources.
B The lamps emit light of different amplitudes.
C The light from the lamps is not coherent.
D The light from the lamps is white

5. A diffraction grating is used to measure the wavelength of monochromatic light, as shown in the diagram.



The spacing of the slits in the grating is 1.00×10^{-6} m. The angle between the first order diffraction maxima is 70.0° .

What is the wavelength of the light?

- A** 287nm **B** 470nm **C** 574nm **D** 940nm

6. A plane wave of amplitude A is incident on a surface of area S placed so that it is perpendicular to the direction of travel of the wave. The energy per unit time reaching the surface is E .

The amplitude of the wave is increased to $2A$ and the area of the surface is reduced to $\frac{1}{2}S$.

How much energy per unit time reaches this smaller surface?

- A** $4E$ **B** $2E$ **C** E **D** $\frac{1}{2}E$

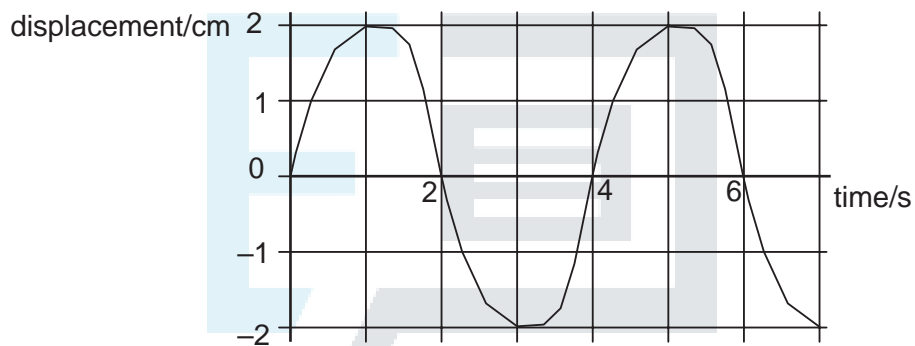


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7. What is the approximate range of frequencies of infra-red radiation?

- A $1 \times 10^3 \text{ Hz}$ to $1 \times 10^9 \text{ Hz}$
- B $1 \times 10^9 \text{ Hz}$ to $1 \times 10^{11} \text{ Hz}$
- C $1 \times 10^{11} \text{ Hz}$ to $1 \times 10^{14} \text{ Hz}$
- D $1 \times 10^{14} \text{ Hz}$ to $1 \times 10^{17} \text{ Hz}$

8. The graph shows how the displacement of a particle in a wave varies with time.



Which of the following is correct?

- A The wave has an amplitude of 2 cm and could be either transverse or longitudinal.
- B The wave has an amplitude of 2 cm and must be transverse.
- C The wave has an amplitude of 4 cm and could be either transverse or longitudinal.
- D The wave has an amplitude of 4 cm and must be transverse.

9. A stationary sound wave has a series of nodes. The distance between the first and the sixth node is 30.0 cm.

What is the wavelength of the sound wave?

- A 5.0 cm
- B 6.0 cm
- C 10.0 cm
- D 12.0 cm

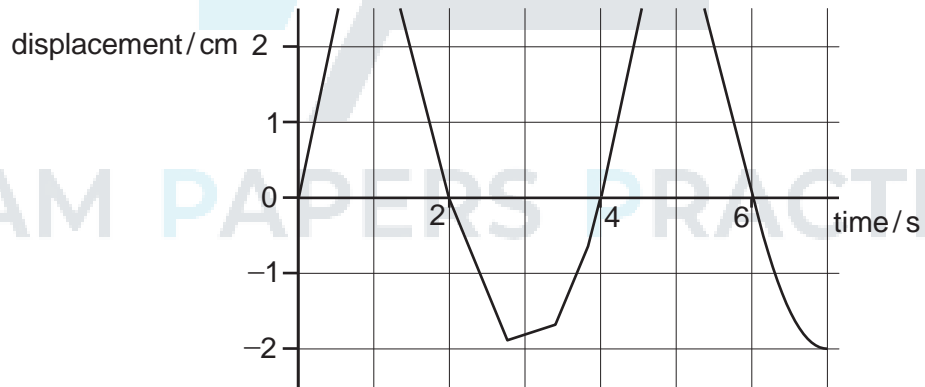
10. Which of the following applies to a progressive transverse wave?

	transfers energy	can be polarised
A	no	no
B	no	yes
C	yes	no
D	yes	yes

11. A signal has a frequency of 2.0 MHz.
What is the period of the signal?

- A $2\mu\text{s}$ B $5\mu\text{s}$ C 200 ns D 500 ns

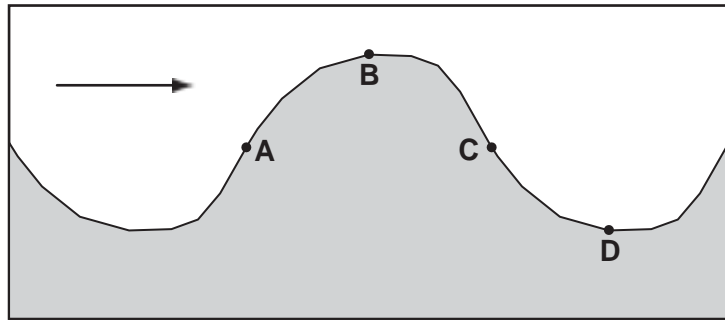
12. The graph shows how the displacement of a particle in a wave varies with time.



Which statement is correct?

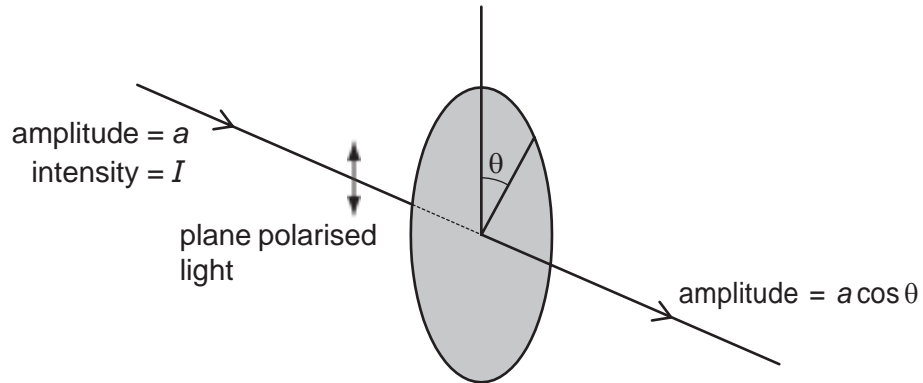
- A The wave has an amplitude of 2 cm and could be either transverse or longitudinal.
- B The wave has an amplitude of 2 cm and must be transverse.
- C The wave has an amplitude of 4 cm and could be either transverse or longitudinal.
- D The wave has an amplitude of 4 cm and must be transverse.

13. The diagram shows a vertical cross-section through a water wave moving from left to right.
At which point is the water moving upwards with maximum speed?



EXAM PAPERS PRACTICE

14. When plane-polarised light of amplitude a is passed through a polarising filter as shown, the amplitude of the light emerging is $a \cos \theta$.



polarising filter

The intensity of the initial beam is I .

What is the intensity of the emerging light when θ is 60.0° ?

- A $0.250I$ B $0.500I$ C $0.750I$ D $0.866I$

15. Which electromagnetic wave would cause the most significant diffraction effect for an atomic lattice of spacing around 10^{-10} m?

- A. infra-red
- B. microwave
- C. ultraviolet
- D. X-ray

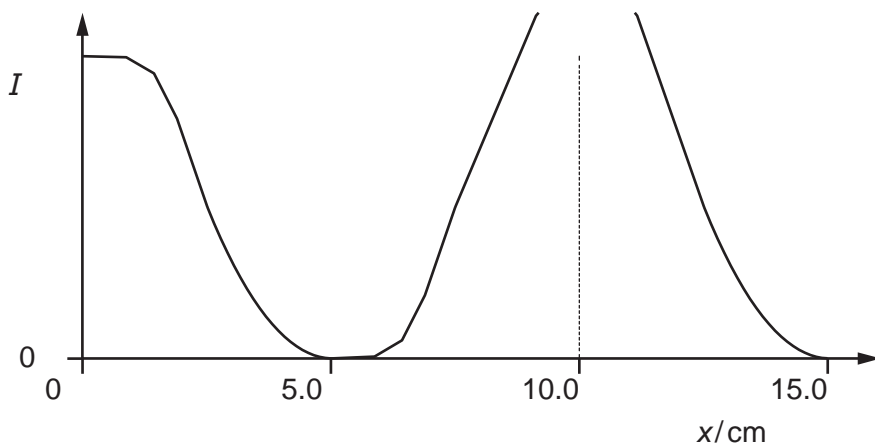
16. Which statement describes a situation when polarisation could not occur?

- A Light waves are reflected.
- B Light waves are scattered.
- C Microwaves pass through a metal grid.
- D Sound waves pass through a metal grid.

17. Which statement about waves is correct?

- A All electromagnetic waves travel at the same speed in a vacuum.
- B Longitudinal waves can be polarised.
- C The amplitude of a wave is directly proportional to the energy transferred by the wave.
- D The frequency of infra-red light is greater than the frequency of ultra-violet light.

18. The variation with distance x of the intensity I along a stationary sound wave in air is shown by the following graph.



The speed of sound in air is 340 m s^{-1} . What is the frequency of the sound wave?

- A 1700 Hz B 2270 Hz C 3400 Hz D 6800 Hz

19. Which statement about longitudinal waves is correct?

- A Longitudinal waves include radio waves travelling through air.
- B Particles in a longitudinal wave vibrate at right-angles to the direction of transfer of wave energy.
- C Some types of longitudinal wave can be polarised.
- D Stationary waves can be produced by the superposition of longitudinal waves.

20. The order of magnitude of the frequency of the longest-wavelength ultraviolet waves can be expressed as 10^x Hz .

What is the value of x ?

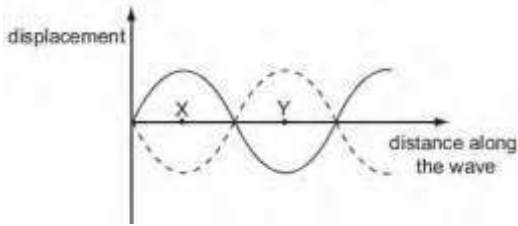
- A 13 B 15 C 17 D 19

21. A sound wave of frequency 150 Hz travels in water at a speed of 1500 m s^{-1} . It then travels through the surface of the water and into air, where its speed is 300 m s^{-1} .

Which line in the table gives the correct values for the wavelengths of the sound in water and in air?

	wavelength in water / m	wavelength in air / m
A	0.10	0.10
B	0.10	0.50
C	10	2.0
D	10	50

22. The graph represents a standing wave at two different times.



What does the distance XY represent?

- A half the amplitude B half the frequency C half the period D half the wavelength

23. In which situation does diffraction occur?

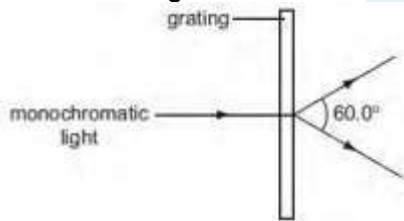
- A A wave bounces back from a surface.
 B A wave passes from one medium into another.
 C A wave passes through an aperture.
 D Waves from two identical sources are superposed.

24. Light of wavelength 700 nm is incident on a pair of slits, forming fringes 3.0 mm apart on a screen.

What is the fringe spacing when light of wavelength 350 nm is used and the slit separation is doubled?
 A 0.75 mm B 1.5 mm C 3.0 mm D 6.0 mm

25. A diffraction grating is used to measure the wavelength of monochromatic light. The spacing of the slits in the grating is

1.15×10^{-6} m. The angle between the first order diffraction maxima is 60.0° , as shown in the diagram.

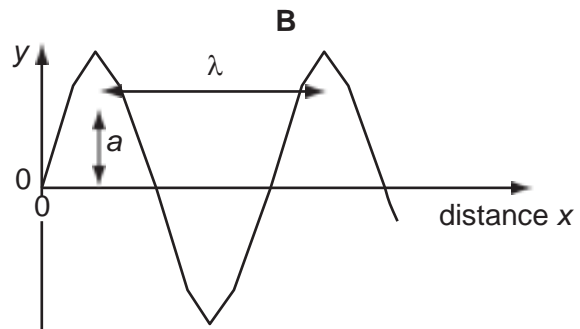
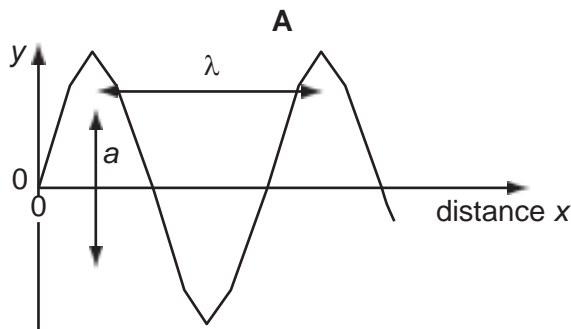


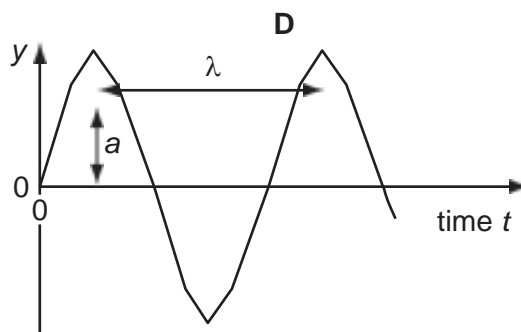
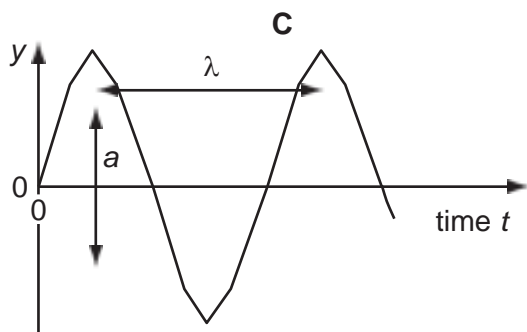
What is the wavelength of the light?

- A 287 nm B 498 nm C 575 nm D 996 nm

26. A sound wave has displacement y at distance x from its source at time t .

Which graph correctly shows the amplitude a and the wavelength λ of the wave?

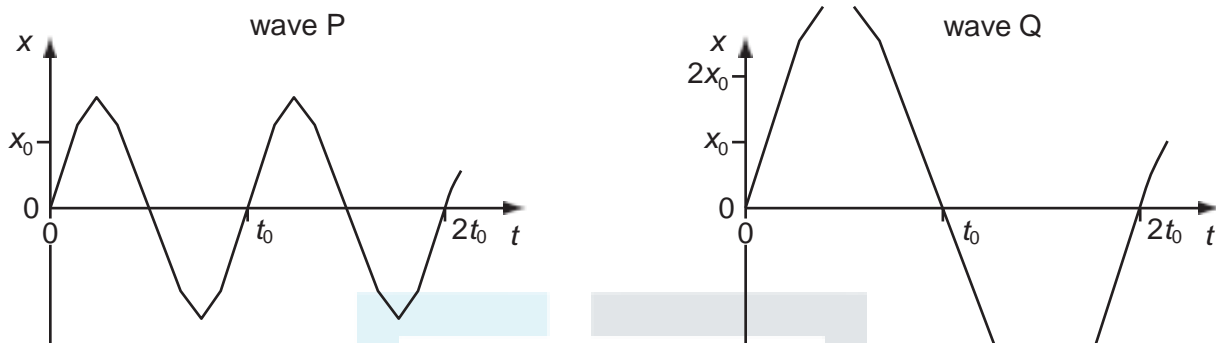




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27. The intensity of a progressive wave is proportional to the square of the amplitude of the wave. It is also proportional to the square of the frequency.

The variation with time t of displacement x of particles in a medium, when two progressive waves P and Q pass separately through the medium, are shown on the graphs.



The intensity of wave P is I_0 .

What is the intensity of wave Q?

- A $\frac{1}{2}I_0$ B I_0 C $8I_0$ D $16I_0$

28. A sound wave of frequency 150 Hz travels in water at a speed of 1500 m s^{-1} . It then travels through the surface of the water and into air, where its speed is 300 m s^{-1} .

Which line in the table gives the correct values for the wavelengths of the sound in water and in air?

	wavelength in water/m	wavelength in air/m
A	0.10	0.10
B	0.10	0.50
C	10	2.0
D	10	50

29. What do not travel at the speed of light in a vacuum?

- a. Electrons
- b. Microwaves
- c. radio waves
- d. X-rays

30. The number of wavelengths of visible light in one metre is of the order of

- A 10^4 . B 10^6 . C 10^8 . D 10^{10} .

31. The amplitude of a wave is A and its intensity is I .

Which amplitude is necessary for the intensity to be doubled to $2I$?

- A A^2 B \sqrt{A} C $\sqrt{2}A$ D $2A$

32. Which value is a possible wavelength for radiation in the ultra-violet region of the electromagnetic spectrum?

- A 3×10^{-2} m B 3×10^{-5} m C 3×10^{-8} m D 3×10^{-10} m

33. Electromagnetic waves from an unknown source in space were found to be significantly diffracted when passing through gaps of the order of 10^{-5} m.

Which type of wave are they most likely to be?

- A radio waves
B microwaves
C infra-red waves
D ultraviolet waves

34. The order of magnitude of the frequency of the longest-wavelength ultraviolet waves can be expressed as 10^x Hz.

What is the value of x?

- A 13 B 15 C 17 D 19

35. The light from two lasers passes through a vacuum. One laser emits red light and the other emits green light.

Which property of the two laser beams must be different?

- A amplitude
B frequency
C plane of polarisation
D speed

36. A health inspector is measuring the intensity of a sound. Near a loudspeaker, his meter records

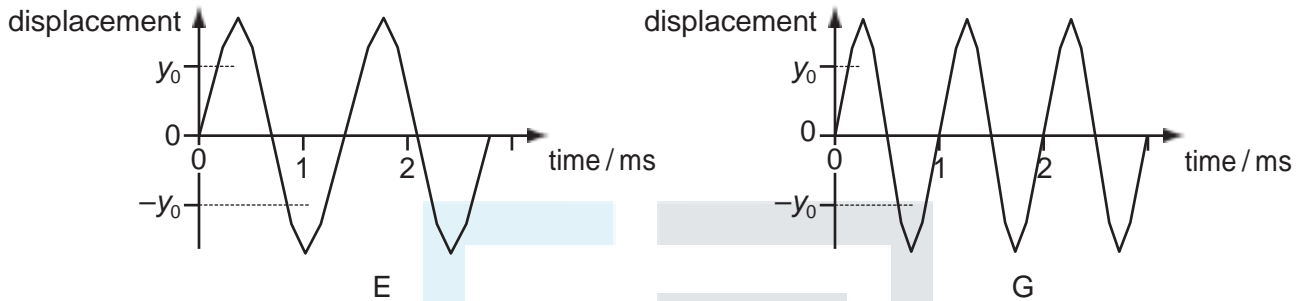
an intensity I . This corresponds to an amplitude A of the sound wave. At another position, the

meter gives an intensity reading of $2I$.

What is the corresponding amplitude of the sound wave?

- A $\frac{A}{\sqrt{2}}$ B $\sqrt{2}A$ C $2A$ D $4A$

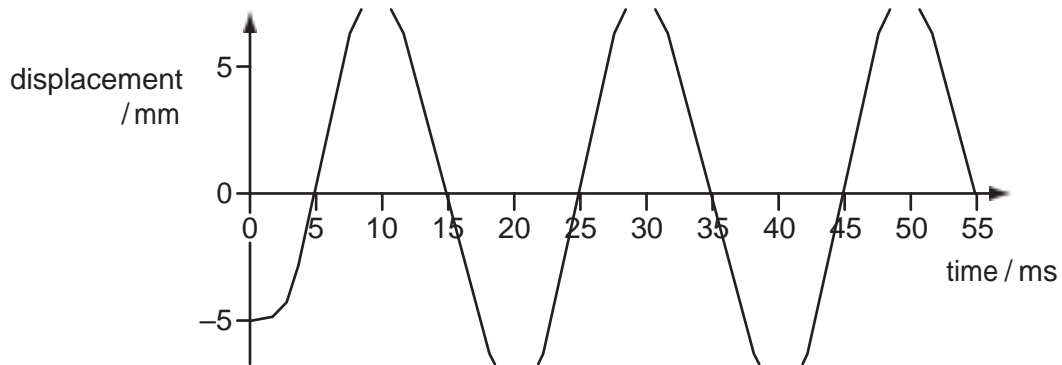
37. Two waves E and G are shown. The waves have the same speed.



Which statement is correct?

- A Wave E has a greater amplitude than wave G.
 B Wave E has a greater intensity than wave G.
 C Wave E has a smaller frequency than wave G.
 D Wave E has a smaller wavelength than wave G.

38. The diagram shows a displacement-time graph for a progressive wave.



What are the amplitude and frequency of the wave?

	amplitude / mm	frequen / Hz
A	5	40
B	5	50
C	10	40
D	10	50

39. Which observation indicates that sound waves are longitudinal?

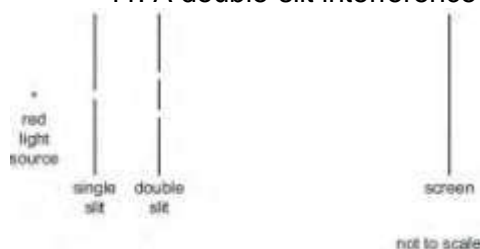
- A Sound can be reflected from a solid surface.
- B Sound cannot be polarised.
- C Sound is diffracted around corners.
- D Sound is refracted as it passes from hot air to cold air.

40. A surveyor's device emits a laser pulse.

What is the time taken for the pulse to travel from the device to a wall 150 m away, where it is reflected, and then return to the device?

- A 0.05 ns B 0.10 ns C 0.50 μ s D 1.0 μ s

41. A double-slit interference experiment is set up as shown.



Fringes are formed on the screen. The distance between successive bright fringes is found to be 4 mm. Two changes are then made to the experimental arrangement. The double slit is replaced by another double slit which has half the spacing. The screen is moved so that its distance from the double slit is twice as great.

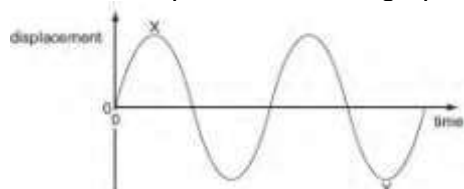
What is now the distance between successive bright fringes?

- A 1 mm B 4 mm C 8 mm D 16 mm

42. A wave motion is described by the oscillation of particles. What is the name given to the number of complete oscillations of a particle in one second?

- A amplitude B frequency C wavelength D wave speed

43. A displacement-time graph for a transverse wave is shown in the diagram.



The phase difference between X and Y can be expressed as $n\pi$. What is the value of n ?

- A 1.5 B 2.5 C 3.0 D 6.0

44. Continuous water waves are diffracted through a gap in a barrier in a ripple tank. Which change will cause the diffraction of the waves to increase?

- A increasing the frequency of the waves
 B increasing the width of the gap
 C reducing the wavelength of the waves
 D reducing the width of the gap

45. The interference patterns from a diffraction grating and a double slit are compared. Using the diffraction grating, yellow light of the first order is seen at 30° to the normal to the grating. The same light produces interference fringes on a screen 1.0 m from the double slit. The slit separation is 500 times greater than the line spacing of the grating. What is the fringe separation on the screen?

- A 2.5×10^{-7} m B 1.0×10^{-5} m
 C 1.0×10^{-3} m D 1.0×10^{-1} m

46. What may be used to produce stationary waves?

- A blowing air over the top of an empty bottle
- B making a loud sound near a mountain
- C passing monochromatic light through a double slit
- D passing water waves through a narrow slit

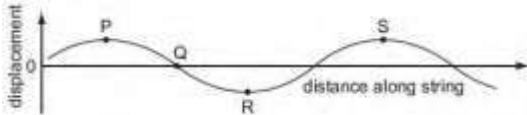
47. Which of the following types of wave can be polarised?

- A a longitudinal progressive wave
- B a longitudinal stationary wave
- C a transverse stationary wave
- D a transverse sound wave

48. Sound wave X has intensity 10^{12} times greater than that of sound wave Y. By how much is the amplitude of X greater than the amplitude of Y?

- A 10^6 times
- B 3.16×10^6 times
- C 5×10^{11} times
- D 10^{12} times

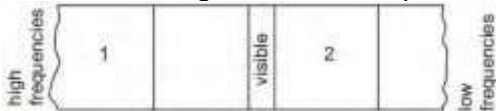
49. The graph shows the shape at a particular instant of part of a transverse wave travelling along a string.



Which statement about the motion of points in the string is correct?

- A The speed at point P is a maximum.
- B The displacement at point Q is always zero.
- C The energy at point R is entirely kinetic.
- D The acceleration at point S is a maximum.

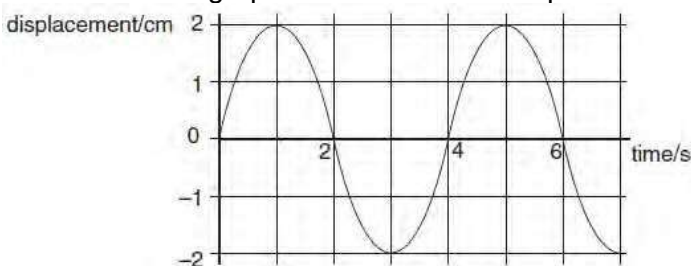
50. The diagram illustrates part of the electromagnetic



Which labels are correct for the regions marked 1 and 2?

	1	2
A	infrared	X-rays
B	microwaves	X-rays
C	ultraviolet	microwaves
D	X-rays	infrared

51. The graph shows how the displacement of a particle in a wave varies with time.



Which of the following is correct?

- A The wave has an amplitude of 2 cm and could be either transverse or longitudinal.
- B The wave has an amplitude of 2 cm and must be transverse.
- C The wave has an amplitude of 4 cm and could be either transverse or longitudinal.
- D The wave has an amplitude of 4 cm and must be transverse.

52. A stationary sound wave has a series of nodes. The distance between the first and the sixth node is 30.0 cm.

What is the wavelength of the sound wave?

- A** 5.0 cm **B** 6.0 cm **C** 10.0 cm **D** 12.0 cm

53. Which of the following applies to a progressive transverse wave?

	transfers energy	can be polarised
A	no	no
B	no	yes
C	yes	no
D	yes	yes

54. Which of the following may be used to produce stationary waves?

- A** blowing air over the top of an empty bottle
B making a loud sound near a mountain
C passing monochromatic light through a double slit
D passing water waves through a narrow slit

55. In an interference experiment, two slits are illuminated with white light.



What is seen on the screen?

- A** The central fringe is black with black and white fringes on each side.
B The central fringe is black with coloured fringes on each side.
C The central fringe is white with black and white fringes on each side.
D The central fringe is white with coloured fringes on each side

56. A light wave of amplitude A is incident normally on a surface of area S . The power per unit area reaching the surface is P .

The amplitude of the light wave is increased to $2A$. The light is then focussed on to a smaller area $\frac{1}{3}S$.

What is the power per unit area on this smaller area?

- A** $36P$
B $18P$
C $12P$
D $6P$

57. A wave has a speed of 340 m s^{-1} and a period of 0.28 ms.

What is its wavelength?

- A 0.095 m B 95 m C 1.2×10^3 m D 1.2×10^6 m

58. Which line in the table summarises the change in wave characteristics on going from infra-red to ultraviolet in the electromagnetic spectrum?

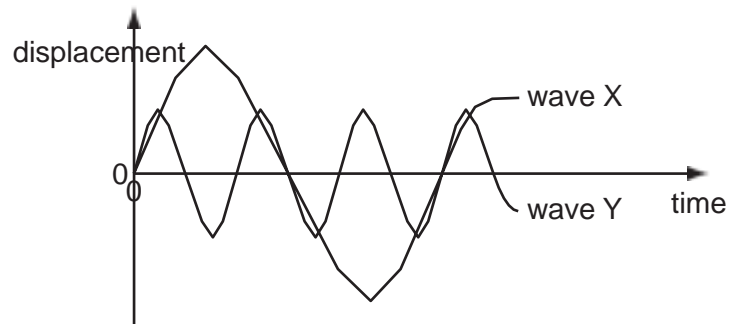
	frequency	speed in a vacuum
A	decreases	decreases
B	decreases	remains constant
C	increases	remains constant
D	increases	increases

59. The order of magnitude of the frequency of the shortest wavelength of visible light waves can be expressed as 10^x Hz.

What is the value of x?

- A 12 B 13 C 14 D 15

60. The diagram shows two waves X and Y.



Wave X has amplitude 8 cm and frequency 100 Hz. What are the amplitude and the frequency of wave Y?

	amplitude / cm	frequen / Hz
A	2	33
B	2	300
C	4	33
D	4	300