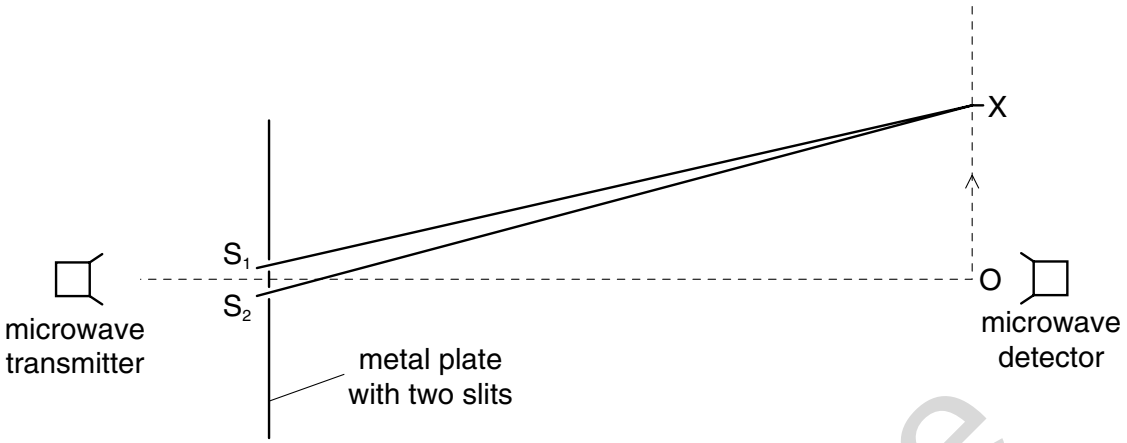
1 The diagram shows an experiment which has been set up to demonstrate two-source interference, using microwaves of wavelength λ.



The detector is moved from O in the direction of the arrow. The signal detected decreases until the detector reaches the point X, and then starts to increase again as the detector moves beyond X.

Which equation correctly determines the position of X?

A $OX = \lambda/2$ **B** $OX = \lambda$ **C** $S_2X - S_1X = \lambda/2$ **D** $S_2X - S_1X = \lambda$

2 Two progressive waves of frequency 300 Hz are superimposed to produce a stationary wave in which adjacent nodes are 1.5 m apart.

What is the speed of the progressive waves?

A $100\,m\,s^{-1}$ **B** $200\,m\,s^{-1}$ **C** $450\,m\,s^{-1}$ **D** $900\,m\,s^{-1}$

3 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.

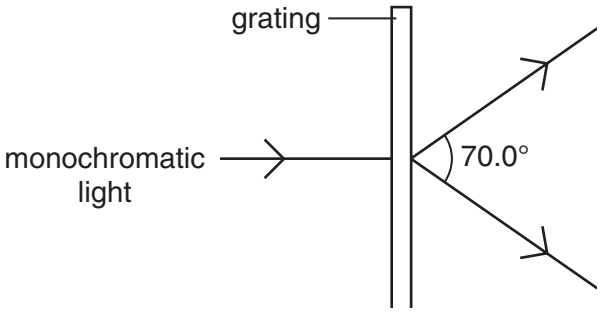
D The light from the lamps is white.

4 The lines of a diffraction grating have a spacing of 1.6×10^{-6} m. A beam of light is incident normally on the grating. The first order maximum makes an angle of 20 ° with the undeviated beam.

What is the wavelength of the incident light?

A 210 nm **B** 270 nm **C** 420 nm **D** 550 nm

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

6 Microwaves of wavelength 3.00 cm are incident normally on a row of parallel metal rods. The separation of the rods is 8.00 cm. The first order diffraction maximum is observed at an angle of 22.0° to the direction of the incident waves.

What is the angle between the first and second order diffraction maxima?

A 22.0° **B** 26.6° **C** 44.0° **D** 48.6°

7 Coherent monochromatic light illuminates two narrow parallel slits and the interference pattern that results is observed on a screen some distance beyond the slits.

Which change increases the separation between the dark lines of the interference pattern?

A using monochromatic light of higher frequency

B using monochromatic light of a longer wavelength

C decreasing the distance between the screen and the slits

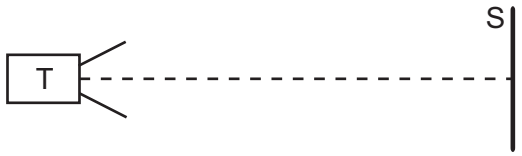
D increasing the distance between the slits

8 Monochromatic light of wavelength 590 nm is incident normally on a diffraction grating. The angle between the two second-order diffracted beams is 43°.

What is the spacing of the lines on the grating?

A 0.87 µm **B** 1.6 µm **C** 1.7 µm **D** 3.2 µm

9 T is a microwave transmitter placed at a fixed distance from a flat reflecting surface S.



A small microwave receiver is moved steadily from T towards S and receives signals of alternate maxima and minima of intensity.

The distance between successive maxima is 15 mm.

What is the frequency of the microwaves?

A 1.0×10^7 Hz

B 2.0×10^7 Hz

C 1.0×10^{10} Hz

D 2.0×10^{10} Hz

10 A teacher sets up the apparatus shown to demonstrate a two-slit interference pattern on the screen.

Which change to the apparatus will increase the fringe spacing?

A decreasing the distance *p*

B decreasing the distance *q*

C decreasing the distance *r*

D decreasing the wavelength of the light

11 A diffraction grating has N lines per unit length and is placed at 90° to monochromatic light of wavelength λ.

What is the expression for θ, the angle to the normal to the grating at which the third order diffraction peak is observed?

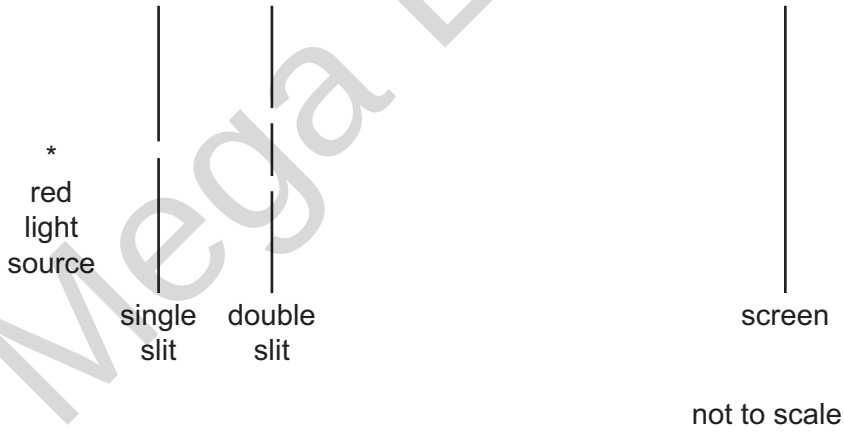
A $\sin\theta = \frac{1}{3N\lambda}$ **B** $\sin\theta = 3N\lambda$ **C** $\sin\theta = \frac{N\lambda}{3}$ **D** $\sin\theta = \frac{3\lambda}{N}$

12 Monochromatic light is incident on a diffraction grating and a diffraction pattern is observed.

Which line of the table gives the effect of replacing the grating with one that has more lines per metre?

	number of orders of diffraction visible	angle between first and second orders of diffraction
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

13 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.

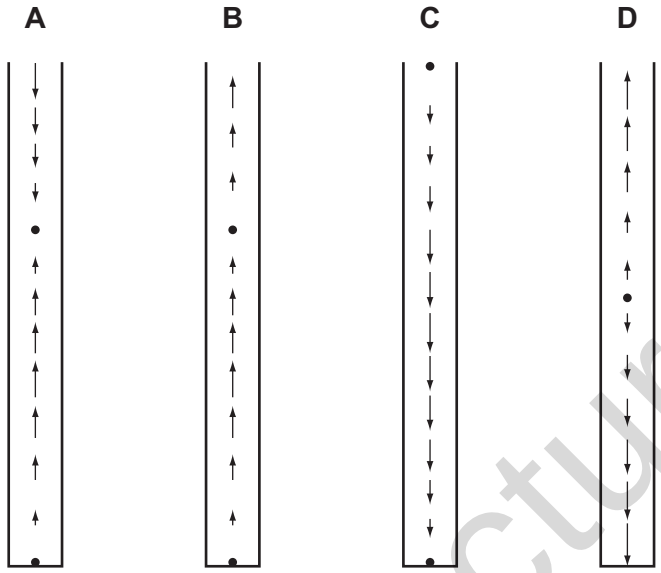
What is now the distance between successive bright fringes?

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

14 A stationary longitudinal wave is set up in a pipe.

In the diagrams below, the length of each arrow represents the amplitude of the motion of the air molecules, and the arrow head shows the direction of motion at a particular instant.

Which diagram shows a stationary wave in which there are two nodes and two antinodes?



15 A two-slit arrangement is set up to produce interference fringes on a screen. The fringes are too close together for convenient observation when a monochromatic source of violet light is used.

In which way would it be possible to increase the separation of the fringes?

A Decrease the distance between the screen and the slits.

B Increase the distance between the two slits.

C Increase the width of each slit.

D Use a monochromatic source of red light.

16 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

17 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

18 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.

19 Fringes of separation *y* are observed on a screen 1.00 m from a Young's slit arrangement that is illuminated by yellow light of wavelength 600 nm.

At which distance from the slits would fringes of the same separation *y* be observed when using blue light of wavelength 400 nm?

A 0.33 m **B** 0.67 m **C** 0.75 m **D** 1.50 m

20 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.

21 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

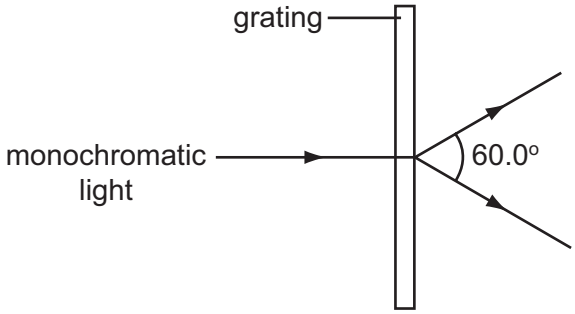
B increasing the width of the gap

C reducing the wavelength of the waves

D reducing the width of the gap

22 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^{o}, as shown in the diagram.



What is the wavelength of the light?

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

23 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

24 Monochromatic light illuminates two narrow parallel slits. The interference pattern which results is observed on a screen some distance beyond the slits.

Which change increases the separation between the dark lines of the interference pattern?

A decreasing the distance between the screen and the slits

B increasing the distance between the slits

C using monochromatic light of higher frequency

D using monochromatic light of longer wavelength

25 T is a microwave transmitter placed at a fixed distance from a flat reflecting surface S.

A small microwave receiver is moved from T towards S and receives signals of alternate maxima and minima of intensity.

The distance between one maximum and the next is 15 mm.

What is the frequency of the microwaves?

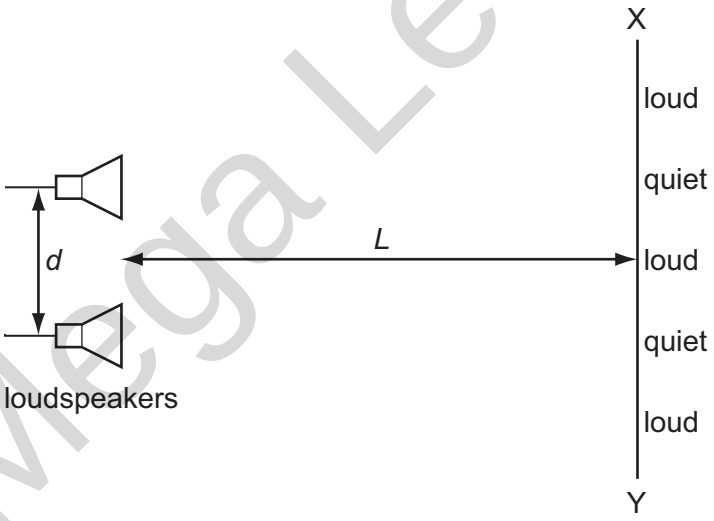
A 1.0×10^7 Hz

B 2.0×10^7 Hz

C 1.0×10^{10} Hz

D 2.0×10^{10} Hz

26 The diagram shows two loudspeakers producing sound waves that are in phase.



As a student moves from X to Y, the intensity of the note she hears is alternately loud and quiet.

The distance between adjacent loud and quiet regions may be reduced by

A decreasing distance *d*.

B increasing distance *L*.

C decreasing the amplitude.

D increasing the frequency.

27 A narrow beam of monochromatic light is incident normally on a diffraction grating. Third-order diffracted beams are formed at angles of 45° to the original direction.

What is the highest order of diffracted beam produced by this grating?

A 3rd **B** 4th **C** 5th **D** 6th

28 Light can exhibit all of the properties listed.

Which property can sound **not** exhibit?

A interference

B polarisation

C refraction

D total internal reflection