Unit 8: Superposition:

Subunit 8.3: Interference:

Topical Question No: 1

29 In an experiment to demonstrate two-source interference of light, a beam of light is split into two beams using two slits 0.50 mm apart. These two beams are incident on a laboratory wall at a distance of 4.0 m.

The wavelength of light is 550 nm.

How far apart are two adjacent interference fringes that are formed on the laboratory wall?

A 0.22 mm **B** 0.44 mm **C** 2.2 mm **D** 4.4 mm

Topical Question No: 2

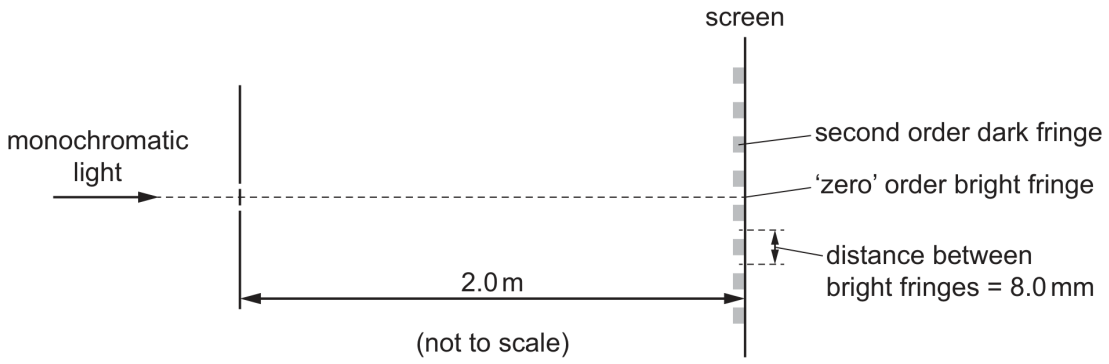
26 In a double-slit interference experiment, light of frequency 6.0×10^{14} Hz is incident on a pair of slits. Bright fringes that are 3.0 mm apart are observed on a screen some distance away.

What is the separation of the bright fringes when the frequency of the light is changed to 5.0×10^{14} Hz?

A 1.8 mm **B** 2.5 mm **C** 3.0 mm **D** 3.6 mm

Topical Question No: 3

27 Monochromatic light is incident on a pair of narrow slits a distance of 0.1 mm apart. A series of bright and dark fringes are observed on a screen a distance of 2.0 m away. The distance between adjacent bright fringes is 8.0 mm.



What is the path difference between the light waves from the two slits that meet at the second order dark fringe?

A 2.0×10^{-7} m

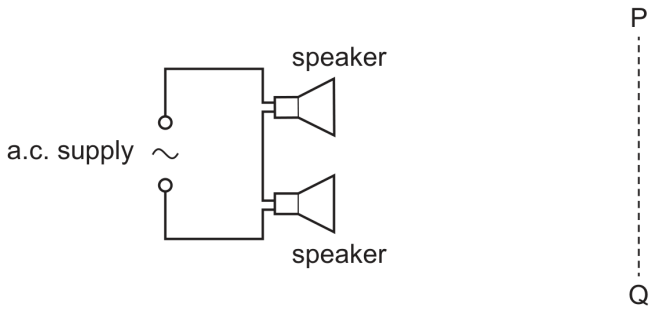
B 4.0×10^{-7} m

C 6.0×10^{-7} m

D 8.0×10^{-7} m

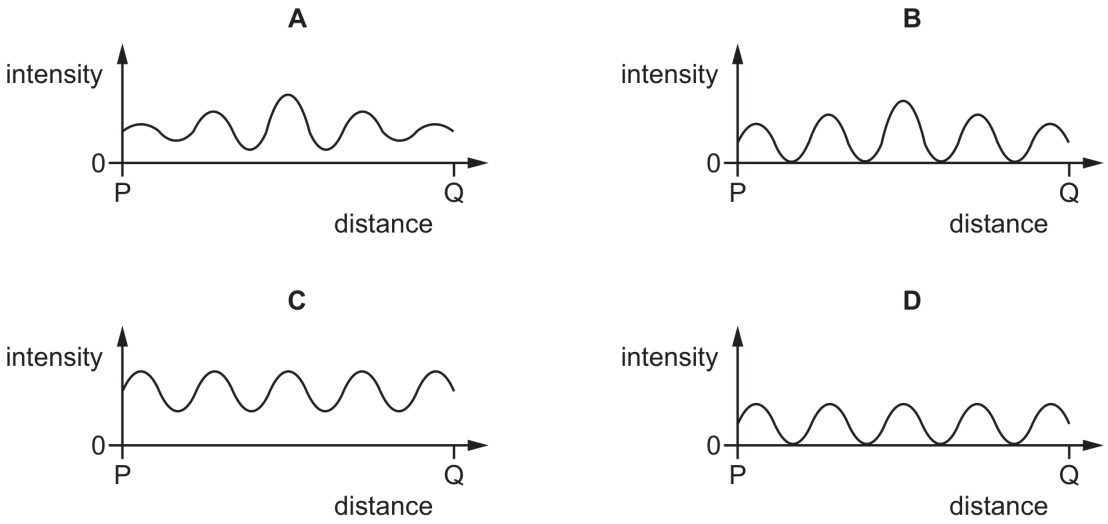
Topical Question No: 4

28 Two identical loudspeakers are connected in series to an a.c. supply, as shown.



A microphone is moved along the line PQ.

Which graph best shows the variation with distance from P of the intensity of the sound detected by the microphone?



Topical Question No: 5

28 The table shows four possible combinations of values for the laser wavelength, slit separation and slit-screen distance in a two-slit interference experiment to show the interference of visible light on a white screen.

Which combination will result in visible fringes being observed?

	laser wavelength / nm	slit separation / mm	slit-screen distance / m
A	200	0.10	5.0
B	200	100	1.0
C	600	0.10	5.0
D	600	100	1.0

Topical Question No: 6

26 Two waves, P and Q, meet at a point X and superpose.

Initially, the two waves meet at X in phase (zero phase difference) so that the resultant wave has an amplitude of 14.0 cm at that point.

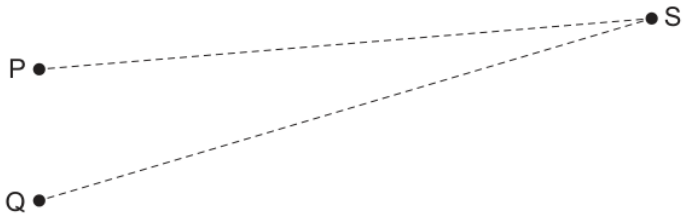
The phase difference between the two waves is then changed so that they meet at X with a phase difference of 180°. The resultant wave now has an amplitude of 4.0 cm at X.

What is the amplitude of one of the waves at point X?

A 2.0 cm **B** 5.0 cm **C** 10 cm **D** 18 cm

Topical Question No: 7

28 Two sources of microwaves P and Q produce coherent waves with a phase difference of 180°. The waves have the same wavelength λ.



At the point S there is a minimum in the interference pattern produced by waves from the two sources. The distance (QS – PS) is called the path difference.

Which expression could represent the path difference?

A $\frac{\lambda}{4}$ **B** $\frac{\lambda}{2}$ **C** λ **D** $\frac{3\lambda}{2}$

Topical Question No: 8

28 Waves are emitted from two coherent sources.

Which statement about the waves must be correct?

A They are in phase.

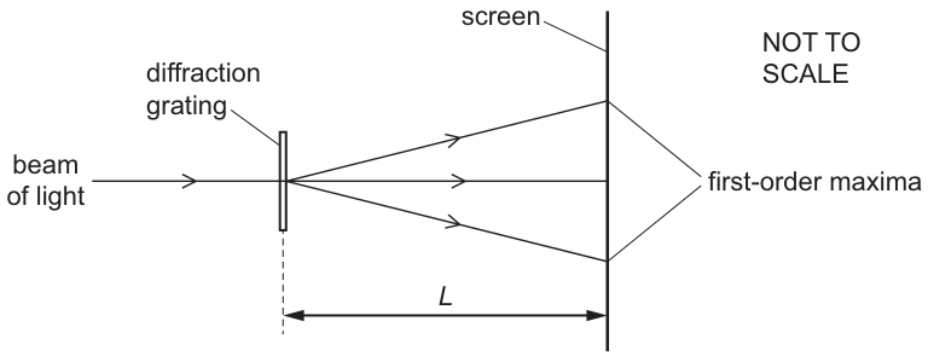
B They are transverse waves.

C They have a constant phase difference.

D They have the same amplitude.

Topical Question No: 9

29 The diagram shows a screen that is a distance *L* from a diffraction grating. The grating has a total number of *N* lines. Any two adjacent lines are a distance *d* apart. A beam of parallel light of wavelength λ is incident normally on the grating.



Which quantities affect the distance between the first-order diffraction maxima on the screen?

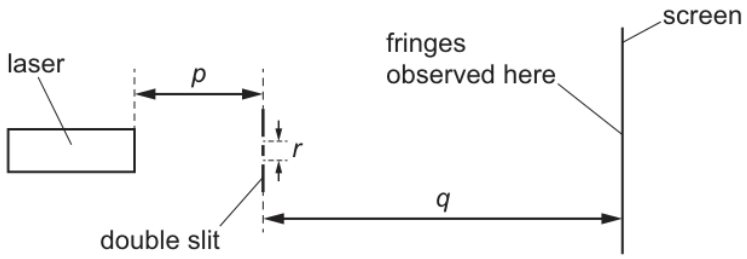
	d	λ	*L*	*N*
A	✓	✓	✓	✗
B	✓	✓	✗	✗
C	✓	✗	✓	✓
D	✗	✓	✗	✓

key
✓ = affects the distance
✗ = does not affect the distance

Topical Question No: 10

31 A student sets up an experiment to investigate double-slit interference.

The student uses light of a single wavelength from a laser to illuminate a double slit so that a pattern of interference fringes is observed on the screen.



The student finds that the fringes are very close together.

What could the student **decrease** in order to increase the separation of the fringes on the screen?

A the distance *p* from the laser to the double slit

B the distance *q* from the double slit to the screen

C the separation *r* of the slits

D the wavelength of the light from the laser

Topical Question No: 11

25 Using monochromatic light, interference fringes are produced on a screen placed a distance D from a pair of slits of separation a. The separation of the fringes is x.

Both a and D are now doubled.

What is the new fringe separation?

A $\frac{x}{2}$ **B** x **C** $2x$ **D** $4x$

Topical Question No: 12

30 Why can an observable interference pattern **never** be obtained between two monochromatic beams of light from different lamps?

A The frequency of the light from the two lamps can never be the same.

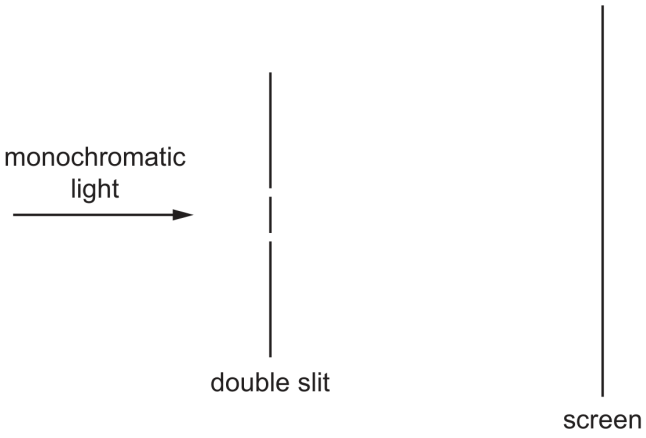
B The light from the two lamps can never be coherent.

C The temperature of the filaments of the two lamps used can never be the same.

D The wavelength of the light from the two lamps must always be different.

Topical Question No: 13

31 A student sets up apparatus to observe the double-slit interference of monochromatic light, as shown.



Interference fringes are formed on the screen.

Which change would increase the distance between adjacent fringes?

A Decrease the distance between the two slits.

B Decrease the width of each slit.

C Move the screen closer to the double slit.

D Use light of a higher frequency.

Topical Question No: 14

30 Interference fringes are produced on a screen by double-slit interference using light of wavelength 600 nm. The fringe separation is 4.0 mm and the separation of the slits is 0.60 mm.

What is the distance between the double slit and the screen?

A 0.25 m **B** 0.40 m **C** 2.5 m **D** 4.0 m

Space for working

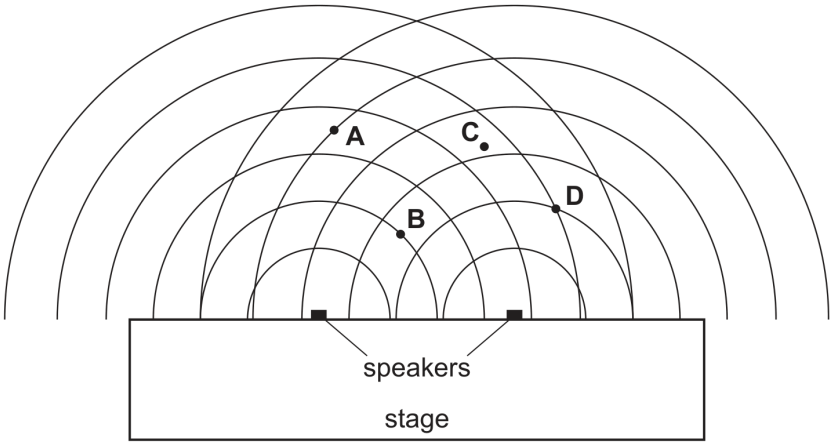
Topical Question No: 15

27 An outdoor concert has two large speakers beside the stage for broadcasting music.

In order to test the speakers, they are made to emit sound of the same wavelength and the same amplitude.

The curved lines in the diagram represent wavefronts.

Where is the loudest sound heard?



Answer Key

1. N/A
2. N/A
3. N/A
4. N/A
5. C
6. B
7. C
8. C
9. A
10. C
11. N/A
12. N/A
13. N/A
14. N/A
15. N/A