doubtnut
India's Number 1 Education App

PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

WAVE OPTICS

Illustration

1. Light waves from two coherent sources superimpose at a point. The waves, at this point, can be expressed as $y_1 = a\sin\left[10^{15}\pi t\right]$ and $y_2 a\sin\left[10^{15}\pi t + \phi\right]$. Find the resultant amplitude if phase difference ϕ is

(a) zero

(b) $\pi / 3$

(c) π

Also find the frequency (Hz) of resultant wave in each case.

Watch Video Solution

2. In young's experiment, the interfacing waves have amplitudes in the ratio $3:2$. Find the ratio of (a) amplitudes and (b) intensities, between the bright and dark fringers.

Watch Video Solution

3. Two coherent sources emit light waves which superimpose at a point where these can be expressed as

$E_1 = E_0 \sin(\omega t + \pi / 4)$

$E_2 = 2E_0 \sin(\omega t - \pi / 4)$

Here, E_1 and E_2 are the electric field strenghts of the two waves at the given point.

If I is the intensity of wave expressed by field strenght E_1, find the resultant intensity

Watch Video Solution

4. Determine the resultant of two waves given by $y_1 = 4\sin(200\pi t)$ and $y_2 = 3\sin(200\pi t + \pi/2)$.

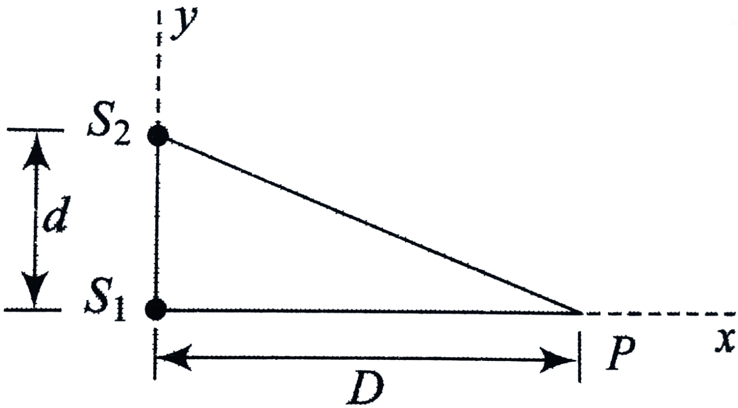
Watch Video Solution

5. Two sources S_1 and S_2 emiting light of wavelenght 600 nm placed a distance 1.0×10^{-2} cm apart.

A detector can be moved on line S_1P which is perpendicular to S_1S_2

(a) What would be the minimum and maximum path difference at the detector as it moves along line S_1P ?

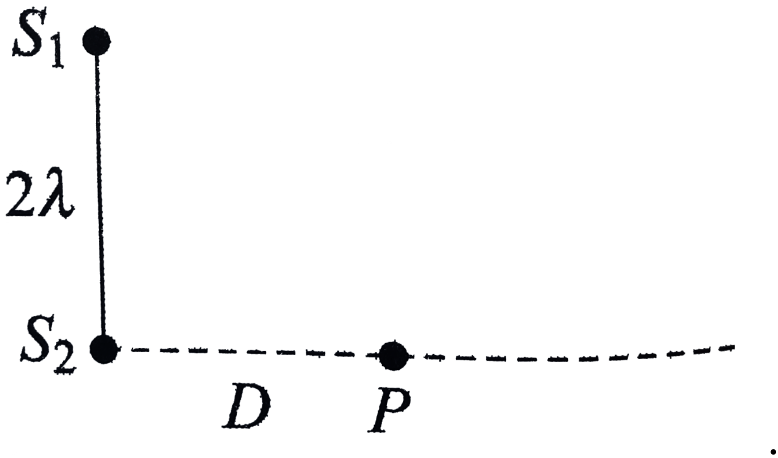
(b) Locate the psoition of the farthest minima detected



Watch Video Solution

6. Two coherent point sources S_1 and S_2 vibrating in phase emit light of wavelength λ. The separation between the sources is 2λ. Consider a line passing through S_2 and perpendicular to line

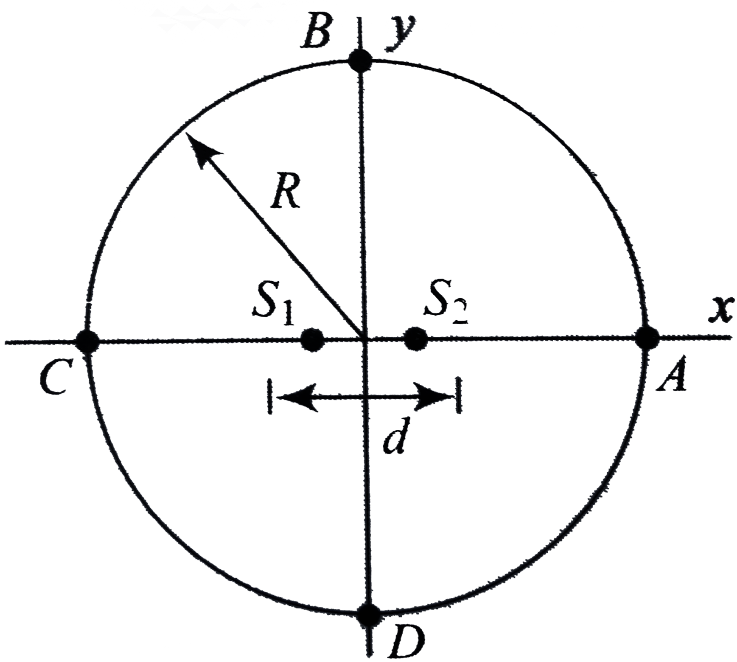
S_1S_2. Find the position of farthest and nearest minima.



Watch Video Solution

7. Two source are placed on x-axis at a separation $d = 3\lambda$. An observer starts moving from A on a circular track of radius R $(R > > d)$. How many bright points and dark points will he observe?

Find the angular positions of maxima and minima.



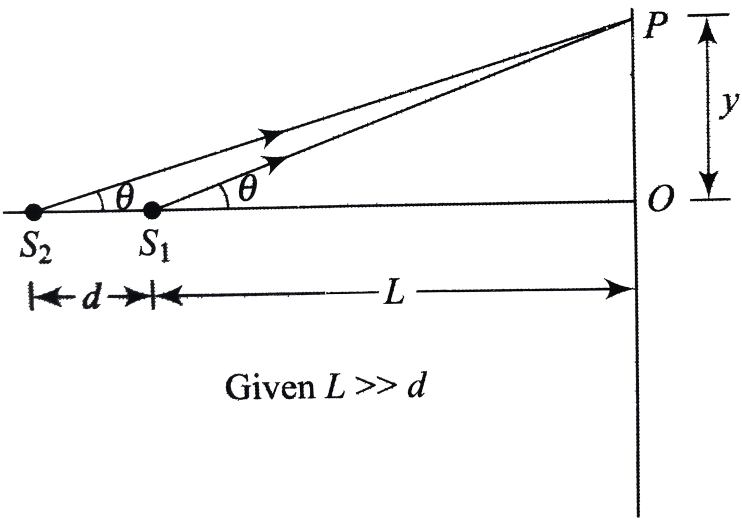
Watch Video Solution

8. Two point sources are placed on a straight line separated by a distance $d = 3\lambda$. Both the sources are placed at a distance L from a wall which is perpendicular to the straight line. Both the sources are sending waves of equal intensity.

Find:

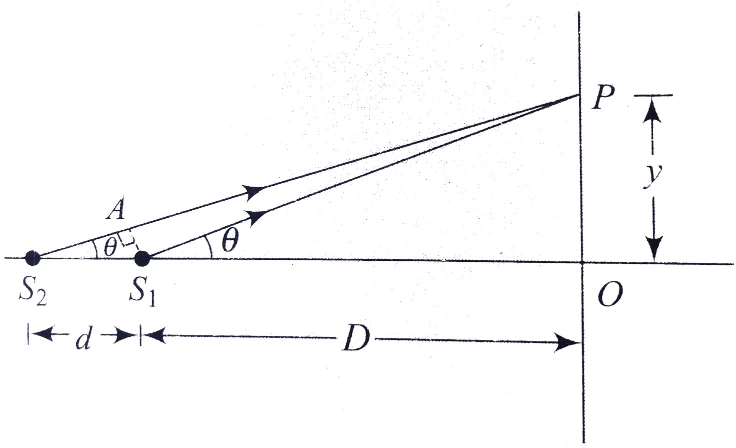
a. Locus of the points on the wall having equal intensity.

b. Maximum and minimun path difference observed on the wall.



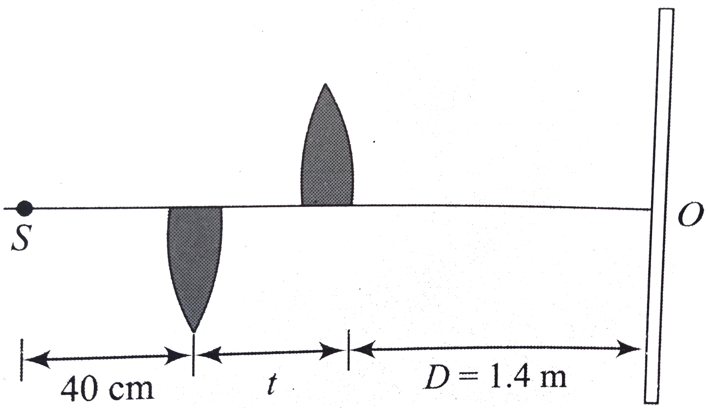
Watch Video Solution

9. (a) In Illustration 2.20, how many dark rings will be observed on the wall? (b) What is the Path difference at point P?



Watch Video Solution

10. A convex lens of focal length 20 cm is cut long its diameter and the two halves are displaced by $t = 1$ cm along the principal axix. A monochromatic point source of wavelength 476 nm is placed at a distance 40 cm from the first half, as shown in Fig. 2.21. Find the position of the first maximum.



Watch Video Solution

11. Two parallel beams of light P and Q are incident normally on a prism and the transmitted rays are brought to focus with the help of a convergent lens as shown in Fig. 2.23. If the intensities of the upper and lower beams immediately after transmission from face AC are 4I abd I, respectively, find the resultant intensity at the focus.

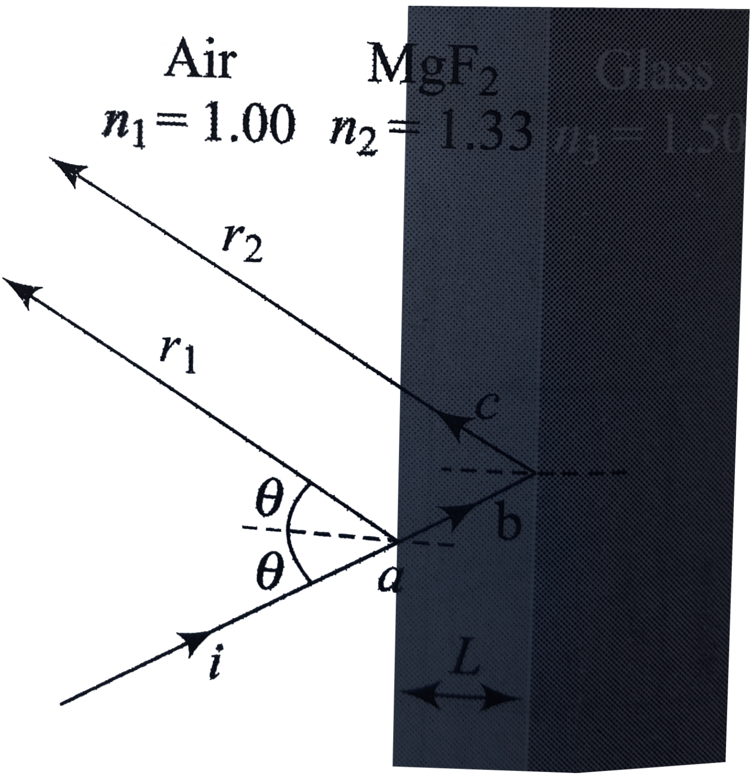
Watch Video Solution

12. White light, with a uniform intensity across the visible wavelength range 430 - 690 nm, is perpendicularly incident on a wate film, of index of refraction $\mu = 1.33$ and thickness $d = 320$nm, that is suspended in air. At what wavelength λ is the light reflected by the film brightest to an observer?

Watch Video Solution

13. A glass lens is coated on one side with a thin film of magnesium fluoride $(MgF_2)$to reduce reflection from the lens surface (Fig. 2.26). The Index of refraction of MgF_2 is 1.38, that of the glass is 1.50. What is the least coating thickness that eliminates (via interference) the reflections at the middle of the visible specturm $(\lambda = 550nm)$?

Assume that the light is approxmately perpendicular to the lens surface.



Watch Video Solution

14. White light is incident normally on a glass plate of thickness 0.50×10^{-6} and index of refraction 1.50. Which wavelength in the visible region (400 nm - 700 nm) are strongly reflacted by the plate ?

Watch Video Solution

15. Red light $I(\lambda = 664nm$ in vacuum) is used in Young's experiment with the slits separated by a distance from the screen given by $D = 2.75m$. Find the distance y on the screen between the central bright fringe and the third-order bright fringe.

Reasoning: This problem can be solved by the first using Eq. (i) to determine the value of θ that locates the third-order bright fringe. Then, trigonometry can be used to obatin the distance y.

Watch Video Solution

16. In a YDSE, $D = 1M, d = 1mm$, and $\lambda = 1/2mm$.

(a) Find the distance between the first and central maxima on the screen.

(b) Find the number of maxima and minima obtained on the screen.

Watch Video Solution

Watch Video Solution

17. Monochromatic light of wavelength 5000Å is used in YDSE, with slit width, $d = 1mm$, distance between screen and slits, $D = 1M$. If intensites at the two slits are $I_1 = 4I_0$ and $I_2 = I_0$, find:

a. finge width β:

b. distance of 5th minima from the central maxima on the screen,

c. intensity at $y = \frac{1}{3}mm$,

d. distance of the 1000th maxima, and

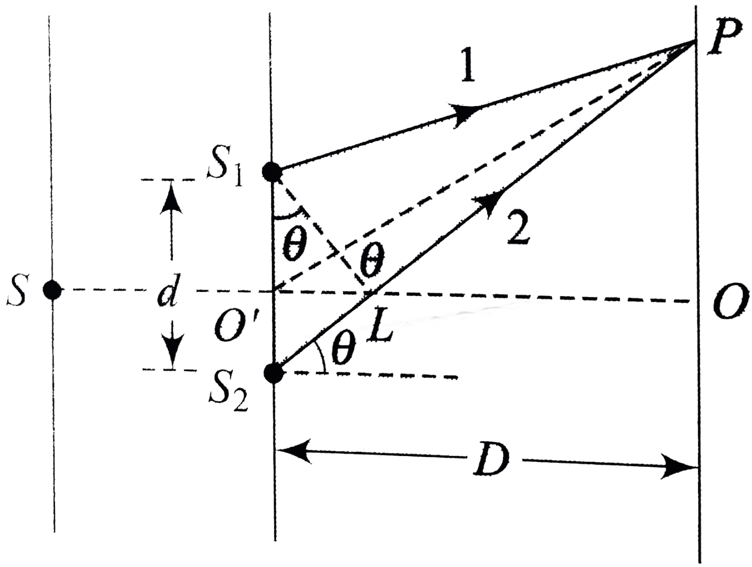
e. distance of the 5000th maxima.

Watch Video Solution

18. Young's double slit experiment is perfor-med inside water $(\mu = 43)$ with light of frequency 6×10^{14} Hz. If the slits are separated by 0.2 mm and the screen kept 1 m from the slits, find the fringe width. Using the same set-up, what will the fringe width be if the experiment is performed in air?

Watch Video Solution

19. In Young's experiment performed with light or wavelength 5500 Å what should be the separation between the two slits so that the highest order of maximum intensity in the interference pattern is 2 ? You may assume $D > > d$.



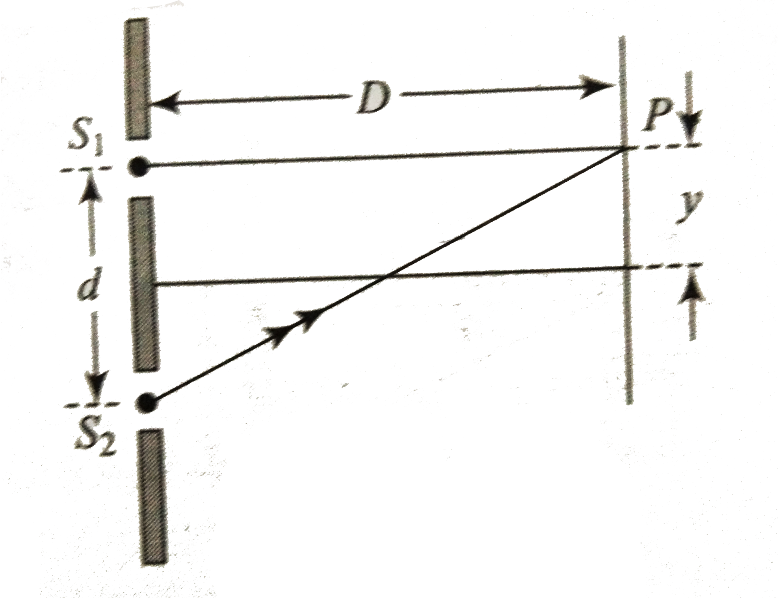
Watch Video Solution

20. In Young's experiment, light of wavelength 600 nm falls on the double slits separated by 0.1 mm.

What is the highest order of maximum intensity in the interference pattern obtained on a screen kept 3 m from the slits? How does the highest order change if the distance of screen from the slits is changed?

Watch Video Solution

21. At a point on the screen directly in front of one of the slits, find the missing wavelengths.

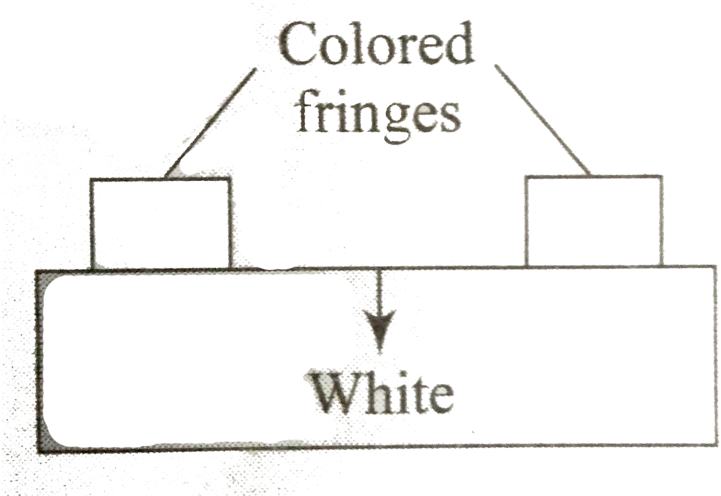


Watch Video Solution

22. In Young's experiment the slits, separated by $d = 0.8mm$, are illuminated with light of wavelength 7200 Å, Interference pattern is obtained on a screen $D = 2m$ from the slits. Find minimum distance from central maximum at which the a average intensity is 50% if of maximum?

Watch Video Solution

23. Figure 2.39 shows a photograph that illustrates the kind of interference fringes that can result when white light, which is a mixture of all colors, is used in Young's experiment, Except for the central fringe, which is white, the bright frings are a rainbow of colors. Why does Young's experiment separate white light into the constituent colors? In any group of colored fringes, such as the two singled out in the figure, why is red farther out from the central fringe than green is? And finally, why is the central fringe white rather than colored?



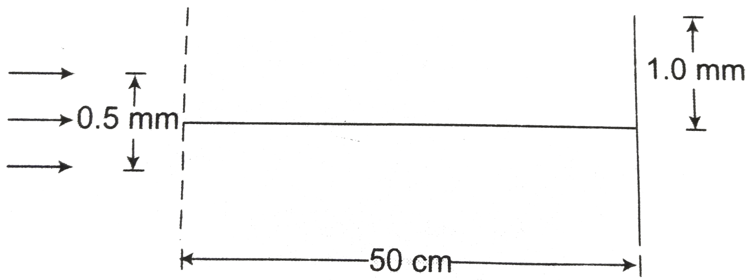
Watch Video Solution

24. White coherent light $(400nm - 700nm)$ is sent through the slits of a YDSE. $d = 0.5mm$, D=50 cm.

There is a hole in the screen at a point $1.0 mm$ away (along the width of the fringes) from the central line.

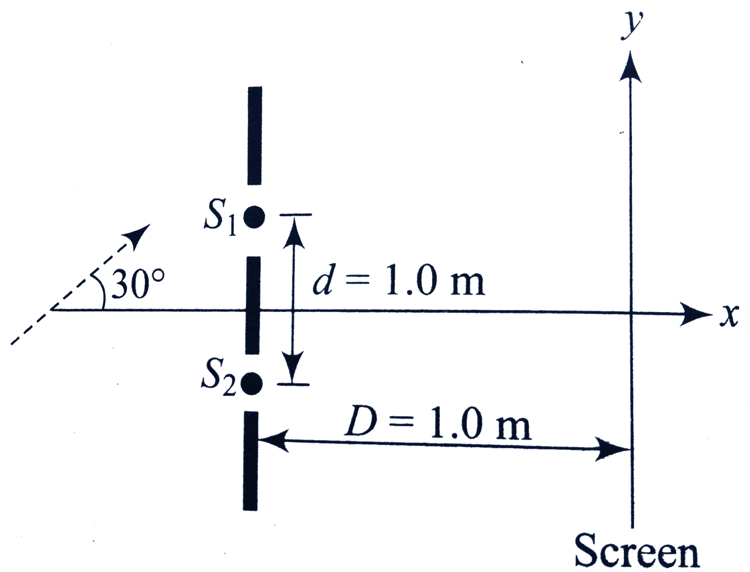
(a) Which wavelength will be absent in the light coming from the hole?

(b) Which wavelength(s) will have a strong intensity?



Watch Video Solution

25. A coherent parallel beam of microwaves of wavelength $\lambda = 0.5mm$ falls on aYoung's double-slit apparatus. The separation between the slits is 1.0 mm. The intensity of microwaves is measured on a screen placed parallel to the plane of the slits at a distance of 1.0 m from it as shown in figure



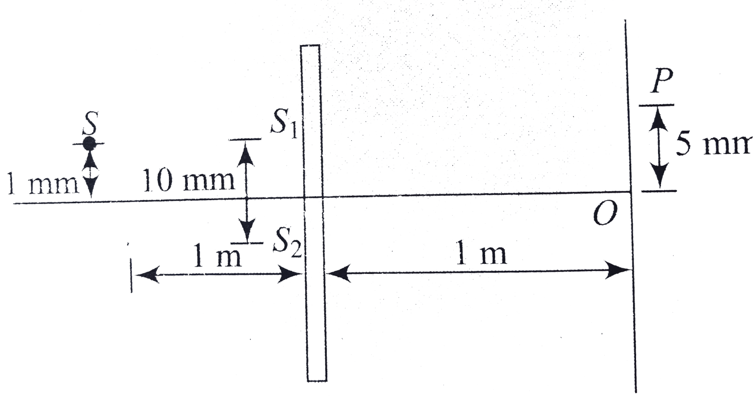
If the incient beam falls normally on the double-slit apparatus, find the order of the interference minima on the screen

Watch Video Solution

26. In Young's double-slit experiment, the point source is placed slightly off the central axis shown in Fig. 2.45.

a. Find the nature and order of the interference at point P.

b. Find the nature and order of the interference at point. O.



Watch Video Solution

27. The wavelength of light coming from a sodium source is 589 nm. What will be its wavelength in water? Refractive index of water 1.33.`

Watch Video Solution

28. A Young's double slit apparatus is immersed in a liquid of refractive index μ_1. The slit plame touches the liquid surface. A parallel beam of monochromatic light of wavelength λ (in air) is incident normally on the slits.

a. Find the fringe width.

b. If one of the slits (say S_2) is covered by a transparent slab of refrative index μ_2 and thickless t as shown, find the new position of central maxima.

c. Now, the other slit, S_1 is also covered by a slab of same thickness and refractive index μ_3 as shown in Fig. 2.49 due to which the central maxima recovers it positon, find the value of μ_3

Find the ratio of intensities at O in the three conditions (a), (b), and (c).

Watch Video Solution

29. A thin paper of thickness 0.02 mm having a refractive index 1.45 is pasted across one of the slits in a Young's double slit experiment. The paper transmits 4/9 of the light energy falling on it. (a) Find the ratio of the maximum intensity to the minimum intensity in the fringe pattern. (b) How many fringes will cross through the centre if an identical paper piece is pasted on the other slit also ? The wavelength of the light used is 600 nm.

Watch Video Solution

30. A double - slit apparatus is immersed in a liquid of refractive index 1.33 it has slit separation of 1mm and distance between the plane of slits and screen 1.33 m the slits are illuminated by a parallel beam of light whose wavelength in air is 800 nm.

(i) Calculate the fringe width.

(ii) One of the slits of apparatus is covered by a thin glass sheet of refractive index 1.53 Find the smallest thickness of the sheet to bring the adjacent minima on the axis.

Watch Video Solution

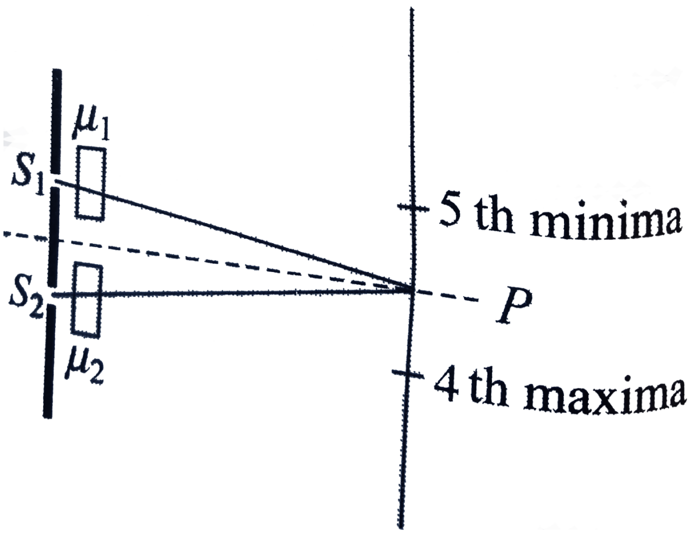
31. A monochromatic light of $\lambda = 500nm$ is incident on two identical slits separated by a distance of $5 \times 10^{-4}m$. The interference pattern is seen on a screen placed at a distance of $1m$ from the plane of slits. A thin glass plate of thickness $1.5 \times 10^{-6}m$ and refractive index $\mu = 1.5$ is placed between one of the slits and the screen. Find the intensity at the center of the screen if the intensity is I_0 in the absence of the plate. Also find the lateral shift of the central maxima and number of fringes crossed through center.

Watch Video Solution

32. In Young's experiment the upper slit is covered by a thin glass plate of refractive index 1.4 while the lower slit is covered by another glass plate, having the same thickness as the first one but having refractive index 1.7 interference pattern is observed using light of wavelength 5400Å

It is found that point P on the screen where the central maximum $(n = 0)$ fell before the glass plates were inserted now has $3/4$ the original intensity. It is further observed that what used to be the fourth maximum earlier, lies below point P while the fifth minimum lies above P.

Calculate the thickness of glass plate. (Absorption of light by glass plate may be neglected.



Watch Video Solution

33. A screen is at distance $D = 80$ cm form a diaphragm having two narrow slits S_1 and S_2 which are $d = 2$ mm apart.

Slit S_1 is covered by a transparent sheet of thickness

$t_1 = 2.5 \mu m$ slit S_2 is covered by another sheet of thickness

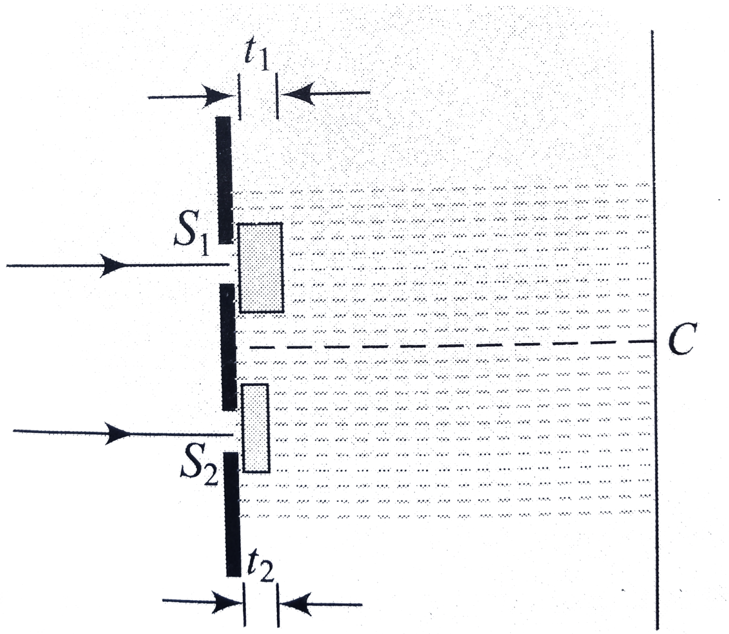
$t_2 = 1.25 \mu m$ as shown if Fig. 2.52.

Both sheets are made of same material having refractive index $\mu = 1.40$

Water is filled in the space between diaphragm and screen. A monochromatic light beam of wavelength

$\lambda = 5000 \text{Å}$ is incident normally on the diaphragm.

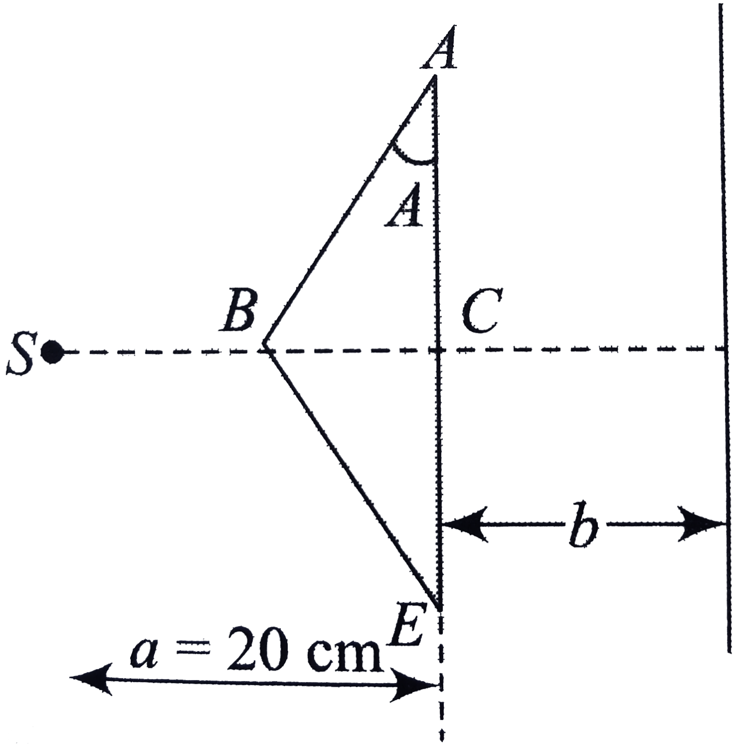
Assuming intensity of beam to be uniform, calculate ratio of intensity of C to maximum intensity of interference pattern obtained on the screen $(\mu_w = 4/3)$



Watch Video Solution

34. Two small angled transparent prisms (each or refracting angle $A = 1^\circ$) are so placed that their bases coincide, so that common base is BC. This device is called Fresnel's biprism and is used to obtain coherent sources of a point source S illuminated by monochromatic light of wavelength 6000Å placed at a distance $a = 20$ cm. Calculate the separation between coherent sources. If a screen is placed at a distance $b = 80$ cm. from the device, what ist the finge which of fringes obtained (Refractive index of material of each prism

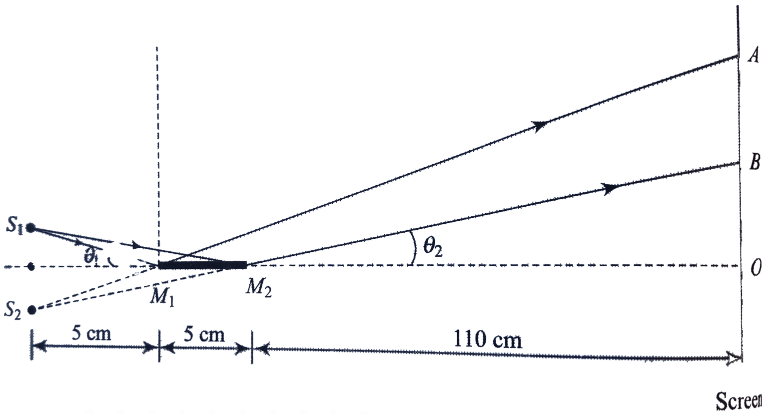
$= 1.5.$)



Watch Video Solution

35. A Lloyd's mirror or length 5 cm is illuminated with monochromatic light of wavelength

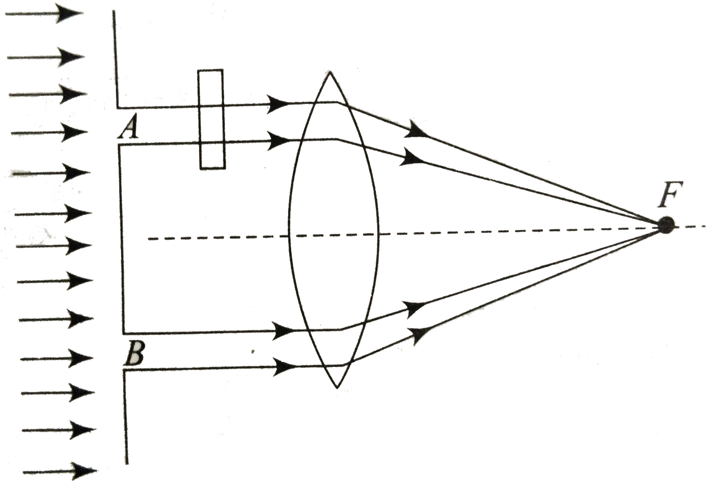
$\lambda(=6000Å)$ from a narrow 1 mm slit in its plane and 5 cm plane from its near edge. Find the fringe width on a screen 120 cm from the slit and width of interference pattern on the screen.



Watch Video Solution

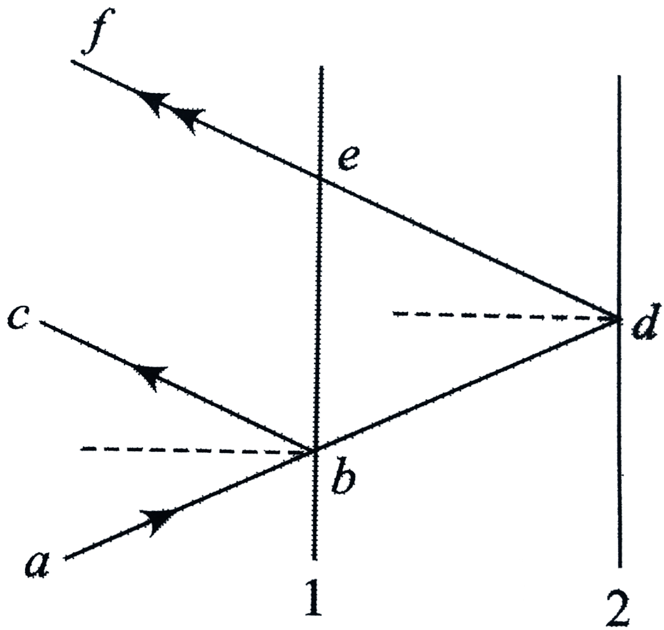
Solved Examples

1. In a modified Young's double-slit experiment, a monochromatic uniform and parallel beam of light of wavelength 6000Å and intensity $(10/\pi)$ W m^{-2} is incident normally on two circular apertures A and B of radii 0.001 m and 0.002 m, respectively. A perfectly transparent film of thickness 2000Å and refractive index 1.5 for the wavelength of 6000Å is placed in front of aperture A (see the figure). Calculate the power (in mW) received at the focal spot F of the lens. Then lens is symmetrically placed with respect to the aperture. Assume that 10% of the power received by each aperture goes in the original direction and is brought to the focal spot.



Watch Video Solution

2. A narrow monochromatic beam of light of intensity 1 is incident on a glass plate as shown in figure Another identical glass plate is kept close to the first one and parallel to it. Each glass plate reflects 25% of the light incident on it and transmits intensities in the interference pattern formed by two beams obtained after one reflection at each plate.

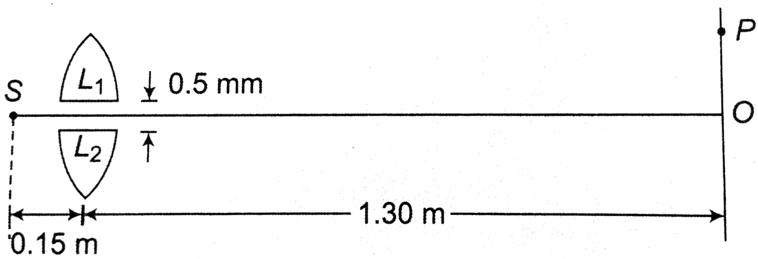


Watch Video Solution

3. In figure S is a monochromatic point source emitting light of wavelength $\lambda = 500nm$. A thin lens of circular shape and focal length $0.10m$ is cut into two identical halves L_1 and L_2 by a plane passing through a doameter. The two halves are placed symmetrically about the central axis SO with a gap of $0.5mm$. The distance along the axis from A to L_1 and L_2 is $0.15m$, while that from L_1 and L_2 to O is $1.30m$. The screen at O is normal to SO.

(a) If the 3^{rd} intensity maximum occurs at point P on screen, find distance OP.

(b) If the gap between L_1 and L_2 is reduced from its original value of $0.5mm$, will the distance OP increases, devreases or remain the same?



Watch Video Solution

4. A double - slit apparatus is immersed in a liquid of refractive index 1.33 it has slit separation of 1mm and distance between the plane of slits and screen 1.33 m the slits are illuminated by a parallel beam of light whose wavelength in air is 800 nm.

(i) Calculate the fringe width.

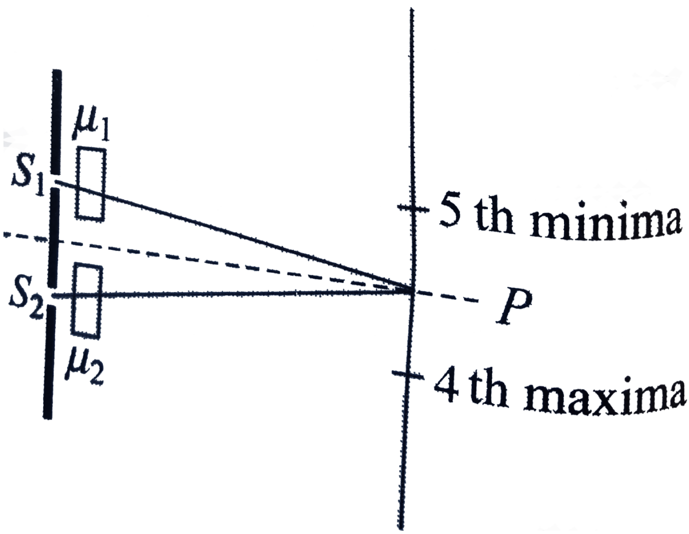
(ii) One of the slits of apparatus is covered by a thin glass sheet of refractive index 1.53 Find the smallest thickness of the sheet to bring the adjacent minima on the axis.

Watch Video Solution

5. In Young's experiment the upper slit is covered by a thin glass plate of refractive index 1.4 while the lower slit is covered by another glass plate, having the same thickness as the first one but having refractive index 1.7 interference pattern is observed using light of wavelength 5400Å

It is found that point P on the screen where the central maximum $(n = 0)$ fell before the glass plates were inserted now has $3/4$ the original intensity. It is further observed that what used to be the fourth maximum earlier, lies below point P while the fifth minimum lies above P.

Calculate the thickness of glass plate. (Absorption of light by glass plate may be neglected.



Watch Video Solution

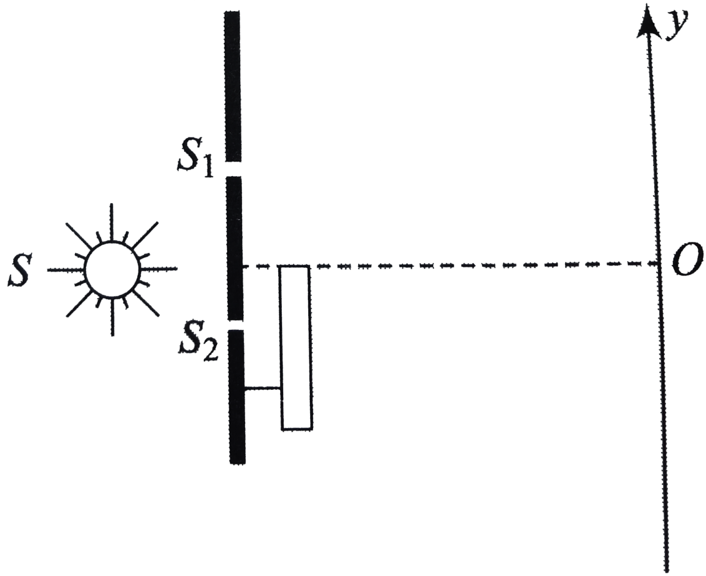
6. The Young's double-slit experiment is done in a medium of refractive index $4/3$. A light of 600 nm wavelength isfalling on the slits having 0.45 mm separation. The lower shift S_2 is covered by a thin glass sheet of refractive index. 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in Figure

a. Find the location of central maximum (bright fringe with zero path difference) on the y-axis.

b. Find the light intensity of point O relative to the maximum fringe intensity.

c. Now , if 600 nm light is replaced by white light of range 400 - 700 nm, find the wavelengths of the light that from maxima exaclty at point O.

(All wavelength in the problem are for the given medium of refractive index $4/3$ Ignoe dispersion.)



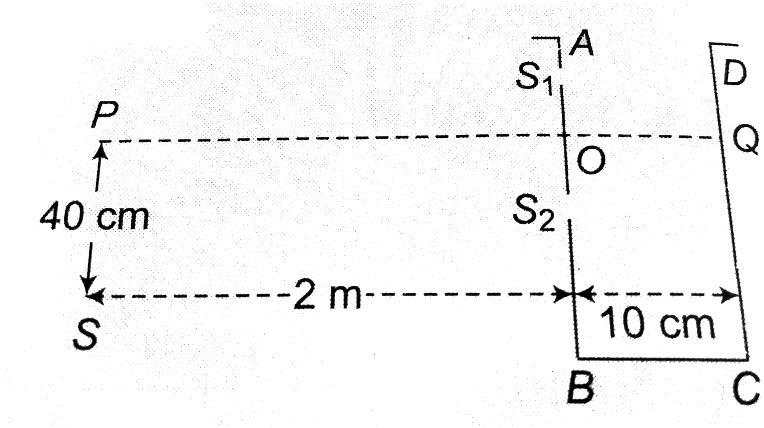
Watch Video Solution

7. A glass of refractive index 1.5 is coated with a thin layer of thickness t and refractive index 1.8 . Light of wavelength λ travelling in air is incident normally on the layer. It is partly reflected at the upper and the lower surfaces of the layer. It is partly reflected at the upper and the lower surfaces of the layer ant the two reflected rays interface . If $\lambda = 648nm$, obtain the least value of $t(\text{in} 10^{-8} m)$ which the rays interface constructively.

Watch Video Solution

8. A vessel ABCD of $10cm$ width has two small slits S_1 and S_2 sealed with idebtical glass plates of equal thickness. The distance between the slits is $0.8mm$. POQ is the line perpendicular to the plane AB and passing through O, the middle point of S_1 and S_2. A monochromatic light source is kept at S, $40cm$ below P and $2m$ from the vessel, to illuminate the slits as shown in the figure. Calculate the position of the central bright fringe on the other wall CD with respect of the line OQ. Now, a liquid is poured into the vessel and filled up to OQ. The central bright fringe is fiund to be at Q.

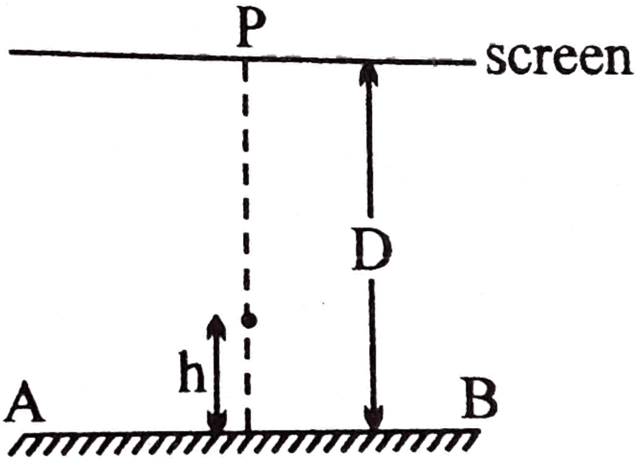
Calculate the refractive index of the liquid.



Watch Video Solution

9. A point sources S emitting light of wavelength $600nm$ is placed at a very small height h above the flat reflecting surface AB(see figure).The intensity of the reflected light is36% of the intensity.interference firnges are observed on a screen placed parallel to the reflecting surface a very large distance D from it.

(A)What is the shape of the interference fringes on the screen?

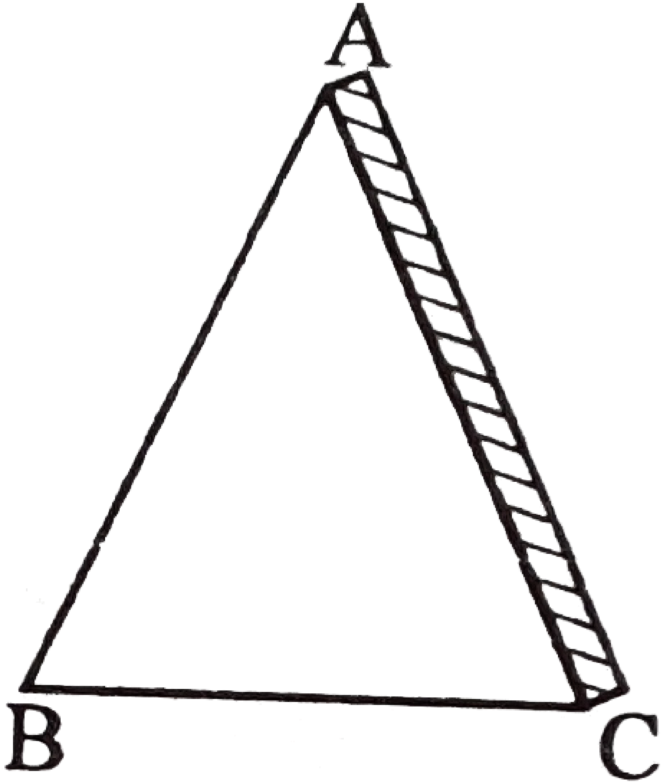


(B)Calculate the ratio of the minimum to the maximum to the maximum intensities in the interference fringes fromed near the point P (shown in the figure) (c) if the intenstities at point P corresponds to a maximum,calculate the minimum distance through which the reflecting surface AB should be shifted so that the intensity at P again becomes maximum.

Watch Video Solution

10. A prism $\left(\mu_P = \sqrt{3}\right)$ has an angle of prism $A = 30^\circ$.A thin film $\left(\mu_f = 2.2\right)$ is coated on face AC as shown in the figure.Light of wavelength $550nm$ is incident on the face ABat60°angle of incidence,find

(I)the angle of its emergence from the face$AC$and



(ii)the minimum thickness (in mn) of the film for which the emerging light is of maximum possible intensity.

Watch Video Solution

Exercise 2.1

1. Two coherent sources of light of intensity ratio β produce interference pattern. Prove that in the interferencepattern

$$\frac{I_{\max} - I_{\min}}{I_{\max} + (I_{\min})} = \frac{2\sqrt{\beta}}{1+\beta}$$

where $I_{\max}$ and $I_{\min}$ are maximum and mininum intensities in the resultant wave.

Watch Video Solution

2. Find the maxinum intensity in case of interference of n identical waves each of intensity

I_0 if the interference is

(a) coherent and (b) incoherent.

Watch Video Solution

3. Explain why two flashlights held close together do not produce an interference pattern on a distant screen?

Watch Video Solution

4. Refractive index of a thin soap film of a uniform thickness is 1.34. Find the smallest thickness of the film that gives in interference maximum in the reflected light when light of wavelength 5360Å fall at normal incidence.

Watch Video Solution

5. A thin transparent film of thickness 3000 Å and refractive index 1.5 ud deposited on a sheet made of a metal. Assuming normal incidence of light and also that the film is a plane parallel one, what will be the color of a pot made from this sheet when observed in white light?

Watch Video Solution

6. By an anodizing process, a transparent film of aluminium oxide of thickness $t = 250$ nm and index of refraction $n_2 = 1.80$ is deposited on a sheet of polished aluminium What is the color of utenslis made from this sheet with observer in white light? Assume normal incidence of the light.

Watch Video Solution

7. As a soap bubble evaporates, it appears black just before it breaks. Explain this phenomenon in

terms of the phase changes that occur on reflection form the two surface of the soap film.

Watch Video Solution

8. If we are to observe interference in a thin film, why must the film not be very thick (with thickness only on the order of a few wavelength)?

Watch Video Solution

9. A soap bubble $(n = 1.33)$ is floating in air. If the thickness of the bubble wall is 115 nm, what is the wavelength of the light that is most strongly reflected?

Watch Video Solution

10. An oil film $(n = 1.45)$ floating on water is illuminated by white light at normal incidence. The film is 280 nm thick. Find (a) the color or the light in the visible specturm most strongly reflected and (b) the color of the light in the specturm most strongly transmitted. Explain your reasoning.

Watch Video Solution

11. A material having an index of refraction of 1.30 is used as an antireflective coating on a piece of glass `(n = 1.50). What should be the minimum thickness of this film in order to minimize reflection of 500 nm light?

Watch Video Solution

12. In solar cells, a silicon solar cell $(\mu = 3.5)$ is coated with a thin film

of silicon monoxide $SiO(\mu = 1.45)$ to minimize reflective losses from the surface.

Determine the minimum thickness of SiO that produces the least reflection at a wavelength of 550nm, near the centre of the visible spectrum. Assume approximately normal incidence .

Watch Video Solution

Exercise 2.2

1. In Young's double slit experiment with wavelength 5890 Å, there are 60 fringe in the field of vision, How many fringes will be observed in the same field of vision id wavelength used is 5460 Å?

Watch Video Solution

2. In YDSE performed with wavelength $\lambda = 5890 \text{Å}$ the angular fringe width is 0.40°. What is the angular fringe width if the entire set-up is immersed in water?

Watch Video Solution

3. In YDSE for wavelength $\lambda = 589 nm$, the interference fringe have angular separation of 3050×10^{-3} rad. For what wavelength would the angular separation be 10.0% greater?

Watch Video Solution

4. A beam of light consisting of wavelengths 6000 Å and 4500 Å is used in a YDSE with D = 1 m and d = 1 mm. Find the least distance from the central maxima, where bright fringes due to the two wavelengths coincide.

Watch Video Solution

5. White light is used in a YDSE with $D = 1m$ and $d = 0.9mm$. Light reaching the screen at position

$y = 1mm$ us passed through a prism and its spectrum is obtained. Find the missing lines in the visible region of this spectrum.

Watch Video Solution

6. Monichromatic lightof wavelenght 600 nm is used ina Young's double slilt experient. One of the slits is covered by a transparent sheet of thicknes 1.8×10^{-5} m made of a material of refractive index 1.6. How many fringe will shift due to the introduction of the sheet?

Watch Video Solution

7. Interference fringes are produced by a double slit arrangement and a piece of plane parallel glass of refractive index 1.5 is interposed in one of the interfering beam. If the fringes are displaced through 30 fringe widths for light of wavelength $6 \times 10^{-5} cm$, find the thickness of the plate.

Watch Video Solution

8. In YDSE with $d = 1mm$ and $D = 1m$, Slabs of $(t = 1\mu m, \mu = 3)$ and $(t = 0.5\mu m, \mu = 2)$ are introduced in front of upper and lower slits, respectively. Find the shift in the fringe pattern.

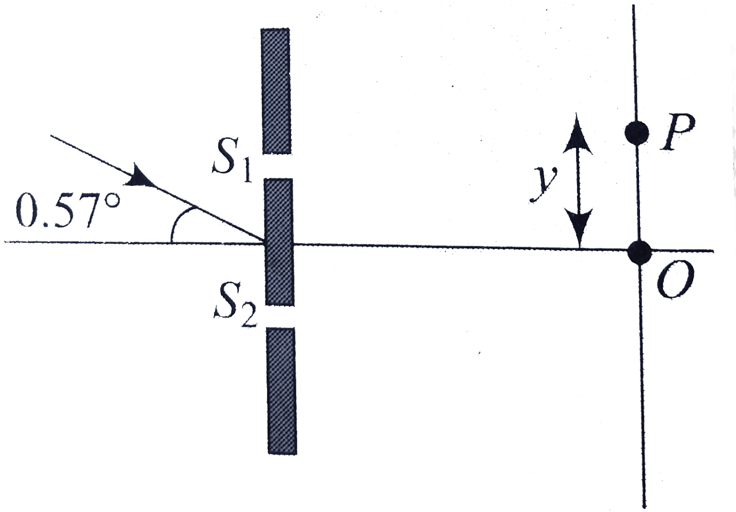
Watch Video Solution

9. In YDSE with $D = 1m, d = 1mm$, light of wavelength $500nm$ is incident at an angle of 0.57° w.r.t. the axis of symmetry of the experimental set-up. If center of symmetry of screen is O as shown figure.

a. find the position of centrla maxima,

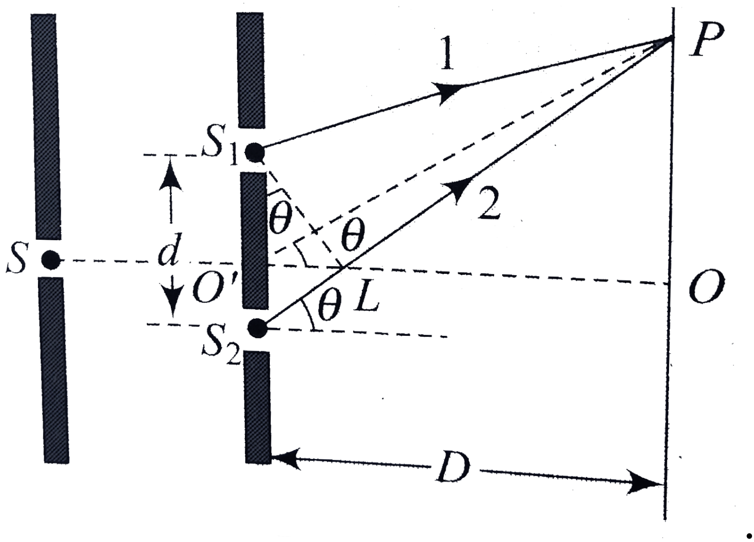
b. find intensity at point O in terms of intensity of central maxima I_0, and

c. find number of maixma lying central maxima.



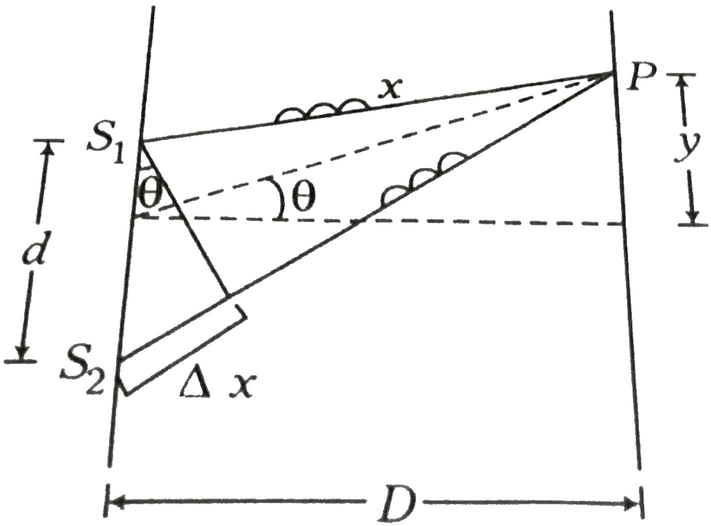
Watch Video Solution

10. In Young's experiment, find the distance between two slits that results in the third minimum for $420 nm$ violet light at an angle 30°



Watch Video Solution

11. Consider an interference arrangement similar to YDSE. Slits S_1 and S_2 are illuminated with coherent microwave sources each of frequency 2 MHz The sources are synchronized to have zero phase difference. The slits are separated by distance d= 75m. The intensity $I_{(\theta)}$ is measured as a function of θ where θ is defined as shown in figure. if I_0 is maximum intensity then calculated $I_{(\theta)}$ for $(i)\theta = 0^\circ, (ii)\theta = \pi/6$ and $(iii)\theta = \pi/2$



Watch Video Solution

12. If Young's double-slit experiment is performed under water, how would be observed interference pattern be affected ?

Watch Video Solution

13. In Young's double -slit experiment, why do we use mono chromatic light ? If while light is used, how would the pattern change ?

Watch Video Solution

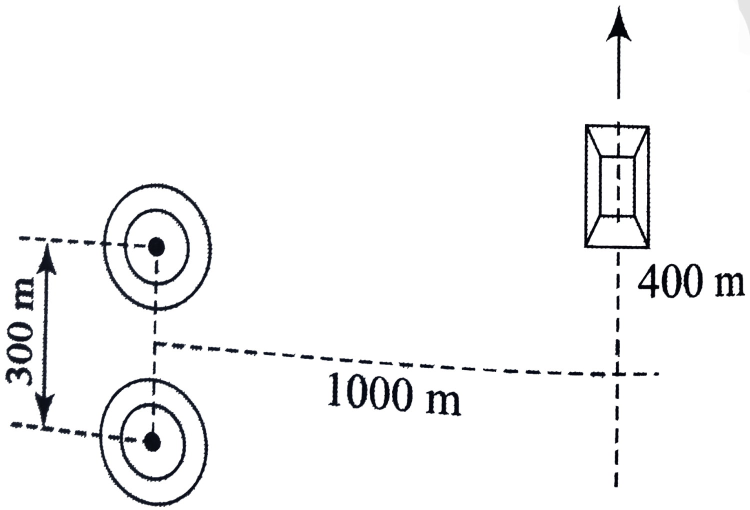
14. Young's interference experiment is performed with monochromatic light. The separation between the slits is 0.500 mm, and the interference pattern on a screen 3.30 m away shows the first side maximum 3.40 mm form the center of the pattern. What is the wavelength ?

Watch Video Solution

15. Two radio antennas separated by 300 m as shown in figure simultaneously broadcast indentical singals at the same wavelength. A radio in a car traveling due north receives the signals. (a)

If the car is at the position of the second maximum, what is the wavelength of the signals?

(b) How much farther must the car travel to encounter the next mininum in reception? (Note: Do not use the small- angle approximation in this problem.)



Watch Video Solution

16. Young's double-slit experiment is performed with a 600 nm light and a distance of 2.00 m between the slits and the screen. The tenth interference minimum is observed 7.5mm, from the central maximum . Determine the spacing of the slits.

Watch Video Solution

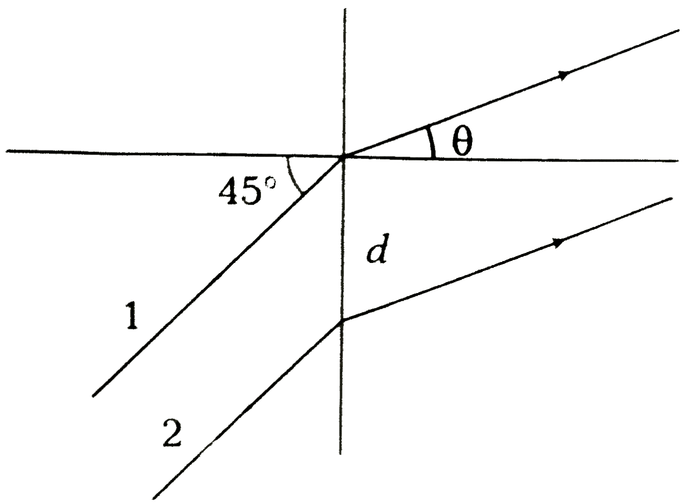
17. Two slits are separated by 0.320 mm. A beam of 500 nm light strikes the slits, producing an interference pattern. Determine the number of maxima observed in the angular range $-30.0^{\circ} < \theta < 30.0^{\circ}$.

Watch Video Solution

18. The intensity on the screen at a certain point in a double-slit interference patteren is 25.0% of the maximum value. (a) What minimum phase difference (in radians) between the sources produces this result? (b) Express this phase difference as a path difference for 486.1 nm light.

Watch Video Solution

19. Distance between the slits, in YDSE, shown in figure is $d = 20\lambda$ where λ is the wavelength of light used. Find the $\angle\theta$ where



(i) central maxima (where path difference is zero) is obtained.

(ii) third order maxima is obtained.

Watch Video Solution

20. In Young's double slit experiment, first slit has width four times the width of the second slit. The ratio of the maximum intensity to the minimum intensity in the interference fringe system is

Watch Video Solution

21. The width of one of the two slits in a Young's double slit experiment is double of the other slit. Assuming that the amplitude of the light coming from a slit is proportional to the slit width, find the ratio of the maximum to the minimum intensity in the interference pattern.

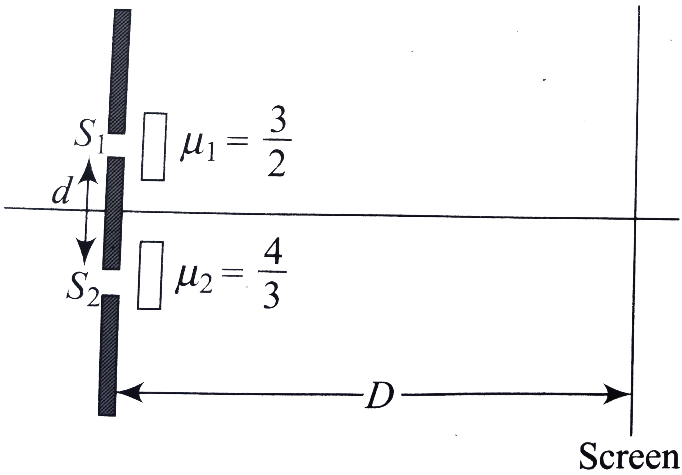
Watch Video Solution

22. In Young's double slit experiment, one of the slit is wider than other, so that the amplitude of the light from one slit is double of that from other slit. If I_m be the maximum intensity, the resultant intensity I when they interfere at phase difference ϕ is given by

Watch Video Solution

Subjective

1. A monochromatic beam of light of 6000 $\mathring{A}$ is used in YDSE set-up. The two slits are covered with two thin films of equal thickness t but of different refractive indices as shown in figure. Considering the intensity of the incident beam on the slits to be I_0, find the point on the screen at which intensity is I_0 and is just above the central maxima. (Assume that there is no change in intensity of the light after passing through the films.) Consider $t = 6\mu m, d = 1mm,$ and $D = 1m,$ where d and D have their usual meaning. Give your answer in mm.



Watch Video Solution

2. A double slit of separation 1.5 mm is illuminated by white light (between 4000 and 8000 Å). On a screen 120 cm away colored interference pattern is formed. If a pinhole is made on this screen at a distance of 3.0 mm from the central white fringe, some wavelengths will be absent in the transimitted light. Find the second longest wavelength (in Å) which will be absent in the transmitted light.

Watch Video Solution

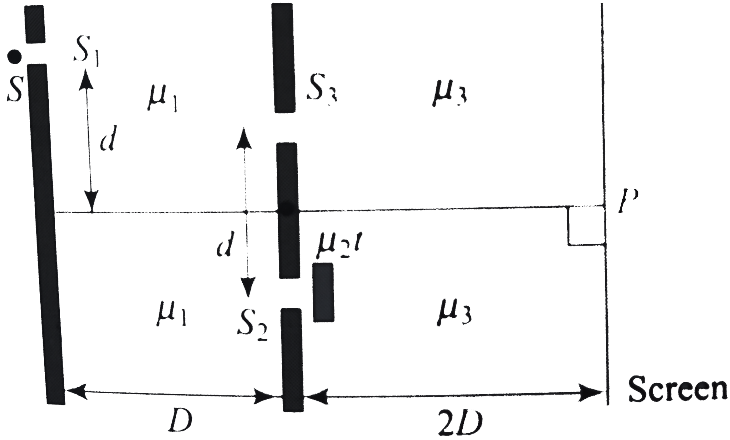
3. In figure S is a monochromatic source of light emitting light of wavelength of wavelength λ (in air). Light on slits S_1 from S and then reaches in the slit S_2 and S_3 through a medium of refractive index μ_1. Light from slit S_2 and S_3 reaches the screen through a medium of refractive index μ_3. A thin transparent film of refractive index μ_2 and thickness t is used placed in front of S_2. Point P is symmetrical w.r.t. S_2 and S_3. Using the values

$d = 1mm, D = 1m, \mu_1 = 4/3,$

$\mu_2 = 3/2, \mu_3 = 9/5,$ and $t = \frac{4}{9} \times 10^{-5} m,$

a. find distance of central maxima from P,

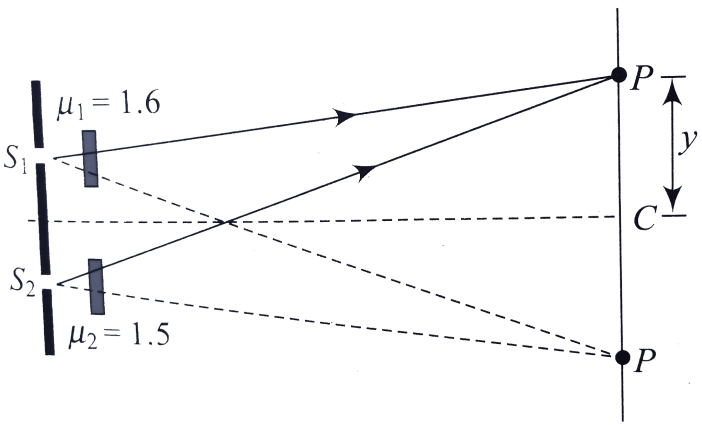
b. If the film in front of S_2 is removed, then by what distance and in which direction will be central maxima shift ?



Watch Video Solution

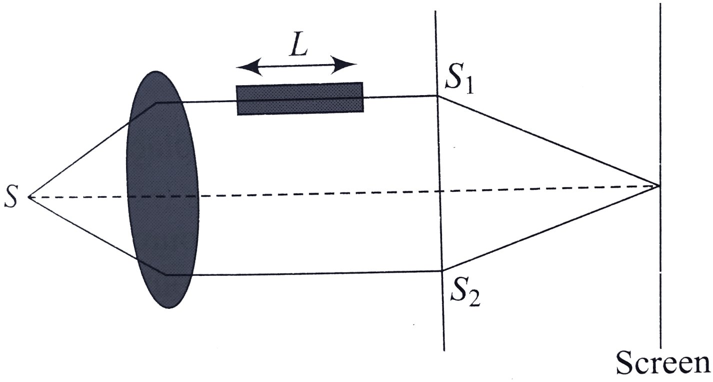
4. In the Young's double-slit experiment, the amplitude os source S_1 is three times the amplitude of the source S_2. These sources are covered by perfectly transparent thin plates of same thickness but different refractive indices 1.6

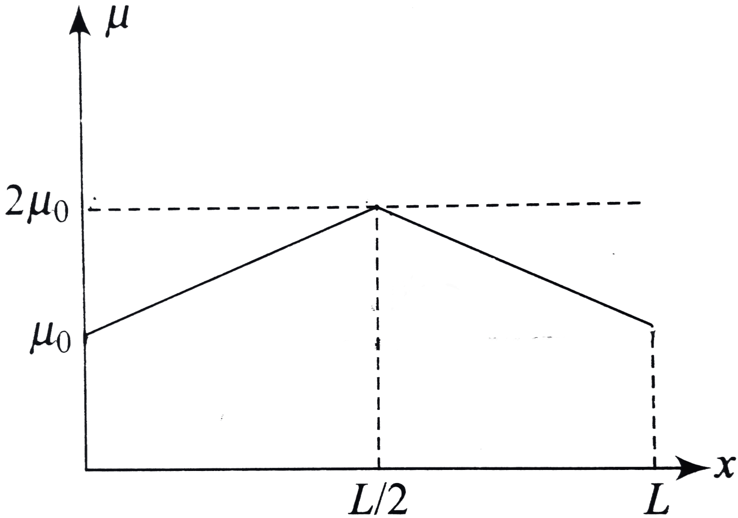
and 1.5, respectively. Now, if the plates are interchanged and the amplitude of source S_1 is made same as that of S_2, then find the amout by which the intensity is changed at a point where previous central maxima was formed. Take thickness of the plate equal to $(110/3)\lambda$, where λ is the wavelength of light used.



Watch Video Solution

5. Figure shows a narrow slit S illuminated b a monochromatic light of wavelength λ in a double-slit experiment. In the path of the rays reaching the upper slit S_1, a tube to length L is interposed in which the index of reflection of the medium varies linearly as shown in figure . The position of the central maximum in the interference pattern on the screen was displaceed by N fringes. Find the value of N in terms of μ_0, L and λ.





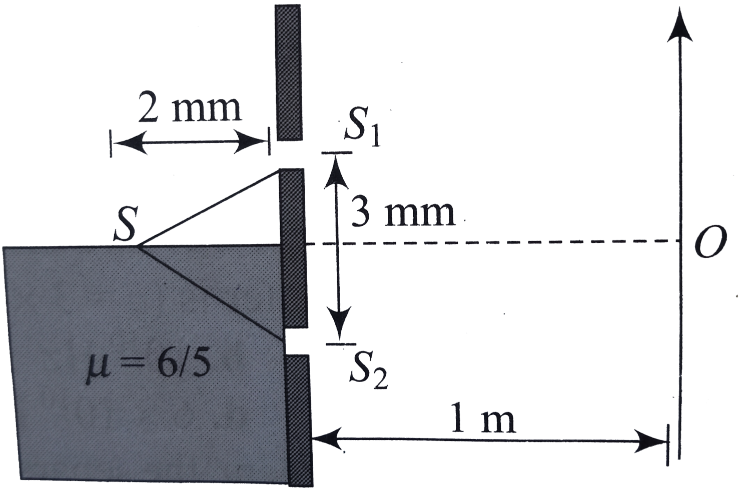
Watch Video Solution

6. In Young's double-slit experiment, a point source is placed on a solid slab of refractive index $6/5$ at a distance of 2 mm from two slits spaced 3 mm apart as shown and at equal distacne from both the slits. The screen is at a distance of 1 m from the slits. Wavelength of light used is 500 nm.

a. Find the position of the central maximum.

b. Find the order of the fringe formed at O.

c. A film of refractive index 1.8 is to be placed in front of S_1 so that central maxima is formed where 200th maxima was formed. Find the thickness of film.



Watch Video Solution

7. In YDSE, the sources is red ligth of wavelength $7 \times 10^{-7} m$. When a thin glass plate of refractive index 1.5 is put in the path of one of the interfering beams, the central bright fringe shifts by 10^{-3} m to the position previously occupied by the 5th bright fringe.

If the source is now changed to green light of wavelength $10^{-7}m$, the central fringe shifts to a position initially occupied by the sixth bright fringe due to red ligth. What will be refractive index of glass plate for the second ligth for changed source of ligth?

Watch Video Solution

8. Figure shows a modified Fresnel biprism experiment with monochromatic source of wavelength 500 nm. The refracting angle of glass prism is 2°. Find the fringe width.

Watch Video Solution

9. Interference fringes are produced by a double slit arrangement

and a piece of plane parallel glass of refractive index 1.5 is interposed in one of

the interfering beam. If the fringes are displaced through 30 fringe widths for light of wavelength $6 \times 10^{-5} cm$, find the thickness of the plate.

Watch Video Solution

10. In YDSE, find the thickness of a glass slab $(\mu = 1.5)$ which should be placed in front of the upper slit S_1 so that the central maximum now lies at a point where 5th bright fringe was lying earlier (before inserting the slab). Wavelength of light used is 5000Å.

Watch Video Solution

11. Bichromatic light is used in YDSE having wavelengths

$\lambda_1 = 400 nm$ and $\lambda_2 = 700 nm$. Find minimum order of bright fringe of λ_1 which overlaps with bright fringe of λ_2 .

Watch Video Solution

Single Correct

1. Microwaves from a transmitter are directed toward a plane reflector. A detector moves along the normal to the reflector. Between positions of 14 successive maxima, the detector travels distancee of 0.14 m . What is the frequency of transimitter?

A. $1.5 \times 10^{10} Hz$

B. $10^{10} Hz$

C. $3 \times 10^{10} Hz$

D. $6 \times 10^{10} Hz$

Answer: a

Watch Video Solution

2. In Young's double-slit experiment, the separation between the slits is d, distance between the slit and screen is $D(D > > d)$, In the interference pattern, there is a maxima exactly in front of each slit. Then the possilbe wavelength(s) used in the experiment are

A. $d^2 / D, d^2 / 2D, d^2 / 3D$

B. $d^2 / D, d^2 / 3d, d^2 / 5D$

C. $d^2 / 2D, d^2 / 4D, d^2 / 6D$

D. none of these

Answer: b

Watch Video Solution

3. In a double-slit experiment, two parallel slits are illuminated first bylight of wavelength 400 nm and then by light of unknown wavelength. The fourth-order dark fringe resulting from the known wavelength of light falls in the same place on the screen as the second-order bright fringe from the unknown wavelength. The value of unknown wavelength of light is

A. 900 nm

B. 700 nm

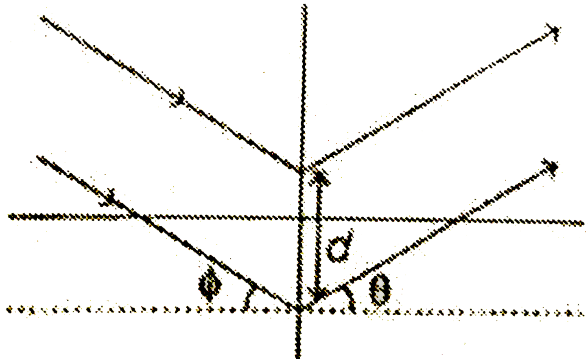
C. 300 nm

D. none of these

Answer: b

Watch Video Solution

4. Light is incident at an angle ϕ with the normal to a plane containing two slits of seperation d. Select the expression that correctly describe the positions of the interference maxima in terms of the incoming angle ϕ and outgoing angle θ.



A. $\sin\phi = \sin\theta = \left(m + \frac{1}{2}\right)\frac{\lambda}{d}$

B. $d\sin\theta = m\lambda$

C. $\sin\phi - \sin\theta = (m+1)\frac{\lambda}{d}$

D. $\sin\phi + \sin\theta = m\frac{\lambda}{d}$

Answer: d

Watch Video Solution

5. In Young's double-slit experiment, the slit are illuminated by monochromatic light. The entire set-up is immersed in pur water. Which of the following act cannot restore the oringinal fringe width?

A. Bringing the slit close together.

B. Moving the screen away from the slit plane.

C. Replacing the incident light by that of longer wavelength.

D. Introducing a thin transparent slab in front of one of the slits.

Answer: d

Watch Video Solution

6. Blue light of wavelength 480 nm is most strongly reflected off a thin film of oil on a glass slab when viewed near normal incidence. Assuming that the index of refraction of the oil is 1.2 and that of the glass is 1.6, what is the minimum thickness of the oil film (other then zero)?

A. 100 nm

B. 200 nm

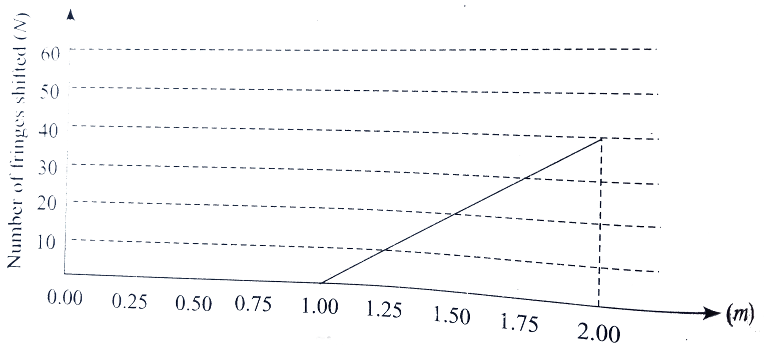
C. 300 nm

D. none

Answer: b

Watch Video Solution

7. The slits in a double-slit interference experiment are illuminated by orange light $(\lambda = 60nm)$. A thin transparent plastic of thickness t is placed in front of one of the slits. The nunber of fringes shifting on screen is plotted versus the refractive index μ of the plastic in graph shown in figure. The value of t is



A. 4.8 mm

B. $640\mu m$

C. $24\mu m$

D. none of these

Answer: c

Watch Video Solution

8. In a YDSE with identical slits, the intensity of the central bright fringe is I_0. If one of the slits is covered, the intensity at the same point is

A. $2I_0$

B. I_0

C. $I_0/2$

D. $I_0/4$

Answer: d

Watch Video Solution

9. The intensity at the maximum in a Young's double slit experiement is I_0 Distance between teo slits is $d = 5\lambda$ where λ is the wavelength of light used in the experiment What will be the intensity in front of the one of the slits on the screen planed at a distance, D=10 d?

A. $\frac{I_0}{2}$

B. $\frac{3}{4}I_0$

C. I_0

D. $\frac{I_0}{4}$

Answer: a

Watch Video Solution

Watch Video Solution

10. Two identical coherent sources are placed on a diameter of a circle of radius R at separation x $(< < R)$ symmetrical about the center of the circle. The sources emit identical wavelength λ each. The number of points on the circle of maximum intensity is $(x = 5\lambda)$

A. 20

B. 22

C. 24

D. 26

Answer: a

Watch Video Solution

11. In Young's double slit experiment $\frac{d}{D} = 10^{-4}$ (d=distance between slit , D=distance of screen from the slits). At a point P on the screen resulting intesity is equal to the intensity due to individual slit I_0. The the distance of point P from the central maximum is $(\lambda = 6000\text{Å})$

A. 2 mm

B. 1 mm

C. 0.5 mm

D. 4 mm

Answer: a

Watch Video Solution

12. To produce a minimum reflection of wavelength near the middle of visible spectrum (550 nm), how thick should a coating of $MgF_2(\mu = 1.38)$ be vaccum-coated on a glass surface?

A. 10^{-7} m

B. 10^{-10} m

C. 10^{-9} m

D. 10^{-8} m

Answer: a

Watch Video Solution

13. A thin film of refractive index 1.5 and thickness 4×10^{-5} cm is illuminated by light normal to the surface. What wavelength within the visible spectrum will be intensified in the reflected beam?

A. 4800Å

B. 5800Å

C. 6000Å

D. 6800Å

Answer: a

Watch Video Solution

14. A plane wave of monochromatic light falls normally on a uniform thin or oil which covers a glass plate. The wavelength of source can be varied continuously. Complete destructive is observed for

$\lambda = 5000 \text{Å}$ and $\lambda = 1000 \text{Å}$ and for no other wavelength in between. If μ of oil is 1.3 and that of glass is 1.5, the thickness of the film will be

A. $6.738 \times 10(-5)cm$

B. $5.7 \times 10^{-5} cm$

C. $4 \times 10^{-5} cm$

D. $2.8 \times 10^{-5} cm$

Answer: a

Watch Video Solution

15. A light ray of frequency v and wavelength λ enters a liquid of refractive index $3/2$. The ray travels in the liquid with

A. frequency v and wavelength $\left(\frac{2}{3}\right)\lambda$

B. frequency v and wavelength $\left(\frac{3}{2}\right)\lambda$

C. frequency v and wavelength λ

D. frequency $\left(\frac{3}{2}\right)$ v and wavelength λ

Answer: a

Watch Video Solution

16. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other Then in the interference pattern

A. the intensities of both the maxima and the minima increase

B. the intensity of the maxima increases and the minima has zero intensity

C. the intensity of the maxima decreases and that of the minima increases

D. the intensity of the maxima decreases and the minima has zero intensity

Answer: a

Watch Video Solution

17. Two light waves having the same wavelengths λ in vacuum are in phase initially . Then the first wave travels a path L_1 through a medium of refractive index n_1 while the second wave travels a path of length L_2 through a medium of refractive index n_2 . After this the phase difference between the two waves is :

A. $\frac{2\pi}{\lambda}(L_1 - L_2)$

B. $\frac{2\pi}{\lambda}(\mu_1 L_1 - \mu_2 L_2)$

C. $\frac{2\pi}{\lambda}(\mu_2 L_1 - \mu_1 L_2)$

D. $\frac{2\pi}{\lambda}\left[\frac{L_1}{\mu_1} - \frac{l_2}{\mu_2}\right]$

Answer: b

Watch Video Solution

18. Light of wavelength $\lambda = 5890\text{Å}$ fall on a double-slit arrangement having separation $d = 0.2mm$. A thin lens of focal length $f = 1m$ is placed near the slits. The linear separation of fringes on a screen placed in the focal plane of the lens is

A. 3 mm

B. 4 mm

C. 2 mm

D. 1 mm

Answer: a.

Watch Video Solution

19. In Young's double slit experiment, the two slits acts as coherent sources of equal amplitude A and wavelength λ. In another experiment with the same set up the two slits are sources of equal amplitude A and wavelength λ but are indoherent. The ratio of the intensity of light at the mid point of the screen in the first case to that in the second case is

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: c

Watch Video Solution

20. In Young'double-slit interference experiment, if the slit separation is made threefold, the fringe width becomes

A. sixfold

B. threefold

C. $3/6$ - fold

D. $1/3$ - fold

Answer: d

Watch Video Solution

21. Sources 1 and 2 emit lights of different wavelengths whereas sources 3 and 4 emit light of different intensities.

The coherence

A. can be obtained by using sources 1 and 2

B. can be obtained by any of these sources

C. cannot be obtained by any of these sources

D. since contrast suffers when sources 3 and 4 are used so coherence cannot be obtained by using sources 3 and 4

Answer: b

Watch Video Solution

22. One of the two slits in YDSE is painted over, so that it transmits only light waves having intensity half of the intensity of the light waves through the order slit . As a result of this

A. the fringe system will altogether disappear

B. the bright fringes will become brighter and the dark fringes will become darker

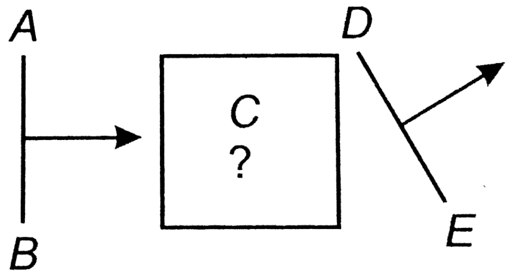
C. both dark and bright fringe will become darker

D. dark fringe will become brighter and bright fringe darker

Answer: d

Watch Video Solution

23. A wave front AB passing through a system C emerges as DE. The system C could be



A. a slit

B. a biprism

C. a prism

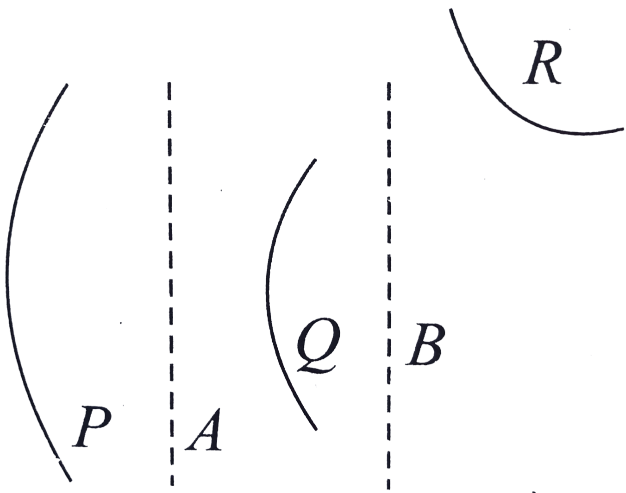
D. a glass slab

Answer: c

Watch Video Solution

Watch Video Solution

24. Figure shows wavefront P Passing through two systems A and B, and emerging as Q and then as R. Then systems A and B could, respectively, be



A. a prism and a convergent lens

B. a convergent lens and a prism

C. a divergent lens and a prism

D. a convergent lens and a divergent lens

Answer: b

Watch Video Solution

25. Light waves travel in vacuum along the y-axis. Which of the following may represent the wave front?

A. x = constant

B. y = constant

C. z = constant

D. $x + y + z$ = constant

Answer: b

Watch Video Solution

26. In Young's double-slit experiment, the y-coordinate of central maxima and 10th maxima are 2 cm and 5 cm, respectively, When the YDSE apparatus is immersed in a liquid of refractive index 1.5, the corresponding y-coordinates will be

A. 2 cm, 7.5 cm

B. 3 cm, 6 cm

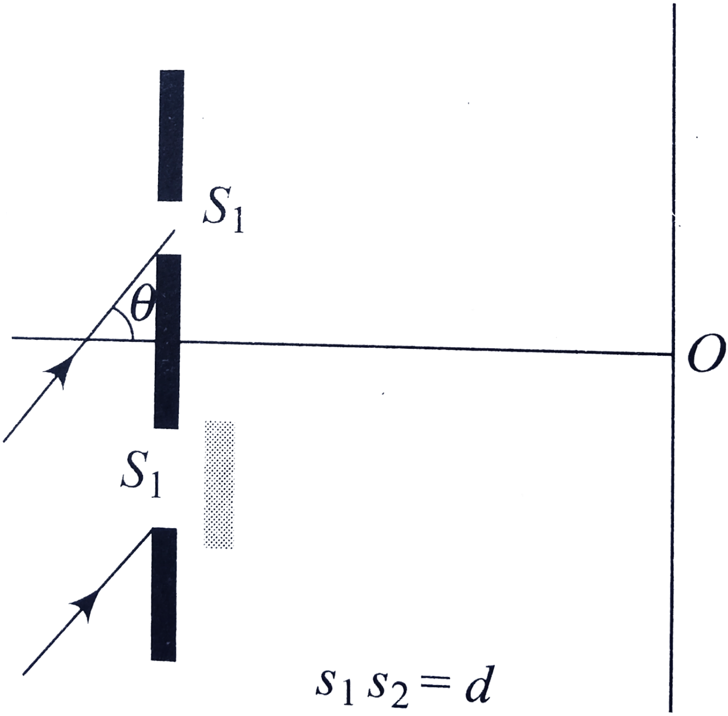
C. 2 cm, 4 cm

D. $4/3cm$, 103 cm

Answer: c

Watch Video Solution

27. A monochromatic beam of light fall on YDSE apparatus at some angle (say θ) as shown in figure. A thin sheet of glass is inserted in front of the lower slit s_2. The central bright fringe (path difference $= 0$) will be obtained



A. at O

B. above O

C. below O

D. anywhere depending on angle θ, thickenss of plate t, and refractive index of glass μ

Answer: d

Watch Video Solution

28. A plate of thickness t made of a material of refractive index μ is placed in front of one of the slits in a double slit experiment. (a) Find the changes in the optical path due to introduction of the plate. (b) What should be the minimum thickness t which will make the intensity at the center of the fringe pattern zero ? Wavelength of the light used is λ. Neglect any absorption of light in the plate.

A. $(\mu - 1)\frac{\lambda}{2}$

B. $(\mu - 1)\lambda$

C. $\frac{\lambda}{2(\mu - 1)}$

D. $\frac{\lambda}{(\mu - 1)}$

Answer: c

Watch Video Solution

29. In Young's double slit experiment how many maxima can be obtained on a screen (including the central maximum) on both sides of the central fringe if $\lambda = 2000 \text{Å}$ and $d = 7000 \text{Å}$

A. 12

B. 7

C. 18

D. 4

Answer: b

Watch Video Solution

30. Young's double slit experiment is made in a liquid. The tenth bright fringe in liquid lies in screen where 6th dark fringe lies in vacuum. The refractive index of the liquid is approximately

A. 1.8

B. 1.54

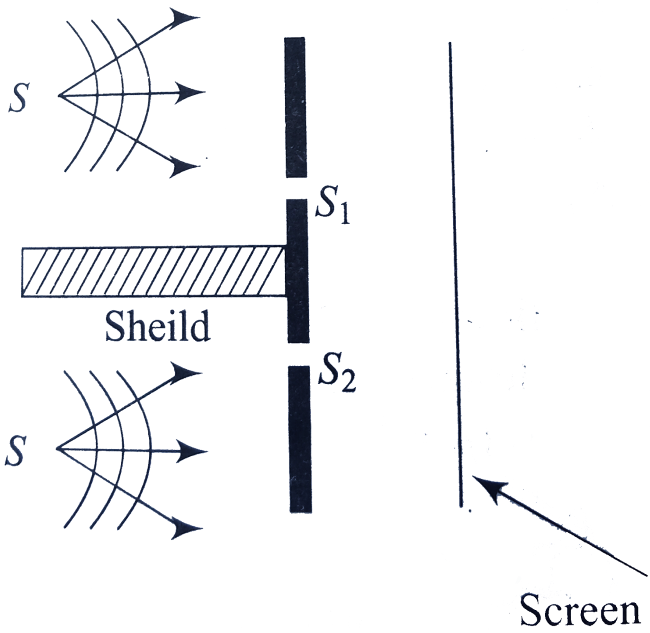
C. 1.67

D. 1.2

Answer: a

Watch Video Solution

31. What happens to the interference pattern if the two slits in Young's experiment are illuminated by two independent sources such as two sodium lamps S and S' as shown in figure



A. Two sets of inteference fringes overlaps.

B. No fringes are observed.

C. The intensity of the bright fringes is doubled.

D. The intensity of the bright fringe become four times.

Answer: b

Watch Video Solution

32. In Young's double-slit experiment, 30 fringes are obtained in the field of view of the observing telescope, when the wavelength of light used is 4000Å. If we use monochromatic light of wavelength $6000 \mathring{A}$, the number of fringes obtained in the same field of view is

A. 30

B. 45

C. 20

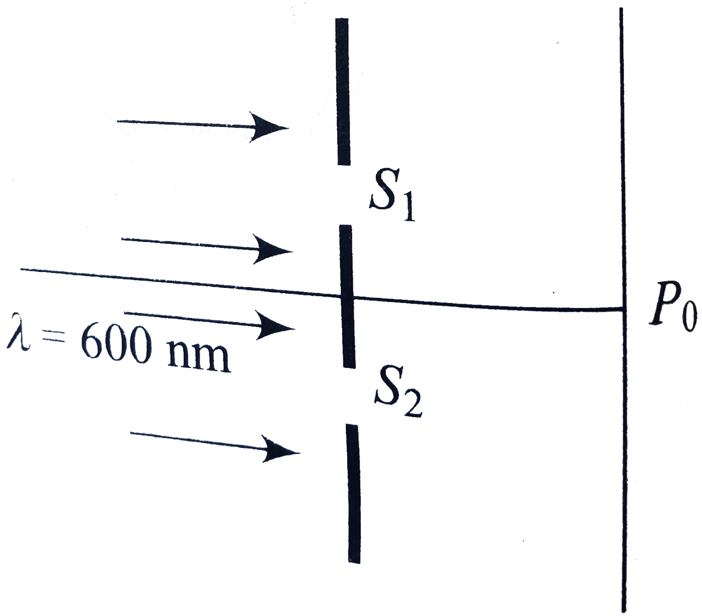
D. none of these

Answer: c

Watch Video Solution

33. In a standard Young's double-slit experiment with coherent light of wavelength 600 nm, the fringe width of the fringes in the central region (near the central fringe, P_0) is observed it to be 3 mm. An extremely thin glass plate is introduced to be displaced by 11 mm. Another thin plate is placed before the second slit and it is observed that the fringe are now displaced by an additional 12 mm. If the additional optical path lengths introduced are

Δ_1 and Δ_2 then



A. $11\Delta_1 = 12\Delta_2$

B. $12\Delta_1 = 11\Delta_2$

C. $11\Delta_1 > 12\Delta_2$

D. none of these

Answer: b

Watch Video Solution

34. In Young's doulbe-slit experiment the separation between two coherent sources S_1 and S_2 is d and the distance between the source and screen is D. In the interference pattern, it is found that exactly in front of one slit, there occurs a minimum. Then the possible wavelengths used in the experiment are

A. $\lambda = \frac{d^2}{D}, \frac{d^2}{3D}, \frac{d^2}{5D}$

B. $\lambda = \frac{d^2}{D}, \frac{d^2}{5D}, \frac{d^2}{9D}$

C. $\lambda = \frac{d^2}{D}, \frac{d^2}{2D}, \frac{d^2}{3D}$

D. $\lambda = \frac{d^2}{3D}, \frac{d^2}{7D}, \frac{d^2}{11D}$

Answer: a

Watch Video Solution

35. Let S_1 and S_2 be the two slits in Young's double-slit experiment. If central maxima is observed at P and angle $\angle S_1PS_2 = \theta$, then fringe width for the light of wavelength λ will be

A. λ/θ

B. $\lambda\theta$

C. $2\lambda/\theta$

D. $\lambda/2\theta$

Answer: a

Watch Video Solution

36. In a two slit experiment with white light, a white fringe is observed o a screen kept behind the slits When the screen in moved away by 0.05 m, this white fringe

A. does not move at all

B. gets displaced from its earlier position

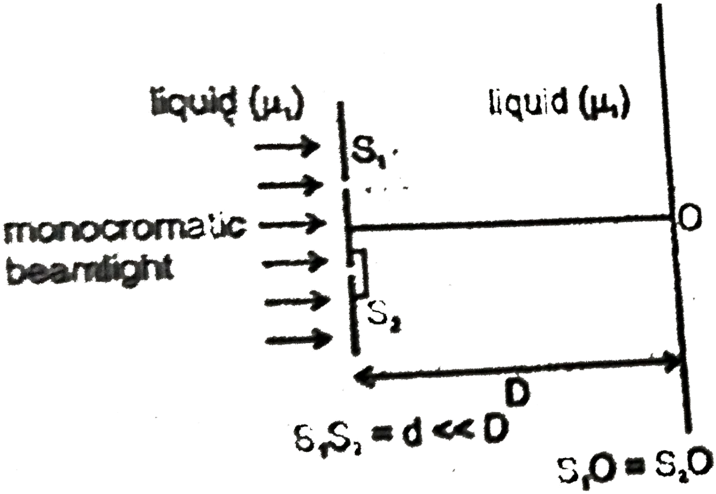
C. become colored

D. disappears

Answer: a

Watch Video Solution

37. Young's double slit experiment is conducted in a liquid of refractive index μ_1 as shown in figure. A thin transparent slab of refractive index μ_2 is placed in front of the slit s_2. The magnitude of optical path difference at 'O' is



A. $\left|\left(\frac{\mu_2}{\mu_1}-1\right)t\right|$

B. $\left|\left(\frac{\mu_1}{\mu_2}-1\right)t\right|$

C. $|(\mu_2-\mu_1)t|$

D. $|(\mu_2-1)t|$

Answer: a

Watch Video Solution

38. In Young's double-slit experment, the frist maxima is observed at a fixed point P on the screen. Now, the screen is continously moved away from the plane of slits. The ratio of intensity at point P to the intensity at point O (center of the screen)

A. remains cosntant

B. keeps on decreasing

C. first decreases and then increases

D. first decreases and then becomes constant

Answer: c

Watch Video Solution

39. Microwaves from a transmitter are directed normally toward a plane reflector. A detector moves along the normal to the reflector. Between positions of 14 successive maxima the detector travels a distance 0.14 m. The frequency of the transmitter is $(c = 3 \times 10^8 ms^{-1})$.

A. $1.5 \times 10^{10} Hz$

B. $3.0 \times 10^{10} Hz$

C. $1.5 \times 10^{9} Hz$

D. $3.0 \times 10^{9} Hz$

Answer: a

Watch Video Solution

40. In a double-slit experiment, the slits are separated by a distance d and the screen is at a distance D from the slits. If a maximum is formed just opposite to each slit, then what is the order or the fringe so formed?

A. $\frac{d^2}{2\lambda D}$

B. $\frac{2d^2}{\lambda D}$

C. $\frac{d^2}{\lambda D}$

D. $\frac{d^2}{4\lambda D}$

Answer: a

Watch Video Solution

41. A parallel beam of white light is incident on a thin film of air of uniform thickness. Wavlength 7200Å and 5400Å are observed to be missing from the spectrum of reflected light viewed normally. The other wavelength in the visible region missing in the reflected spectrum is

A. 6000Å

B. 4320Å

C. 5500Å

D. 6500Å

Answer: b

Watch Video Solution

42. Two beams of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. Then the difference between the resultant intensities at A and B is

A. $2I$

B. $4I$

C. $5I$

D. $7I$

Answer: b

Watch Video Solution

43. In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

A. 12

B. 18

C. 24

D. 30

Answer: b

Watch Video Solution

44. In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

A. 2λ

B. $2\lambda/3$

C. $\lambda/3$

D. λ

Answer: a

Watch Video Solution

45. A double-slit experiment, arrangement produces interference fringes for sodium light $(\lambda = 589nm)$ that have an angular separation of 3.50×0^{-3} rad . For what wavelength would the angular separation to 10% greater?

A. 527 nm

B. 648 nm

C. 722 nm

D. 449 nm

Answer: b

Watch Video Solution

46. In Young's double-slit experimetn, the intensity of light at a point on the screen, where the path difference is λ,is I . The intensity of light at a point where the path difference becomes $\lambda/3$ is

A. $\frac{I}{4}$

B. $\frac{I}{3}$

C. $\frac{I}{2}$

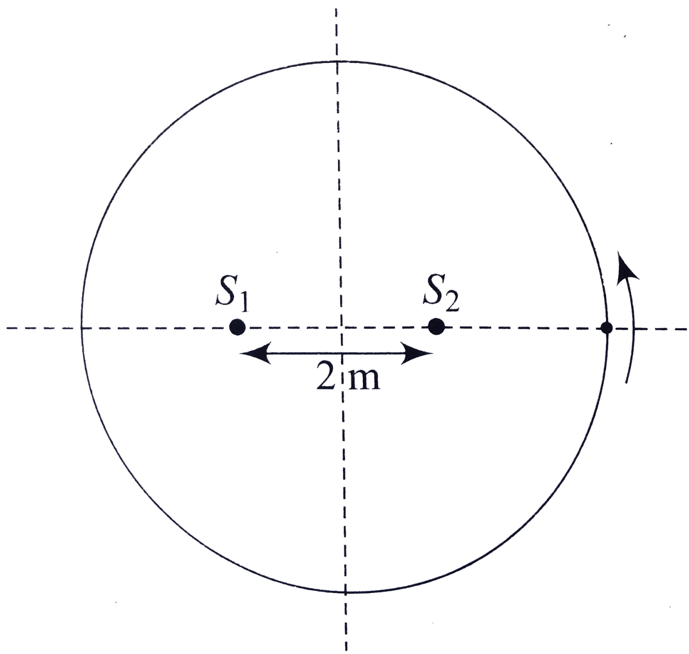
D. I

Answer: a

Watch Video Solution

Watch Video Solution

47. Two point sources separated by 2.0 m are radiating in phase with $\lambda = 0.50m$. A detector moves in a circular path around the two sources in a plane containing them. How many maxima are detected?



A. 16

B. 20

C. 24

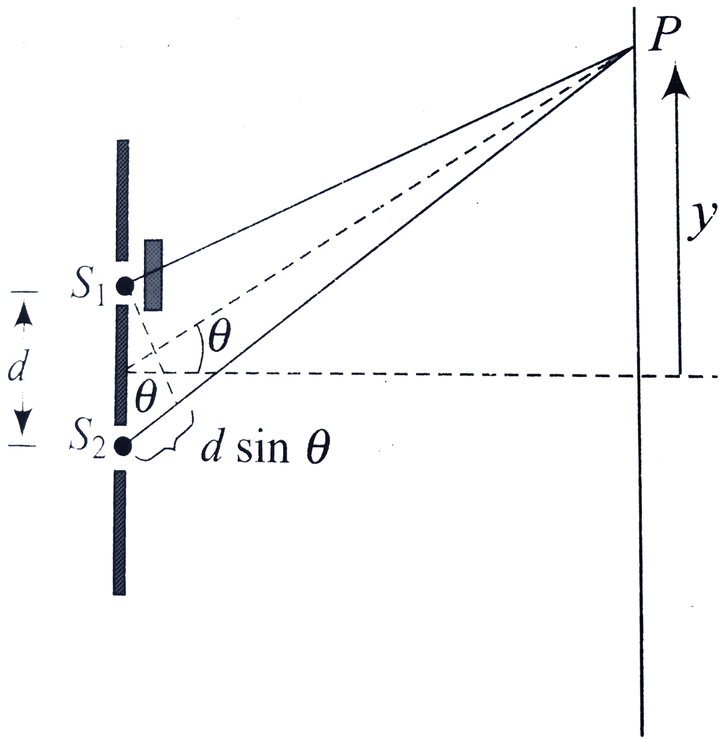
D. 32

Answer: a

Watch Video Solution

48. In YDSE, light of wavelength $\lambda = 5000 \mathring{A}$ is used, which emerges in phase from two a slits distance $d = 3 \times 10^{-7} m$ apart. A transparent sheet of thickness $t = 1.5 \times 10(-7)m$, refractive indes

$n = 1.17$, is placed over one of the slits. Where does the central maxima of the interference now appear from the center of the screen? (Find the value of y?)



A. $\frac{D(\mu - 1)t}{2d}$

B. $\frac{2D(\mu - 1)t}{d}$

C. $\frac{D(\mu + 1)t}{d}$

D. $\frac{D(\mu - 1)t}{d}$

Answer: d

Watch Video Solution

49. A young's double slit apparatus is immersed in a liquid of refractive index 1.33.It has slit separation of 1 mm and interference pattern is observed on the screen at a distance 1.33 m from plane of slits.The wavelength in air is 6300Å

Calculate the fringe width.

A. $6.3 \times 10^{-4} m$

B. $8.3 \times 10^{-4} m$

C. $6.3 \times 10^{-2} m$

D. $6.3 \times 10^{-5} m$

Answer: a

Watch Video Solution

50. In Young's double-slit experiment, the slit separation is 0.5 mm and the screen is 0.5 m away from the slit. For a monochromatic light of wavelength 500 nm, the distance of 3rd maxima from the 2nd minima on the other side of central maxima is

A. 2.75 mm

B. 2.5 mm

C. 22.5 mm

D. 2.25 mm

Answer: d

Watch Video Solution

51. A light of wavelength 6000Å shines on two narrow slits separeted by a distance 1.0 mm and illuminates a screen at a distance 1.5 m away. When one slit is covered by a thin glass plate of refractive index 1.8 and other slit by a thin glass plate of refractive index μ, the central maxima shifts by 0.1 rad. Both plates have the same thickness of 0.5 mm. The value of refractive index μ of the glass is

A. 1.4

B. 1.5

C. 1.6

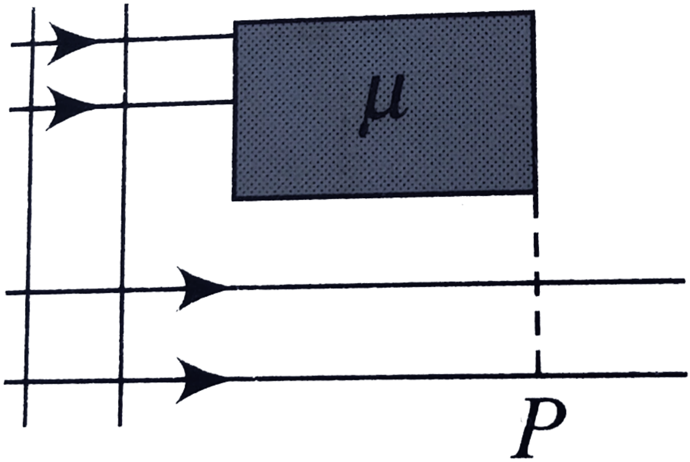
D. none of these

Answer: c

Watch Video Solution

52. A plane wavefront travelling in a straight line in vacuum encounters a medium ofrefractive index m.

At P, the shape of the wavefront is



a.

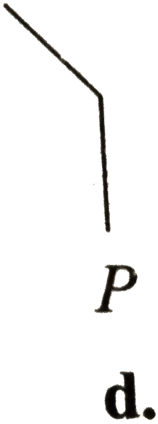
A.

b.

B.

c.

C.



D.

Answer: b

Watch Video Solution

53. In Young's double-slit experiment, the wavelength of light was changed from 7000Å to 3500 Å`. While doubling the separation between the slits, which of the following is not true for this experiment?

A. The width of fringe changes.

B. The color of bright fringes change.

C. The separation between seccessive bright fringes changes.

D. The separation between successive bright fringes unchanged.

Answer: d

Watch Video Solution

54. Calculate the wavelength of light used in an interference experiment from the following data: Fringe width = 0.03 cm. Distance between slits and eyepiece through which the interference pattern is observed is 1 m. Distance between the images of the virtural when a convex lens of focal length 16 cm is used at a distance of 80 cm from the eyepiece is 0.8 cm.

A. 6000Å

B. 0.00006Å

C. 6000 cm

D. 0.00006 m

Answer: a

Watch Video Solution

55. In Young's double-slit experiment the angular width of a fringe formed on a distant screen is 1°. The wavelength of light used is 6000Å. What is the spacing between the slits?

A. 344 mm

B. 0.1344mm

C. 0.0344 mm

D. 0.034 mm

Answer: c

Watch Video Solution

56. In a double-slit experiment, the slits are separated by a distance d and the screen is at a distance D from the slits. If a maximum is formed just opposite to each slit, then what is the order or the fringe so formed?

A. $\frac{d^2}{2\lambda D}$

B. $\frac{d}{2\lambda D}$

C. $\frac{d^2}{4\lambda D}$

D. 0

Answer: a

Watch Video Solution

57. In a Young's double slit experiment using monochromatic light, the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the slits and screen is doubled. It is found that the distance between successive maxima now is the same as observed fringe shift upon the introduced of the mica sheet . Calculate the wavelength of the monochromatic light used in the experiment .

A. $(1/2)t(\mu - 1)$

B. $t(\mu - 1)$

C. μt

D. $3\mu t$

Answer: a

Watch Video Solution

58. In YDSE, find the thickness of a glass slab $(\mu = 1.5)$ which should be placed in front of the upper slit S_1 so that the central maximum now lies at a point where 5th bright fringe was lying earlier (before inserting the slab). Wavelength of light used is 5000Å.

A. $5 \times 10^{-6} m$

B. $3 \times 10^{-6} m$

C. $10 \times 10^{-6} m$

D. $5 \times 10^{-5} m$

Answer: a

Watch Video Solution

59. In Young's double-slit experiment, the slit are 0.5 mm apart and the interference is observed on a screen at a distance of 100 cm from the slits, It is found that the ninth bright fringe is at a distance of 7.5 mm from the second dark fringe from the center of the fringe pattern. The wavelength of the light used in nm is

A. 5000Å

B. $\frac{5000}{7}\text{Å}$

C. 2500Å

D. $\frac{2500}{7}\text{Å}$

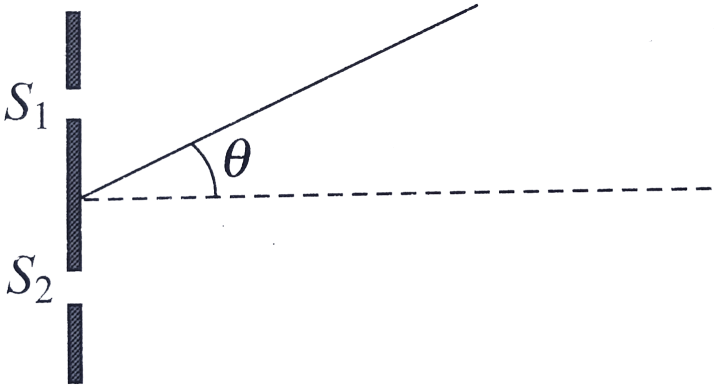
Answer: a

Watch Video Solution

60. Figure shows two coherent sources S_1 and S_2 emitting wavelength λ. The separation $S_1S_2 = 1.5\lambda$ and S_1 is ahead in phase by $\pi/2$ relative to S_2 Then the maxima occur in direction θ given by $\sin^{-1}$ of

(i) 0 (ii) $1/2$ (iii) $-1/6$ (iv) $-5/6$

Correct option are



A. (ii), (iii), and (iv)

B. (i), (ii), and (iii)

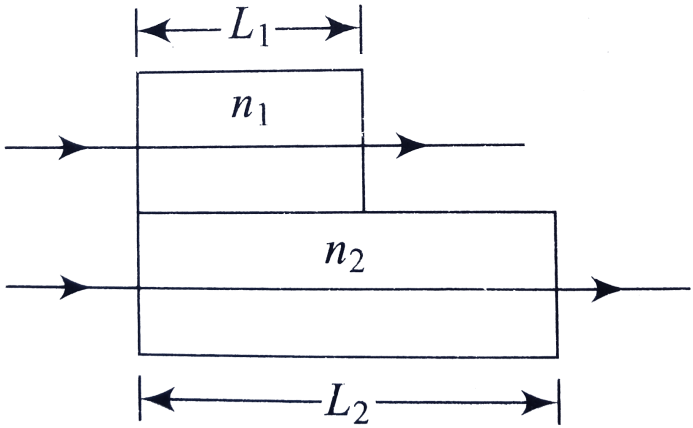
C. (i), (iii), and (iv)

D. All the above

Answer: a

Watch Video Solution

61. Two waves of light in air have the same wavelength and are intially in phase. They then travel through plastic layers with thickness of $L_1 = 3.5mm$ and $L_2 = 5.0mm$ and indices of refraction $n_1 = 1.7$ and $n_2 = 1.25$ as shown in figure. The rays later arrive at a common point. The longest wavelength of light for which constructive interference occurs at the point is



A. $0.8mm$

B. $1.2mm$

C. $1.7mm$

D. $2.9mm$

Answer: b

Watch Video Solution

62. Light from a sources emitting two wavelengths λ_1 and λ_2 is allowed to fall on Young's double-slit apparatus after filtering one of the wavelengths. The position of interference maxima is noted. When the filter is removed both the wavelengths are incident and it is found that maximum intensity is produced where the fourth maxima occured previously. If the other wavelength if filtered, at the same location the third maxima is found. What is the raito of wavelength?

A. $\frac{2}{3}$

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

C. $\frac{3}{4}$

D. $\frac{4}{3}$

Answer: c

Watch Video Solution

63. The wavefront of a light beam is given by the equation $x + 2y + 3x = c$ (where c is arbitrary constant), then the angle made by the direction of light with the y-axis is

A. $\cos^{1}.\ \frac{1}{\sqrt{14}}$

B. $\sin^{1}.\ \frac{2}{\sqrt{14}}$

C. $\cos^{1}.\ \frac{2}{\sqrt{14}}$

D. $\sin^{1}.\ \frac{3}{\sqrt{14}}$

Answer: c

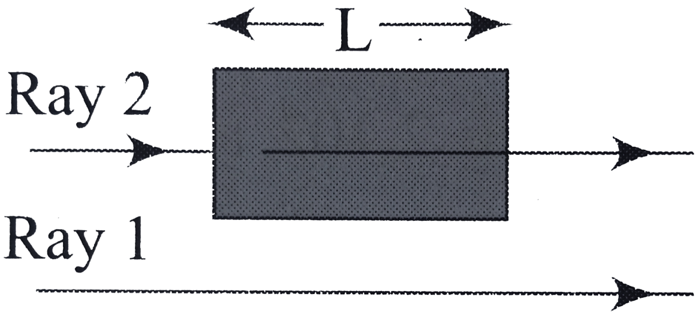
Watch Video Solution

64. As shown in figure waves with identical wavelengths and amplitudes and which are intially in phase travel through difference media. Ray 1 travels through air and Ray 2 through a transparent medium for equal length L, in four different situations. Rays reach a common point on the screen. The number of wavelengths in length L is N_2 for Ray 2 and N_1 for Ray 1. In the following table, values of N_1 and N_2 are given for all four situations. The order or the situations according to the intensity of the light at the common point in descending order is Situations

1 2 3 4

N_1 2.75 1.80 3.00 3.25

N_2 2.75 2.80 3.25 4.00



A. $I_3 = I_4 > I_2 > I_1$

B. $I_1 > I_3 = \ > I_4 > I_2$

C. $I_1 > I_2 > I_3 > I_4$

D. $I_2 > I_3 = I_4 > I_1$

Answer: d

Watch Video Solution

65. If the distance between the first maxima and fifth minima of a double-slit pattern is 7 mm and the slits are separated by 0.15 mm with the screen 50 cm from the slits, then wavelength of the light used is

A. 600 nm

B. 525 nm

C. 467 nm

D. 420 nm

Answer: a

Watch Video Solution

66. In YDSE, $D = 1m$, $d = 1mm$, and $\lambda = 5000nm$. The distance of the 100th maxima from the central maxima is

A. $\frac{1}{2}m$

B. $\frac{\sqrt{3}}{2}$ m

C. $\frac{1}{\sqrt{3}}$ m

D. does not exist

Answer: c

Watch Video Solution

67. Let S_1 and S_2 be the two slits in Young's double-slit experiment. If central maxima is observed at P and angle $\angle S_1PS_2 = \theta$, then fringe width for the light of wavelength λ will be

A. λ / θ

B. $\lambda\theta$

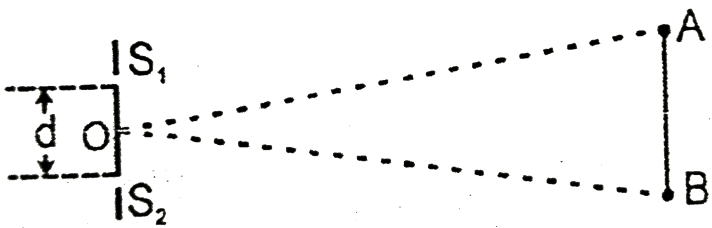
C. $2\lambda / \theta$

D. $\lambda / 2\theta$

Answer: a

Watch Video Solution

68. Figure shows two coherent sources $S_1 - S_2$ vibrating in same phase. AB is an irregular wire lying at a far distance from the sources S_1 and S_2. Let $\frac{\lambda}{d} = 10^{-3} m, \angle BOA = 0.12^{\circ}$. How many bright spots will be seen on the wire, including points A and B



A. 2

B. 3

C. 4

D. more than 4

Answer: b

Watch Video Solution

69. The path difference between two interfering waves at a point on the screen is $\lambda / 6$, The ratio of intensity at this point and that at the central bright fringe will be (assume that intensity due to each slit is same)

A. 0.853

B. 8.53

C. 0.75

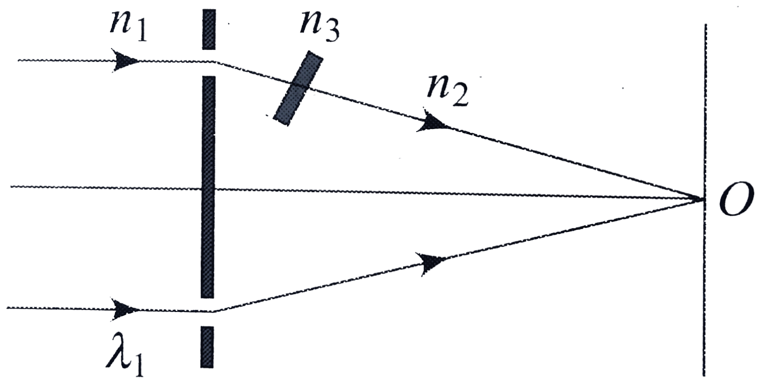
D. 7.5

Answer: c

Watch Video Solution

70. In YDSE shown in figure a parallel beam of light is incident on the slits from a medium of refractive index n_1. The wavelength of light in this medium is λ_1. A transparent slab of thickness t and refractive index n_3 is put in front of one slit. The medium between the screen and the plane of the slits is n_2.

The phase difference between the light waves reaching point O (symmetrical, relative to the slits) is



A. $\frac{2\pi}{n_1\lambda_1}(n_3 - n_2)t$

B. $\frac{2\pi}{\lambda_1}(n_3 - n_2)t$

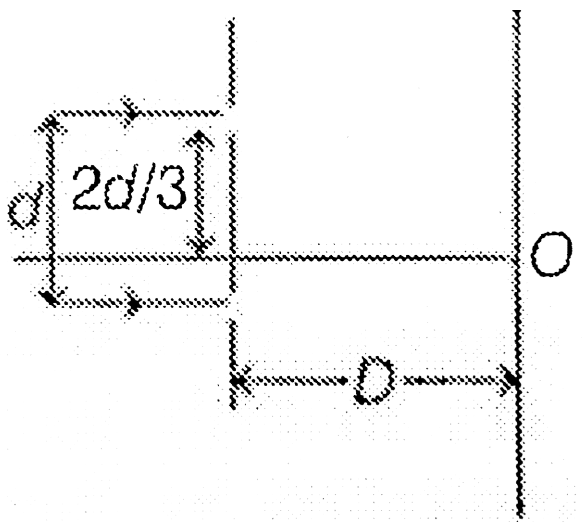
C. $\frac{2\pi n_1}{n_2\lambda_1}\left(\frac{n_3}{n_2} - 1\right)t$

D. $\frac{2\pi n_1}{\lambda_1}(n_3 - n_2)t$

Answer: a

Watch Video Solution

71. In the figure shown, if a parallel beam of light is incident on the plane of the slits, then the distance of the nearest white spot on the screen from O is [assume $d < < D, \lambda < < d$]



A. 0

B. $d/2$

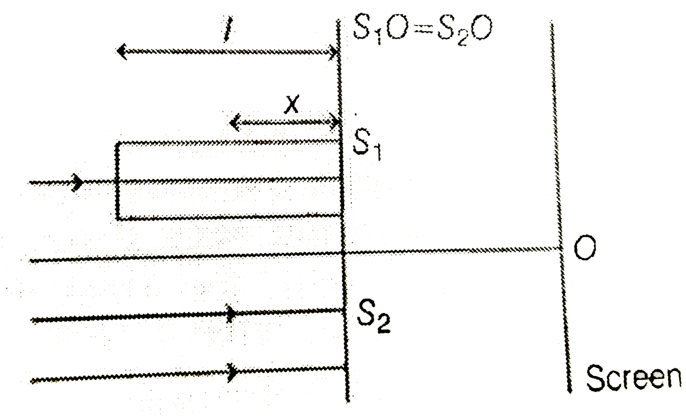
C. $d/3$

D. $d/6$

Answer: d

Watch Video Solution

72. In the figure shown, a parallel beam of light is incident on the plane of the slits of a Young's double slit experiment. Light incident on the slit S_1 passes through a medium of variable refractive index $\mu = 1 + ax$(where'x' is the distance from the the plane of slits as shown), upto a distance 'l' before falling on S_1. Rest of the speace is filled with air. If at O a minima is formed, then the minimum value of the positive constant a (in term of l and wavelength $'\lambda'$ in air) is:



A. $\frac{\lambda}{l}$

B. $\frac{\lambda}{l^2}$

C. $\frac{l^2}{\lambda}$

D. none of these

Answer: b

Watch Video Solution

73. Interference fringes were produced using light in a doulbe-slit experiment. When a mica sheet of uniform thickness and refractive index 1.6 (relative to air) is placed in the path of light from one of the slits, the central fringe moves through some distance. This distance is equal to the width of 30 interference bands if light of wavelength 4800 is used. The thickness (in μm) of mica is

A. 90

B. 12

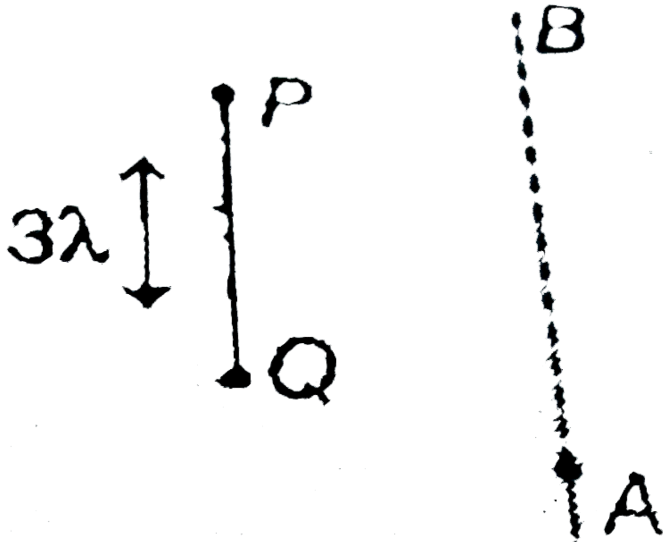
C. 14

D. 24

Answer: d

Watch Video Solution

74. Two coherent ligh sources each of wavelength λ are separated by a distance 3λ. The maximum number of minimas formed on line AB which runs from $-\infty$ to $+\infty$ is



A. 2

B. 4

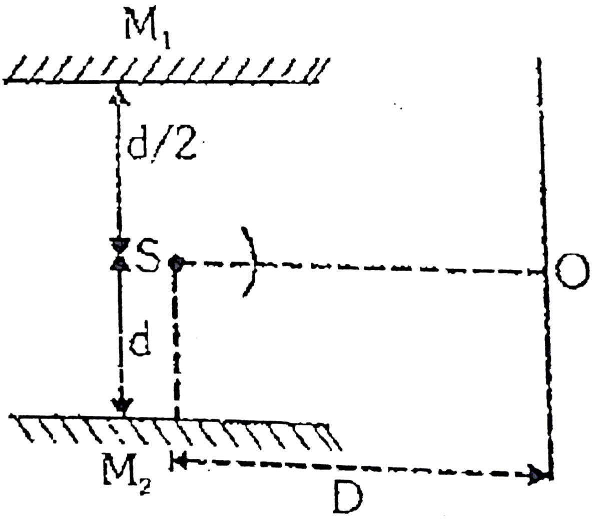
C. 6

D. 8

Answer: c

Watch Video Solution

75.



M_1 and M_2 are plane mirrors and kept parallel to each other. At point O there will be a maxima for wavelength λ. Light from monochromatic source S of wavelength λ is not reaching directly on the screen then λ is $[D > > d > > \lambda]$

A. $\frac{3d^2}{D}$

B. $\frac{3d^2}{2D}$

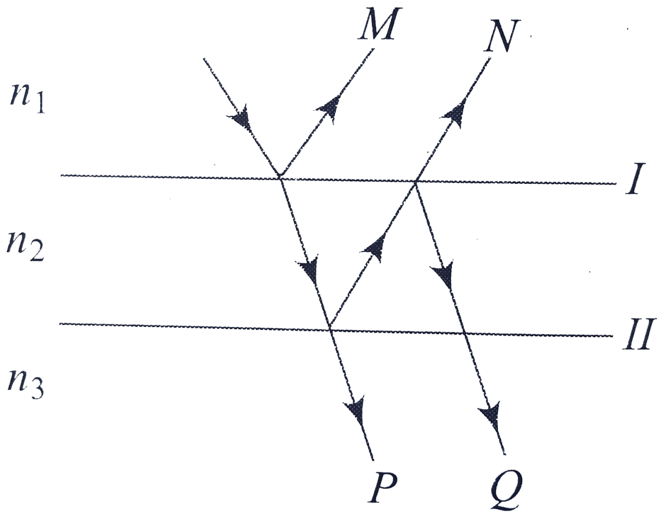
C. $\frac{d^2}{D}$

D. $\frac{2d^2}{D}$

Answer: b

Watch Video Solution

76. A ray of light is incident on a thin film, As shown in figure, M and N two reflected rays while P and Q are two transmitted rays. Rays N and Q undergo a phase change of π. Correct ordering of the refracting indices is



A. $n_2 > n_3 > n_1$

B. $n_3 > n_2 > n_1$

C. $n_3 > n > n_2$

D. none of these, the specified changes cannot occur

Answer: b

Watch Video Solution

77. If one of the two slits of Young's double-slit experiment is painted so that it transmits half the light intensity as the second slit, then

A. finge pattern disappears

B. bright fringes become brighten and dark ones become darker

C. dark and bright fringes get fainter

D. dark fringes get brighter and bright fringes get darker

Answer: d

Watch Video Solution

78. Coherent light with wavelength 600nm passes through two very narrow slits and the interference pattern is observed on a screen 3.00 m from the slits. The first order bright fringe is at 4.94 mm from the centre of the central bright fringe. For what wavelength of light will the first order dark fringe be observed at this same point on the screen?

A. 600 nm

B. 1200 nm

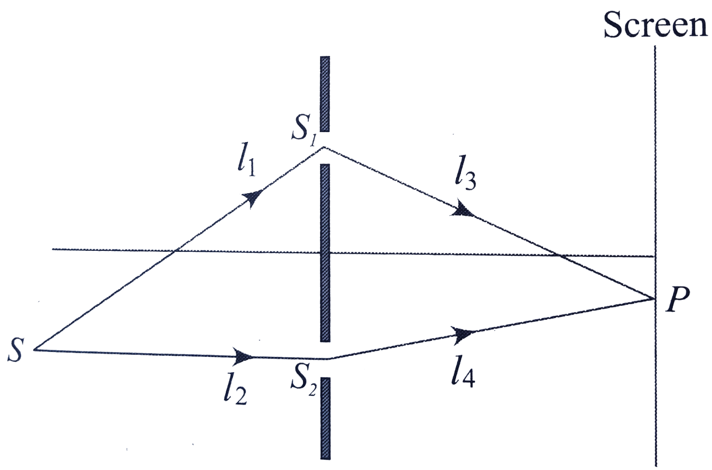
C. 300 nm

D. 900 nm

Answer: b

Watch Video Solution

79. The YDSE apparatus is as shown in figure. The condition for point P to be a dark fringe is



A. $(l_1 - l_3) + (l_2 - l_4) = n\lambda$

B. $(l_1 - l_2) + (l_3 - l_4) = n\lambda$

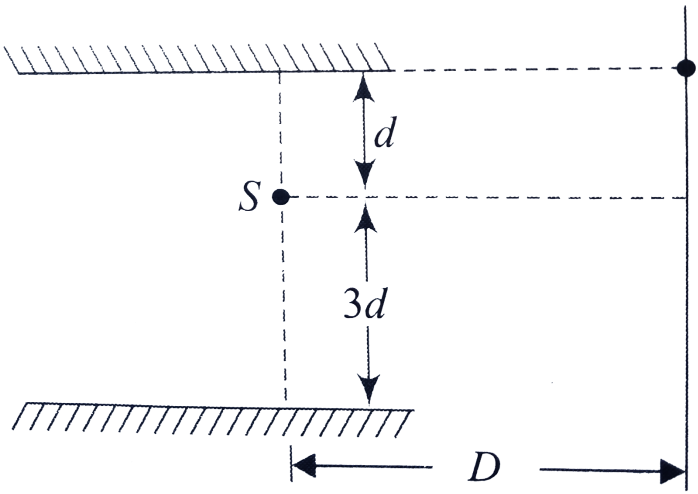
C. $(l_1 + l_3) + (l_2 + l_4) = \frac{(2n-1)\lambda}{2}$

D. $(l_1 - l_2) + (l_4 - l_3) = \frac{(2n-1)\lambda}{2}$

Answer: b

Watch Video Solution

80. Consider the optical system shown in figure. The point source of ligth S is having wavelength equal to λ. The light is reaching screen only after reflection. For point P to be socond maxima, the value of λ would be ($D > > d$ and $d > > \lambda$)



A. $\frac{12d^2}{D}$

B. $\frac{6d^2}{D}$

C. $\frac{3d^2}{D}$

D. $\frac{24d^2}{D}$

Answer: a

Watch Video Solution

Watch Video Solution

81. In YDSE, if a bichromatic light having wavelengths λ_1 and λ_2 is used, then maxima due to both lights will overlaps at a certain distance y from the central maxima. Take separation between slits as d and distance between screen and slits as D. Then the value of y will be

A. $\left(\frac{\lambda_1 + \lambda_2}{2D}\right)d$

B. $\frac{\lambda_1 - \lambda_2}{D} \times 2d$

C. LCM of $\frac{\lambda_1 D}{d}$ and $\frac{\lambda_2 D}{d}$

D. HCF of $\frac{\lambda_1 D}{d}$ and $\frac{\lambda_2 D}{d}$

Answer: c

Watch Video Solution

82. In YDSE, $d = 2mm$, $D = 2m$, and $\lambda = 500nm$.

If intensities of two slits are I_0 and $9I_0$, then find intensity at $y = \frac{1}{6}mm$.

A. $7I_0$

B. $10I_0$

C. $16I_0$

D. $4I_0$

Answer: a

Watch Video Solution

83. In YDSE, let A and B be two slits. Films of thickness t_A and t_B and refractive μ_A and μ_B are placed in front of A and B, respectively. If $\mu_A t_A = \mu_A t_B$, then the central maxima will

A. not shift

B. shift toward A

C. shift toward B

D. (b) if $t_B < t_A$ and (C) if $t_B < t_A$

Answer: d

Watch Video Solution

84. In YDSE, find the missing wavelength at $y = d$, where symbols have their usual meaning $(take D > > d)$.

A. $\frac{d^2}{D}$

B. $\frac{2d^2}{7D}$

C. $\frac{3d^2}{D}$

D. $\frac{d^2}{3D}$

Answer: b

Watch Video Solution

85. In YDSE, the amplitude of intensity variation fo the two sources is found to be 5% of the average intensity. The ratio of the intensities of two interfering sources is

A. 2564

B. 1089

C. 1681

D. 869

Answer: c

Watch Video Solution

86. In YDSE, water is filled in the space between the slits and screen. Then

A. Fringe pattern shifts upward but fringe width remains unchanged

B. fringe width decreases and fringe pattern shifts upward

C. fringe width remains unchanged and central fringe does not shift

D. fringe width decreases and fringe pattern does not shift

Answer: d

Watch Video Solution

87. In YDSE, having slits of equal width, let β be the fringe width and I_0 be the maximum intensity. At a distance x from the central brigth fringe, the intensity will be

A. $I_0 \cos\left(\frac{x}{\beta}\right)$

B. $I_0 \cos^2\left(\frac{2\pi x}{\beta}\right)$

C. $I_0 \cos^2\left(\frac{\pi x}{\beta}\right)$

D. $\frac{I_0}{4} \cos^2\left(\frac{\pi x}{\beta}\right)$

Answer: c

Watch Video Solution

88. Two identical coherent sources of wavelength λ are placed at $(100\lambda, 0)$ and $(-50\lambda, 0)$ along x-axis. The number of maxima and minima detected are ,respectively [include origin and $(5\lambda, 0)$]

A. 51 and 50

B. 101 and 100

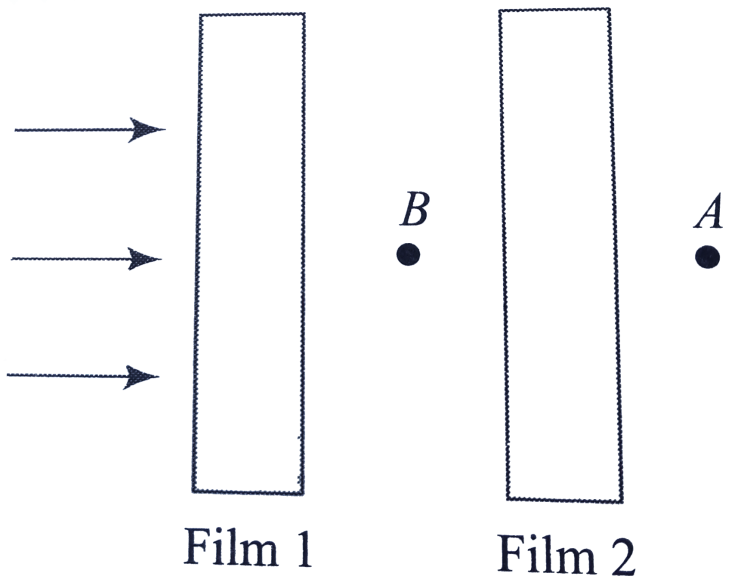
C. 49 and 50

D. 50 and 49

Answer: b

Watch Video Solution

89. Two thin films of the same material but different thickness are separated by air. Monochormatic light is incident on the first film. When viewed normally form point A, the second film appears dark.



A. the first film will appear bright

B. the first film will appear dark

C. the second film will appear bright

D. the second film will appear dark

Answer: d

Watch Video Solution

90. Consider an YDSE that has different slit width. As a result, amplitude of waves from two slits are A and 2A, respectively. If I_0 be the maximum intensity of the interference pattern, then intensity of the pattern at a point where phase difference between waves is ϕ is

A. $\frac{I_0}{9}\cos^2\phi$

B. $\frac{I_0}{3}\sin^2.\ \frac{\phi}{2}$

C. $\frac{I_0}{9}[5+4\cos\phi]$

D. $\frac{I_0}{9}[5 + 8\cos\phi]$

Answer: c

Watch Video Solution

91. In YDSE of equal width slits, if intensity at the center of screen is I_0, then intensity at a distance of $\beta / 4$ from the central maxima is

A. I_0

B. $\frac{I_0}{2}$

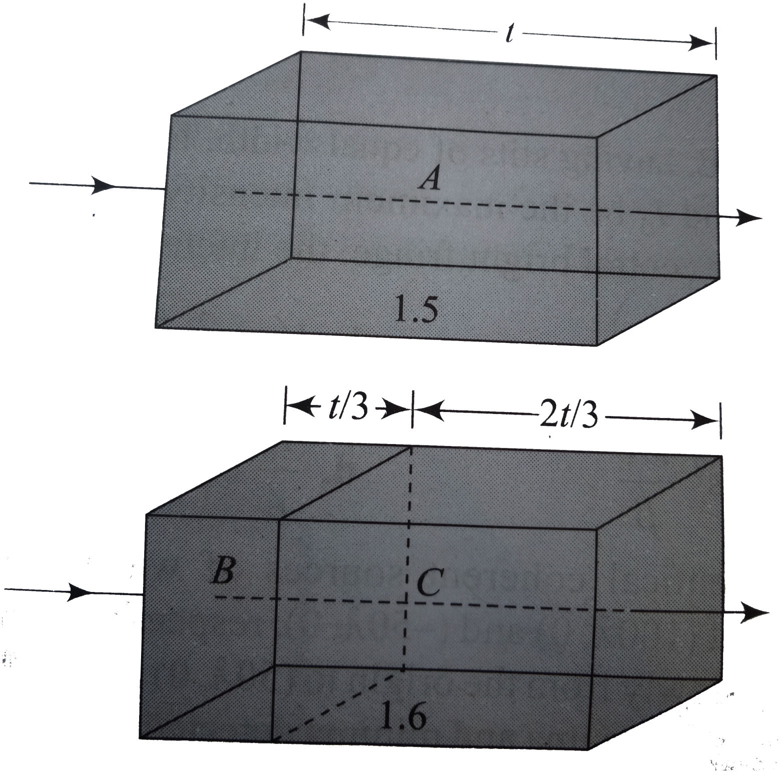
C. $\frac{I_0}{4}$

D. $\frac{I_0}{3}$

Answer: b

Watch Video Solution

92. Two transparent slabs have the same thickness as shown in figure. One in made of material A of refractive index 1.5. The other is made of two materilas B and C with thickness in the ratio 1:2. The refractive index of C is 1.6. If a monochromatic parallel beam passing through the slabs has the same number of wavelengths inside both, the refractive index of B is



A. 1.1

B. 1.2

C. 1.3

D. 1.4

Answer: c

Watch Video Solution

93. Find the speed of light of wavelength $\lambda = 780 nm$ (in air) in a medium of refractive index $\mu = 1.55$.

(b) What is the wavelength of this light in the given medium ?

A. $\phi_0 = \frac{1}{n}\left(\frac{2\pi}{\lambda_0}\right)x$

B. $\phi_0 = n\left(\frac{2\pi}{\lambda_0}\right)x$

C. $\phi_0 = (n-1)\left(\frac{2\pi}{\lambda_0}\right)x$

D. $\phi_0 = \frac{1}{(n-1)}\left(\frac{2\pi}{\lambda_0}\right)x$

Answer: b

Watch Video Solution

94. In young's double-slit experiment, the slit are 2 mm apart and are illuminated with a mixture ot two wavelengths $\lambda_0 = 750nm$ and $\lambda = 900nm$, The minimum distance from the common central bright fringe on a screen 2 m from the slits, where a bright fringe from one interference pattern coincides with a bright fringe from the other, is

A. 1.5 mm

B. 3 mm

C. 4.5 mm

D. 6 mm

Answer: c

Watch Video Solution

95. In Young's interference experiment, if the slit are of unequal width, then

A. no fringe will be formed

B. the position of minimum intensity will not be completley dark

C. bright fringe as displaced form the original central position

D. distance between two consecutive dark fringe will not be equal to the distance between two consecutive brigth fringes

Answer: b

Watch Video Solution

96. Two wavelengths of light λ_1 and λ_2 and sent through Young's double-slit apparatus simultaneously. If the third-order bright fringe coincides with the fourth-order bright fringe, then

A. $\frac{\lambda_1}{\lambda_2} = \frac{4}{3}$

B. $\frac{\lambda_1}{\lambda_2} = \frac{3}{4}$

C. $\frac{\lambda_1}{\lambda_2} = \frac{5}{4}$

D. $\frac{\lambda_1}{\lambda_2} = \frac{4}{5}$

Answer: a

Watch Video Solution

97. In Young's interference experiment, the central bright fringe can be indentified due to the fact that it

A. has greater intensity than other fringes which are bright

B. is wider than the other bright fringes

C. is narrower than the other bright fringes

D. can be obtained by using white light instead of monochromatic light

Answer: d

Watch Video Solution

98. A flake of glass (refractive index 1.5) is placed over one of the opening of a double-slit apparatus. The interference pattern displaced itself through seven successive maxima toward the side where the flake is placed. If wavelength of the light is $\lambda = 600nm$, then the thickness of the flake is

A. 2100 nm

B. 4200 nm

C. 8400 nm

D. none of above

Answer: c

Watch Video Solution

99. Two identical sources each of intensity I_0 have a separation $d = \lambda / 8$, where λ is the wavelength of the waves emitted by either source. The phase difference of the sources is $\pi / 4$ The intensity distribution $I(\theta)$ in the radiation field as a function of θ Which specifies the direction from the sources to the distant observation point P is given by

A. $I(\theta) = I_0 \cos^2 \theta$

B. $I(\theta) = \frac{I_0}{4} \cos^2 \left(\frac{\pi\theta}{8}\right)$

C. $I(\theta) = 4I_0 \cos^2 \left[\frac{\pi}{8}(\sin\theta + 1)\right]$

D. $I(\theta) = I_0 \sin^2 \theta$

Answer: c

Watch Video Solution

100. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other Then in the interference pattern

A. the intensities of both the maxima and the minima increases

B. the intensity of the maximum increase and minima has zero intensity

C. the intensity of the maxima decreases and that of minima increases

D. the intensity of the maxima decreases and the minima has zero intensity

Answer: a

Watch Video Solution

101. In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

A. 12

B. 18

C. 24

D. 30

Answer: b

Watch Video Solution

102. A certain region of a soap bubble reflects red light of vacuum wavelength $\lambda = 650 nm$. What is the minimum thickness that this region of the soap bubble could be have? Take the index of reflection of the soap film to be 1.41.

A. $1.2 \times 10^{-7} m$

B. $650 \times 10^{-9} m$

C. $120 \times 10^{7} m$

D. $650 \times 10^{5} m$

Answer: a

Watch Video Solution

103. In a Young's double slit experiment using monochromatic light, the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the slits and screen is doubled. It is found that the distance between successive maxima now is the same as observed fringe shift upon the introduced of the mica sheet . Calculate the wavelength of the monochromatic light used in the experiment .

A. 4500Å

B. 5700Å

C. 6000Å

D. 4000Å

Answer: c

Watch Video Solution

104. In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

A. 2λ

B. $(2/3)\lambda$

C. $\lambda/3$

D. λ

Answer: a

Watch Video Solution

105. In Young's double slit experiment, the intensity of light at a point on the screen where path difference is λ is I. If intensity at another point is I/4, then possible path differences at this point are

A. $\lambda/2, \lambda/3$

B. $\lambda/3, \lambda/3$

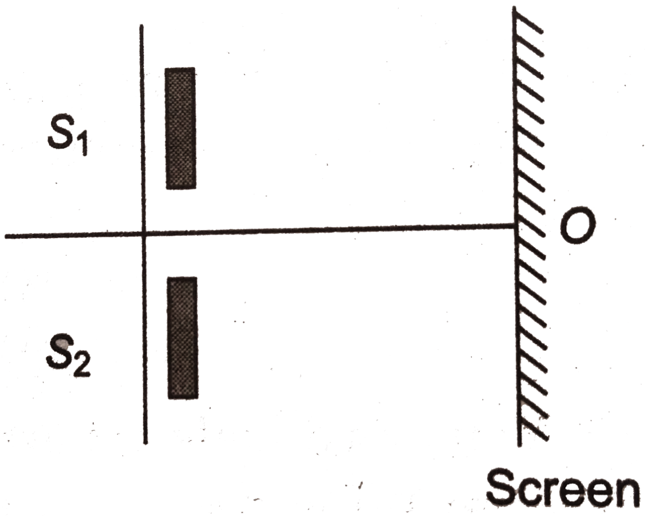
C. $\lambda/3, \lambda/4$

D. $2\lambda/3, \lambda/4$

Answer: b

Watch Video Solution

106. YDSE is carried with two thin sheets of thickness 10.4μ m each and refractive index $\mu_1 = 1.52$ and $\mu_2 = 1.40$ covering the slits S_1 and S_2 respectively. If white light of range 400nm to 780 nm is used, then which wavelength will form maxima exactly at point O, the centre of the screen



A. 416 nm only

B. 624 nm only

C. 416 nm and 624 bn only

D. None of these

Answer: c

Watch Video Solution

107. High-quality camera lenses are often coated to prevent reflection. A lens has an optical index of refraction of 1.72 and a coating with an optical index os refraction 1.31. For near normal incidence, the minimum thickness of the coating to prevent reflection for wavelength of $5.3 \times 10^{-7} m$ is

A. $0.75 \mu m$

B. 0.2 mm

C. $0.1 \mu m$

D. 1.75 mm

Answer: c

Watch Video Solution

108. A long horizontal slit is placed 1 mm above a horizontal plane mirror. The interference between the light coming directly from the slit and the after reflection is seen on a screen 1 m away from the slit. If the mirror reflects only 64% of the light falling on it, the ratio of the maximum to the minimum intensity in the interference pattern observed on the screen is

A. $8:1$

B. $3:1$

C. $81:1$

D. $9:1$

Answer: c

Watch Video Solution

109. In a Young's double slit experiment $\lambda = 500nm, d = 1.0mm$ and $D = 1.0m.$ Find the minimum distance from the central maximum for which the intensity is half of the maximum intensity.

A. $2 \times 10^{-4} m$

B. $1.25 \times 10^{-4} m$

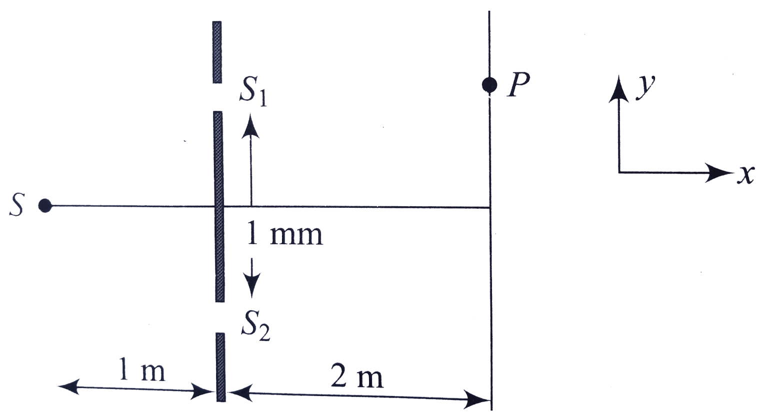
C. $4 \times 10^{-4} m$

D. $2.5 \times 10^{-4} m$

Answer: b

Watch Video Solution

110. In young's double-slit experiment set up, sources S of wavelength 50 nm illumiantes two slits S_1 and S_2 which act as two coherent sources. The sources S oscillates about its own position according to the equation $y = 0.5 \sin \pi t$, where y is in nm and t in seconds. The minimum value of time t for which the intensity at point P on the screen exaclty in front of the upper slit becomes minimum is



A. 1 s

B. 2 s

C. 3 s

D. 1.5 s

Answer: a

Watch Video Solution

111. Intensity obseverd in an interferecne pattern is $I = I_0 \sin^2 \theta$. At $\theta = 30^\circ$, Intensity $I = 5 \pm 0.002$.

The pecentage error in angle is

A. $4\sqrt{3} \times 10^{-2}\%$

B. $\frac{4}{\pi} \times 10^{-2}\%$

C. $\frac{4\sqrt{3}}{\pi} \times 10^{-2}\%$

D. $\sqrt{3} \times 10^{-2}\%$

Answer: c

Watch Video Solution

112. A thin uniform film of refractive index 1.75 is placed on a sheet of glass of refractive index 1.5. At room temperature $(20^{\circ}C)$ this film is just thick enoungh for light with wavelength 600 nm reflected off the top of the film to be canceled by light reflected from the top the glass. After the glass is placed in on oven and slowly heated to $170^{\circ} C$, the film conceals reflected light with wavelength 606 nm. The coefficient of linear expansion of the film is (ignore any changes in the refractive index of the film due to the temperature change)

A. $3.3 \times 10^{-5} .^{\circ} C^{-1}$

B. $6.6 \times 10^{-5} .^{\circ} C^{-1}$

C. $9.9 \times 10^{-5} .^{\circ} C^{-1}$

D. $2.2 \times 10^{-5} .^{\circ} C^{-1}$

Answer: b

Watch Video Solution

113. Two slits spaced 0.25 mm apart are placed 0.75 m from a screen and illuminated by coherent light with a wavelength of 650 nm. The intensity at the center of the central maximum $(\theta = 0^\circ)$ is I_0. The distance on the screen from the center of the central maximum to the point where the intensity has fallen to $I_0/2$ is nearly

A. 0.1 mm

B. .25 mm

C. 0.4 mm

D. 0.5 mm

Answer: d

Watch Video Solution

114. Two thin parallel slits that are 0.012 mm apart are illuminated by a laser beam of wavelength 650 nm. On a very large distant screen, the total number of bright fringes including the central fringe and those on both sides of it is

A. 38

B. 37

C. 40

D. 39

Answer: b

Watch Video Solution

115. The index of refraction of a glass plate is 1.48 at $\theta_1 = 30.^\circ C$ and varies linearly with temperature with a coefficient of $2.5 \times 10^{-5} .^\circ C^{-1}$. The coefficient of linear expansion of the glass is 5×10^{-9} ^ $\circ C^{-1}$. At 3 $0.^{\circ} C$, the length of the glass plate is 3 cm. This plate is placed in front of one of the slit n Young's double-slit experiment. If the plate is being heated so that it temperature increases at a rate of $5^{\circ} C^{-1}$ min, the light sources has wavelength $\lambda = 589nm$ and the glass plate initially ia at $\theta = 30^{\circ} C$. The number of fringes that shift on the screen in each minute is nearly (use approximation)

A. 1

B. 11

C. 110

D. 1.1×10^3

Answer: b

Watch Video Solution

116. Two thin parallel slits are made in on opaque sheet of film when a monochromatic beam of light is shonw through then at normal incidence. The first bright fringes in the transmitted light occur at $\pm 45^\circ$ with the original direction of the ligth beam on a distant screen when the apparatus is in air. When the apparatus is immersed in a liquid, the same bright fringe now occur at $\pm 30^{\circ}$. The index of refraction of the liquid is

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $\frac{4}{3}$

D. $\frac{3}{2}$

Answer: a

Watch Video Solution

117. Two monochromatic coherent point sources S_1 and S_2 are separated by a distance L. Each sources emits light of wavelength λ, where $L > > \lambda$. The line S_1S_2 when extended meets a screen perpendicular to it at point A. Then

A. the interference fringe on the screen are straight lines shape

B. the interference fringes on the screen are strainght lines perpendicular to the line S_1S_2A

C. point A is an intensity maxima if $L = n\lambda$

D. point A is always an intensity maxima for any separation L

Answer: c

Watch Video Solution

118. In Young's double-slit experiment, let A and B be the two slit. A thin film of thickness t and refractive index μ is placed in front of A. Let $\beta =$ fringe width. Then the central maxima will shift

A. toward A

B. toward B

C. by $t(\mu - 1)\frac{\beta}{\lambda}$

D. by $\mu t \frac{\beta}{\lambda}$

Answer: a.,c

Watch Video Solution

119. If the first minima in Young's double-slit experiment occurs directly in front of one of the slits (distance between slit and screen $D = 12cm$ and distance between slits $d = 5cm$), then the wavelength of the radiation used can be

A. 2 cm

B. 4 cm

C. $\frac{2}{3}cm$

D. $\frac{4}{3}cm$

Answer: a.,c

Watch Video Solution

120. If one of the slit of a standard Young's double slit experiment is covered by a thin parallel sided glass slab so that it transmits only one-half the light intensity of the other, then

A. the fringe pattern will get shifted toward the covered slit

B. the fringe pattern will get shifted away from the covered slit

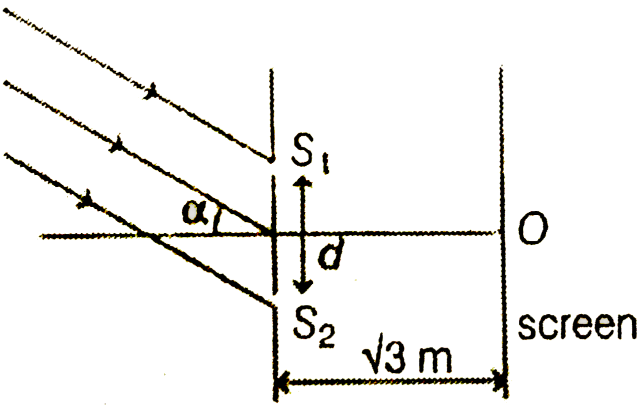
C. the fringe pattern will become less bright and the dark ones will become more bright

D. the fringe width will remain unchanged

Answer: a.,c.,d

Watch Video Solution

121. A parrallel beam of light $(\lambda = 5000\text{Å})$ is incident at an angle $\alpha = 30^\circ$ as shown in YDSE experiment. Intensity due to each slit at any point on screen in I_0. The distance between slits is 1mm. The intensity at central point O on the screen is KI_0. Find the value of K.



A. the intensity at O is $4I_0$

B. the intensity at is zero

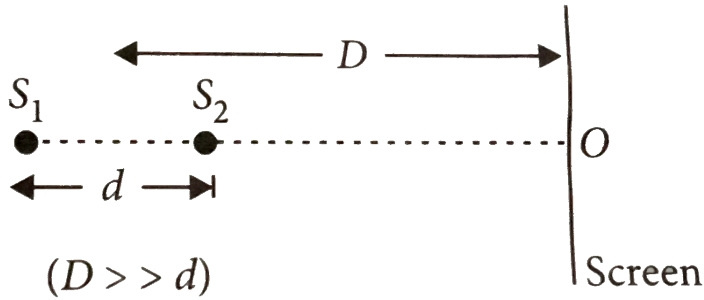
C. the intensity at a point on the screen 1 m below O is $4I_0$

D. the intensity at a point on the screen 1 m below O is zero

Answer: a.,c

Watch Video Solution

122. Two points monochromatic and coherent sources of light of wavelength λ are each placed as shown in the figure below. The initial phase difference between the sources is zero. Select the incorrect statement.



A. If $d = \frac{7\lambda}{2}$, O will be a minima

B. If $d = \lambda$, only one maxima can be observed on the screen

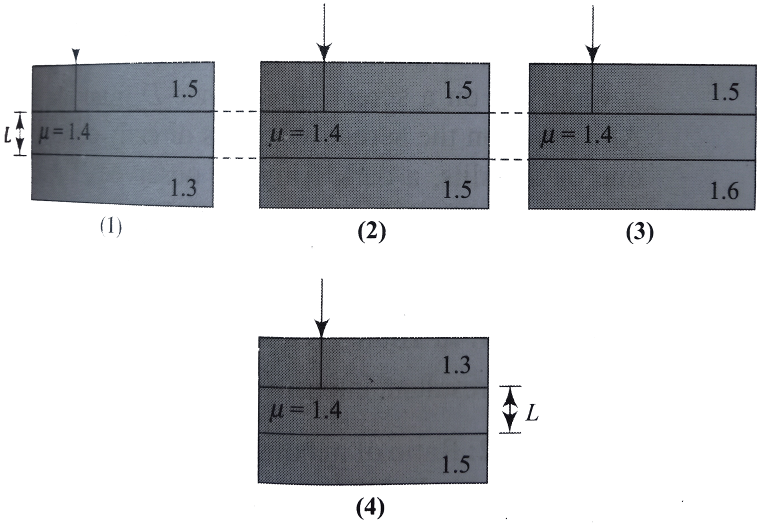
C. If $d = 4.8\lambda$, then total 10 minima would be there on the screen

D. If $d = \frac{5\lambda}{2}$, the intensity at O would be minimum.

Answer: a.,b.,c.,d

Watch Video Solution

123. Consider a film of thickness L as shown in four different cases belew. Notice the observation of film with perpendicularly falling light. Mark the correct statememt(S).



A. For (1) and (2), the reflection at film interfaces causes zero phase difference for two reflected rays.

B. For (2) and (3), the reflection at film interfaces causes a phase difference of π for two reflected rays.

C. For (1), the film will appear dark, if it is observed through reflected rays from film interfaces.

D. For (3), the film will appear dark, if it is observed through reflected rays from film interfaces.

Answer: b.,d

Watch Video Solution

124. In YDSE, the sources is place symmetrical to the slits. If a transparent slab is placed in front of the upper slit, then

A. intensity of central maxima may change

B. intensity of central maxima may not change

C. central maxima will be shifted up

D. intensity of dark fringe will be always zero

Answer: a.,b.,c.

Watch Video Solution

125. A transparent slab of thickness t and refractive index μ is inserted in front of upper of YDSE apparauts. The wavelength of ligth used. is λ. Assume that there is no absorption of light by the slab. Mark the correct statement(s).

A. The intensity of dark fringes will be 0, if slits are identical

B. The change in optical path due to insertion of plate is μt.

C. The change in optical path due to insertion of plate is $(\mu - 1)t$

D. For making intensity zero at center of screen,

the thickness can be $\frac{5\lambda}{2(\mu - 1)}$.

Answer: a.,c.,d

Watch Video Solution

126. A light wave of wavelength λ_0 propagates from point A to point B. We introduce in its path a glass plate of refractive index n and thickness l. Then introduction of the plate alters the phase of the plate at B by an angle ϕ. If λ is the wavelength of light on emerging from the plate, then

A. $\Delta\phi = 0$

B. $\Delta\phi = \frac{2\pi l}{\lambda_0}$

C. $\Delta\phi = 2\pi l\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$

D. $\Delta\phi = \frac{2\pi l}{\lambda_0}(n-1)$

Answer: c.,d

Watch Video Solution

127. A ray of light has speed v_0, frequency f_0 a wavelength λ_0 in vacuum. When this ray of light enters in a medium of refractive index corresponding values are v, f and λ. Then

A. its wavelength increases, frequency decreases

B. its wavelength decreases, frequency remains same

C. its wavelength increases, frequency remains same

D. $\Delta\lambda = \lambda_0\left(\frac{1}{\mu} - 1\right)$ and $\Delta v = 0$

Answer: b.,d

Watch Video Solution

128. In Young's double slit experiment the ratio of intensitities of bright and dark fringes is 9 this means that

A. the intensities at the screen due to the two slits are 5 units and 4 units, respectively

B. the intersities at the screen due to the two slits are 4 units and 1 units, respectively

C. the amplitude ratio is 3

D. the amplitude ratio is 2

Answer: b.,d

Watch Video Solution

Multiple Correct

1. In Young's double-slit experiment, two wavelengths of light are used simultaneously where $\lambda_2 = 2\lambda_1$. In the fringe pattern observed on the screen,

A. maxima of wavelength λ_2 can coincide with minima of wavelength λ_1

B. fringe width of λ_2 will be double that of fringe width of λ_1 and nth order maxima of

λ_2 will coincide with 2nd order maxima of λ_1

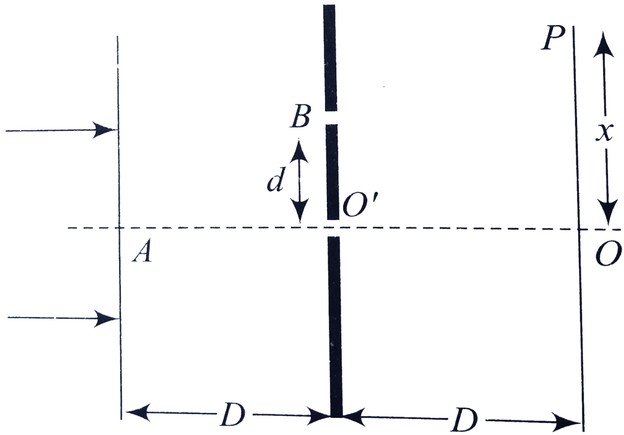
C. nth order minima of λ_2 will coincide with 2th order minima of λ_1

D. none of above

Answer: b.,c

Watch Video Solution

2. The minimum value of d os that there is a dark fringe at O is $d_{\min}$. For the value of $d_{\min}$, the distance at which the next bright fringe is formed is x. Then



A. $d_{\text{min}} = \sqrt{\lambda D}$

B. $d_{\text{min}} = \sqrt{\frac{\lambda D}{2}}$

C. $x = \frac{d_{\text{min}}}{2}$

D. $x = d_{\text{min}}$

Answer: b.,d

Watch Video Solution

3. Slit 1 of Young's double-slit experiment is wider then slit 2, so that the light from slits are given as $A_1 = A_0 \sin \omega t$ and $A_2 = 3A_0 \sin\left(\omega + \frac{\pi}{3}\right)$, , The resultant amplitude and intensity, at a point where the path difference between them is zero, are A and I, respectively. Then

A. $A = \sqrt{13}A_0$

B. $A = 4A_0$

C. $I \propto 16A_0^2$

D. $I \propto 13A_0^2$

Answer: a.,d

Watch Video Solution

4. A radio transmitting station operating at a frequency of 120MHz has two identical antennas that radiate in phase. Antenna B is 9.00m to the right of antenna A. Consider point P between the antennas and along the line connecting them, a horizontal distance x to the right of antenna A. For what values of x will constructive interference occur at point P?

A. $x = 14.95m, n = 1$

B. $x = 5.6m, n = 2$

C. $x = 1.65m, n = 3$

D. $x = 0m, n = 3.6$

Answer: a.,b.,c

Watch Video Solution

5. A two-slit inteference, experiment uses coherent light of wavelength $5 \times 10^{-7}m$. Intensity in the interference pattern for the following points are I_1, I_2, I_3, and I_4, respectively

1. A point that is close to one slit than the other by $5 \times 10^{-7} m.$

2. A point where the light waves received from the two slits are out of phase by $\frac{4\pi}{3}$ rad.

3. A point that is closer to one slit than the other by $7.5 \times 10^{-7} m.$

4. A point where the light waves received by the two slits are out of phase by $\frac{\pi}{36}$ rad.

Then which of following statements is/are correct?

A. $I_1 > I_4 > I_2 > I_3$

B. $I_1 > I_4 > I_2 > I_3$

C. $4I_2 = I_4$

D. $I_3 = 0$

Answer: a

Watch Video Solution

6. Statement I: In Young's experiment, the fringe width for dark fringes is different from that of white fringes.

Statement II: In Young's doulbe-slit experiment, when the fringes are observed with a source of white light then only black and bright fringes are observed.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: d

Watch Video Solution

7. Statement I: Thin films such as soap bubble or a thin layer of oil on water show beautiful colors when illuminated by white light.

Statement II: It happens due to the interference of light reflected form the upper surface of thin film.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: c

Watch Video Solution

8. In a Young's double slit experiment, the separaton between the two slits is d and the wavelength of the light is λ. The intensity of light fallin on slit 1 is four times the intensity of light falling on slit 2. Choose the correct choice (s).

A. if $d = \lambda$, the screen will contain one maximum

B. if $\lambda < d < 2\lambda$, at least one more maximum (besides the centrl maximum) will be observed on the screen.

C. If the intersity of light falling on slit 1 is reduced so that it becomes equal to that of slit 2 the intensities of the observed dark and bright fringes will increased

D. If the intensity of light falling off on slit 2 is increased so that it becomes equal to that of slit 1, the intensity of the observed dark and bright fringes will increases.

Answer: A::B

Watch Video Solution

Assertion- Reasoning

1. Statement I: In Young's double-slit experiment, the two slits are at distance d apart. Interference pattern is observed on a screen at distance D from the slits. At a point on the screen which is directly opposite to one of the slits, a dark fringe is observed. Then, the wavelength of wave is proportional to the squar of distance between two slits.

Statement II: For a dark fringe, intensity is zero

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: b

Watch Video Solution

2. Statement I: In Young's experiment, for two coherent sources, the resultant intensity is given by $I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$

Statement II: Ratio of maximum to minimum intensity is $\frac{I_{\max}}{I_{\min}} = \frac{\left(\sqrt{I_1} + \sqrt{I_2}\right)^2}{\left(\sqrt{I_1} - \sqrt{I_2}\right)^2}$.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: b

Watch Video Solution

3. Statement I: In calculating the disturbance produced by a pair of superimposed incoherent wave trians, you can add their intensities.

Statement II: $I_1 + I_2 + 2\sqrt{I_1 I_2} \cos \delta$. The average value of $\cos \delta = 0$ for incoherent waves.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

4. Statement I: Fringe width depends upon refractive index of the medium.

Statement II: Refractive index changes optical path of ray of light forming fringe pattern.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: b

Watch Video Solution

5. Statement I: In Young's experiment, the fringe width for dark fringes is different from that of white fringes.

Statement II: In Young's doulbe-slit experiment, when the fringes are observed with a source of white light then only black and bright fringes are observed.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: c

Watch Video Solution

6. Statement I: In interference, all the fringes are of same, width

Statement II: In interference, fringe width is independent of the position of fringe.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

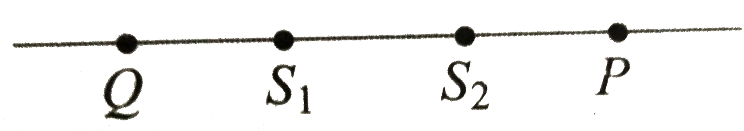
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

7. Statement I: Two point coherent sources of light S_1 and S_2 are placed on a line as shown in figure. P and Q are two points on that line. If at point P maximum intensity is observed, then maximum intensity should also be observed at Q.



Statement II: In figure the distance $|S_1P - S_2P|$ is equal to distance $|S_1Q - S_2Q|$.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

8. Statement I: Two coherent point sources of light having no-zero phase difference are separated by a small distance. Then, on the perpendicular bisector of line segment joining both the point sources, constructive interference cannot be obtained.

Statement II: For two waves from coherent point sources to interfere constructively at a point, the magnitude of their phase difference at that point must be $2m\pi$ (where m is non-negative integer).

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is True, Statement II is True, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: d

Watch Video Solution

9. Statement I: While calculating intensities in interference pattern, we can add the intensities of the individual waves.

Statement II: Principle of superposition is valid for liner waves.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

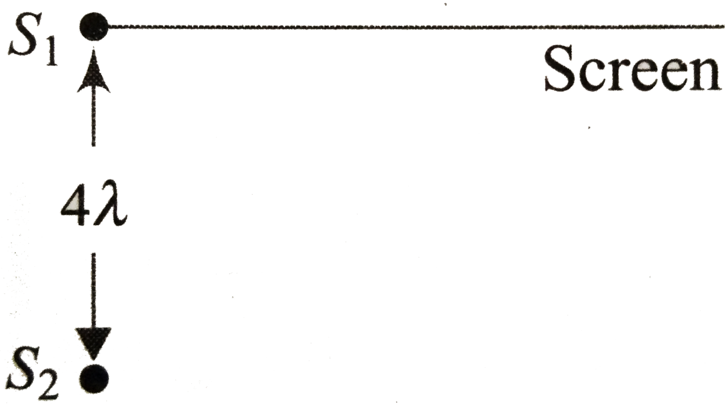
C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: d

Watch Video Solution

10. Statement I: For the situation shown in figure two identecal coherent light sources produce interference pattern on the screen. The intensity of minima nearest to S_1 is not exactly zero.



Statement II: Minimum intensity is zero, when interfering waves have same intensity at the location of superposition.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

11. Statement I: In YDSE, if separation between the slits is less than wavelength of light, then no interference pattern can be observed.

Statement II: For interference pattern to be observed, light sources have to be coherent.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

D. Statement I is False, Statement II is True.

Answer: b

Watch Video Solution

12. Statement I: We can hear around corners, but we can not see around corners.

Statement II: Wavelength of sound is much greater than wavelength of light.

A. Statement I is True, statement II is True, Statement II is a correct explanation for Statement I.
B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.
C. Statement I is True, Statement II is False.
D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

13. Statement I: An electron beam is used to obtain interference in a simple Young's double-slit experiment arrangement with appropriate distance between the slits. If the speed of electrons in increased, the fringe width decreases.

Statement II: de Broglie wavelength of electron is inversely proportional to the speed of the electrons.

A. Statement I is True, statement II is True, Statement II is a correct explanation for

Statement I.

B. Statement I is Ture, Statement II is Ture, Statement II is NOT a correct explanation for Statement I.

C. Statement I is True, Statement II is False.

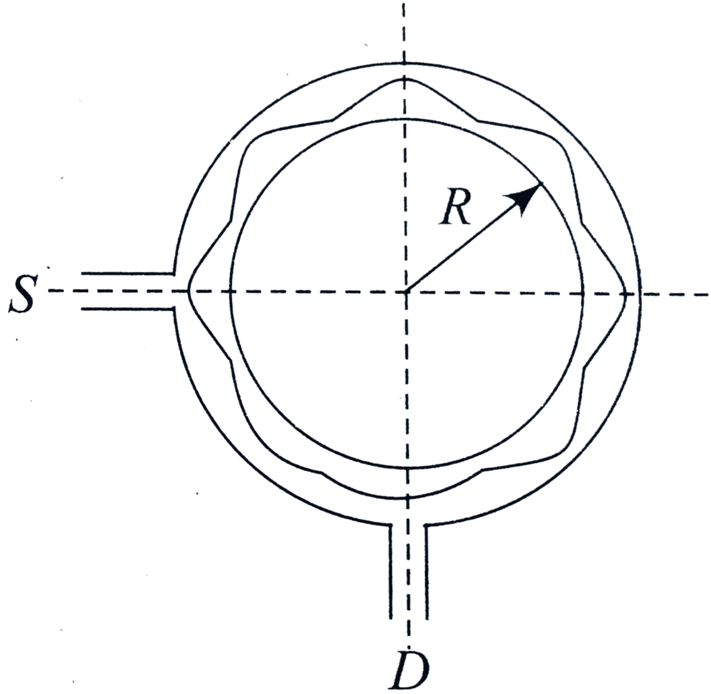
D. Statement I is False, Statement II is True.

Answer: a

Watch Video Solution

Linked Comprehension

1. A narrow tube is bent in the form of a circle of radius R, as shown in figure. Two small holes S and D are made in the tube at the position at right angle to each other. A source placed at S generates a wave of intensity I_0 which two parts: one part travels along the longer path, while the other travels along the shorter path. Both the waves meet at point D where a detector is placed.



1. If a maxima if formed at a detector, then the magnitude of wavelength λ of the, wave produced is given by

A. π R

B. π R/(2)

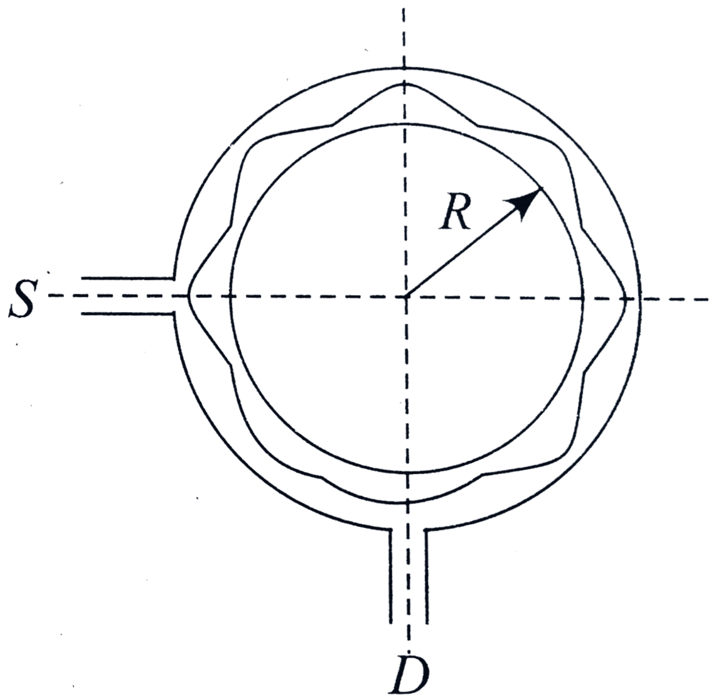
C. π R/(4)

D. all of these

Answer: d

Watch Video Solution

2. A narrow tube is bent in the form of a circle of radius R, as shown in figure. Two small holes S and D are made in the tube at the position at right angle to each other. A source placed at S generates a wave of intensity I_0 which two parts: one part travels along the longer path, while the other travels along the shorter path. Both the waves meet at point D where a detector is placed.



2. If a minima is formed at the detector, then the magnitude of wavelength λ of the wave produced is given by

A. $2\pi R$

B. $\frac{3}{2}\pi R$

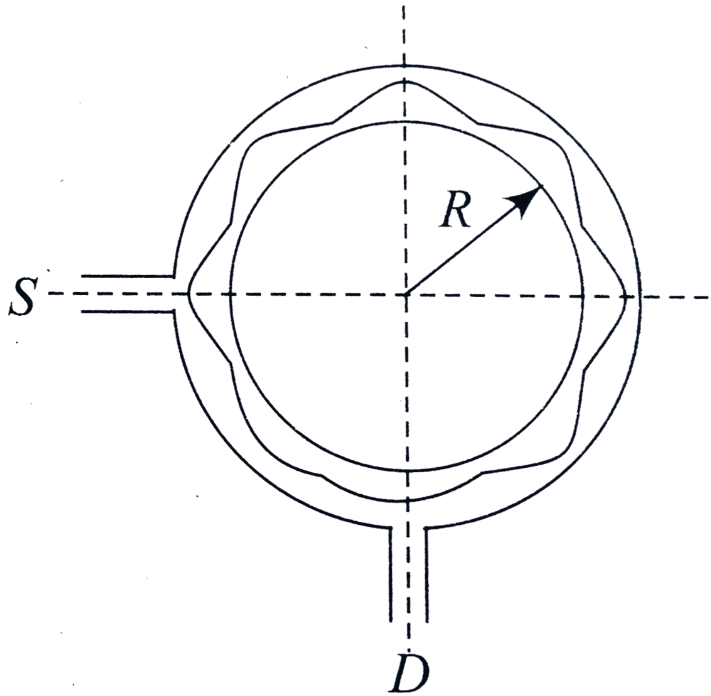
C. $\frac{5}{2}\pi R$

D. none of these

Answer: a

Watch Video Solution

3. A narrow tube is bent in the form of a circle of radius R, as shown in figure. Two small holes S and D are made in the tube at the position at right angle to each other. A source placed at S generates a wave of intensity I_0 which two parts: one part travels along the longer path, while the other travels along the shorter path. Both the waves meet at point D where a detector is placed.



The maximum intensity produced at D is given by

A. $4I_0$

B. $2I_0$

C. I_0

D. $3I_0$

Answer: b

Watch Video Solution

4. A thin film of a specific meterial can be used to decrease the intensity of reflected light. There is destrucive inteference of wave reflected from upper and lower surface of the film. These films are called non-reflecting or anti-reflecting coatings. The process of coating the lens or surface with non-reflecting film is called blooming as shown in figure The refracting index of coating (n_1) is less than that of the glass (n_2).

4. If a light of wavelength λ is incident normally and the thickness of film is t, then optical path difference between waves reflected from upper and lower surface of the film is

A. $2n_1t$

B. $2n_1t - \frac{\lambda}{2}$

C. $2n_1t + \frac{\lambda}{2}$

D. 2 t

Answer: a

Watch Video Solution

5. A thin film of a specific meterial can be used to decrease the intensity of reflected light. There is destrucive inteference of wave reflected from upper and lower surface of the film. These films are called non-reflecting or anti-reflecting coatings. The process of coating the lens or surface with non-reflecting film is called blooming as shown in figure The refracting index of coating (n_1) is less than that of the glass (n_2).

5. magnesium fluoride (MgF_2) is generally use as

anti-reflection coating. If refractive index of MgF_2 is 1.25, then minimum thickness of film required is (Take $\lambda = 500nm$)

A. 125 nm

B. 75 nm

C. 100 nm

D. 225 nm

Answer: c

Watch Video Solution

6. A thin film of a specific meterial can be used to decrease the intensity of reflected light. There is destrucive inteference of wave reflected from upper and lower surface of the film. These films are called non-reflecting or anti-reflecting coatings. The process of coating the lens or surface with non-reflecting film is called blooming as shown in figure The refracting index of coating (n_1) is less than that of the glass (n_2).

6. If the thickness of film in above question in not technologically possible to manufacture, then next thickness of film required is (approximately)

A. 300 nm

B. 125 nm

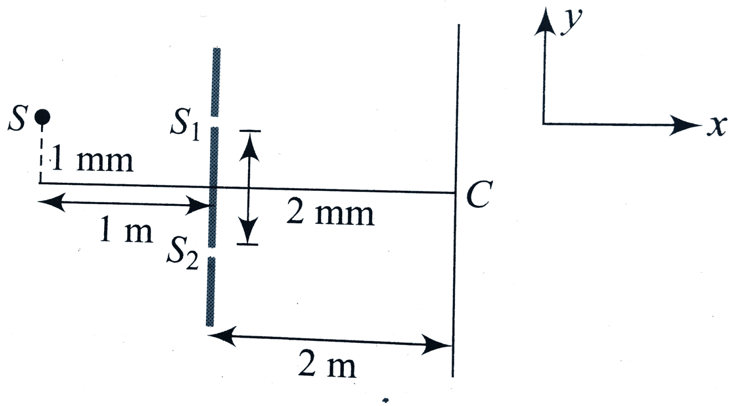
C. 750 nm

D. 550 nm

Answer: a

Watch Video Solution

7. In a Young's double-slit experiment set up, source S of wavelength 6000Å illuminates two slits S_1 and S_2 which act two coherent sources. The sources S oscillates about its shown position according to the eqation $y = 1 + \cos \pi t$, where y is in millimeter and t in second.



At $t = 0$, fringe width is β_1, and at $t = 2$ s, width of figure is β_2. Then

A. $\beta_1 > \beta_2$

B. $\beta_2 > \beta_1$

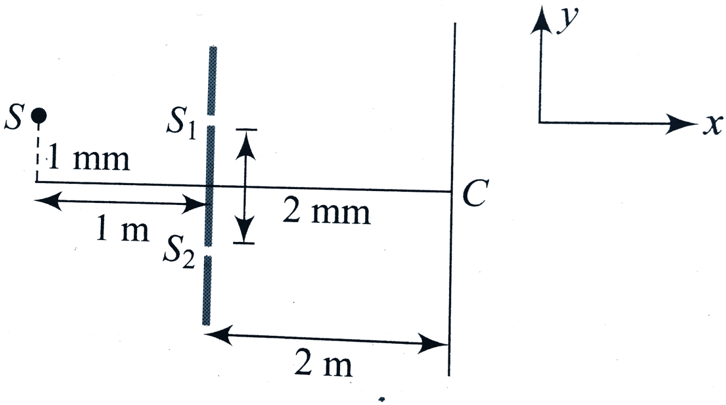
C. $\beta_1 = \beta_2$

D. data is insufficient

Answer: b

Watch Video Solution

8. In a Young's double-slit experiment set up, source S of wavelength 6000Å illuminates two slits S_1 and S_2 which act two coherent sources. The sources S oscillates about its shown position according to the eqation $y = 1 + \cos \pi t$, where y is in millimeter and t in second.



At $t = 2$ s, the position of central maxima is

A. 2 mm above C

B. 2 mm below C

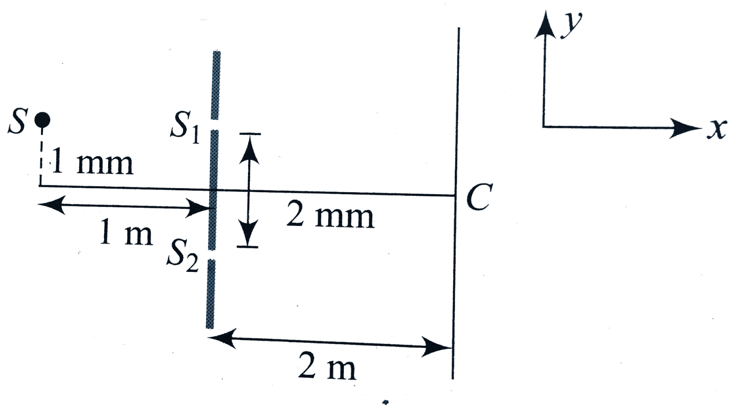
C. 4 mm above C

D. 4 mm below C

Answer: d

Watch Video Solution

9. In a Young's double-slit experiment set up, source S of wavelength 6000Å illuminates two slits S_1 and S_2 which act two coherent sources. The sources S oscillates about its shown position according to the eqation $y = 1 + \cos \pi t$, where y is in millimeter and t in second.



At $t = 2$ s, the position of central maxima is

A. 1 mm above C

B. 1 mm below C

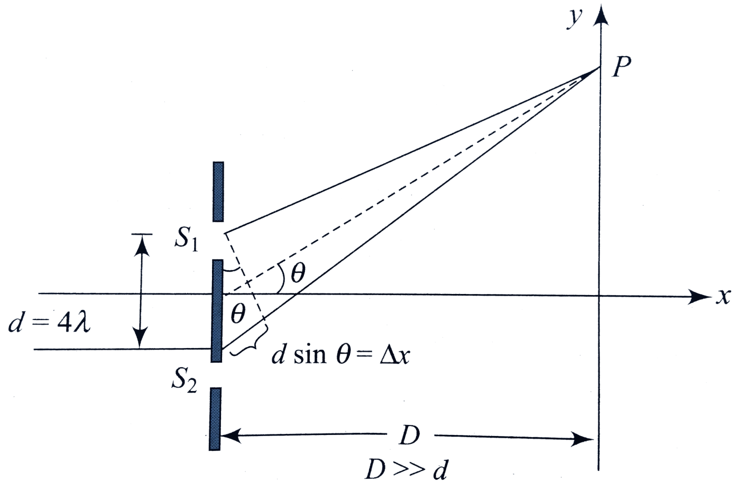
C. 2 mm above C

D. 2 mm below C

Answer: a

Watch Video Solution

10. Two coherent sources emit light of wavelength λ. Separation between them, $d = 4\lambda$.



If a detector moves along the y-axis, what is the maximum number of minima observed?

A. 6

B. 9

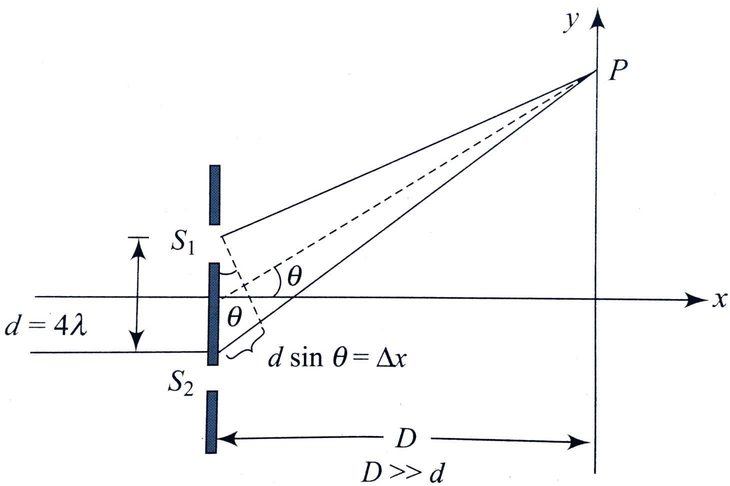
C. 5

D. 4

Answer: b

Watch Video Solution

11. Two coherent sources emit light of wavelength λ. Separation between them, $d = 4\lambda$.



If a detector moves along the y-axis, what is the maximum number of minima observed?

A. 2

B. 3

C. 5

D. 4

Answer: d

Watch Video Solution

12. In YDSE, the sources is red ligth of wavelength $7 \times 10^{-7} m$. When a thin glass plate of refractive index 1.5 is put in the path of one of the interfering beams, the central bright fringe shifts by 10^{-3} m to the position previously occupied by the 5th bright fringe.

What is the thickness of the plate?

A. $5\mu m$

B. $0.005\mu m$

C. $7\mu m$

D. $0.007\mu m$

Answer: c

Watch Video Solution

13. In Young's experiment, the source in red light of wavelength 7×10^{-7} m. When a thin glass plate of refractive index. 1.5 at this wavelength is put in the path of one of the interfering beams, the central bright fringe shifts by 10^{3} m to position previously occpied by the 5th bright fringe. Find the thickness of the plate.

When the source is now changed to green light of wavelength 5×10^{-7} m, the central fringe shifts to position initially occupied by the 6th bright fringe due to red light, Find the refractive index of the glass for the green light. Also, estimate the change in fringe width due to the change in wavelength.

A. $2.6 \mu m$

B. $1.6 \mu m$

C. $1.2 \mu m$

D. $2.2 \mu m$

Answer: b

Watch Video Solution

14. In YDSE, the sources is red ligth of wavelength $7 \times 10^{-7} m$. When a thin glass plate of refractive index 1.5 is put in the path of one of the interfering beams, the central bright fringe shifts by 10^{-3} m to the position previously occupied by the 5th bright fringe.

What is the thickness of the plate?

A. $-0.57 \times 10^{-4} m$

B. $-0.47 \times 10^{-4} m$

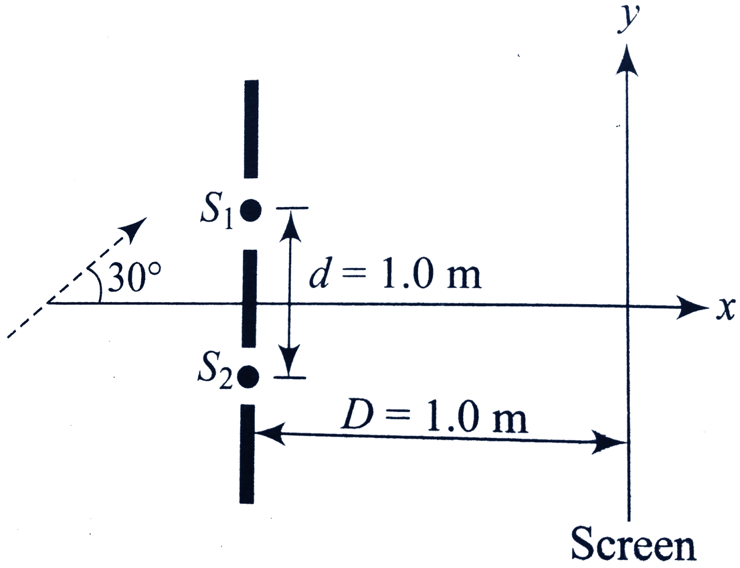
C. $-0.37 \times 10^{-4} m$

D. $-0.27 \times 10^{-4} m$

Answer: a

Watch Video Solution

15. A coherent parallel beam of microwaves of wavelength $\lambda = 0.5mm$ falls on aYoung's double-slit apparatus. The separation between the slits is 1.0 mm. The intensity of microwaves is measured on a screen placed parallel to the plane of the slits at a distance of 1.0 m from it as shown in figure



If the incient beam falls normally on the double-slit apparatus, find the order of the interference minima on the screen

A. Only the first order minima are possible

B. Only the first order and second minima are possible

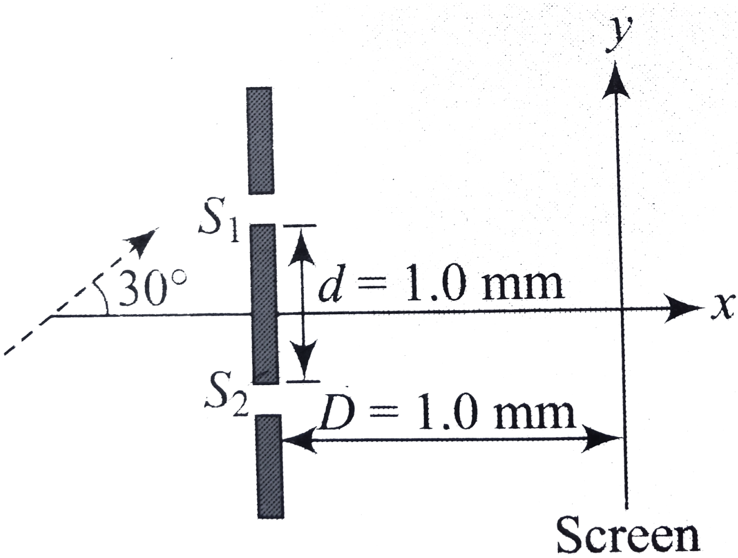
C. Total six minima appear on the screen

D. Total eight minima appear on the screen

Answer: a

Watch Video Solution

16. A coherent parallel beam of microwaves of wavelength $\lambda = 0.5mm$ falls on aYoung's double-slit apparatus. The separation between the slits is 1.0 mm. The intensity of microwaves is measured on a screen placed parallel to the plane of the slits at a distance of 1.0 m from it as shown in Fig. 2.42. If the incident beam makes an angle or 30° with the x-axis (as in the dotted arrow shown in the figure), find the y-coordinates of the first minima on either side of the central maximum.



A. a. $\frac{3}{\sqrt{7}}$ and $\frac{1}{\sqrt{15}} m$

B. b. $\frac{3}{\sqrt{7}}$ and $\frac{2}{\sqrt{15}} m$

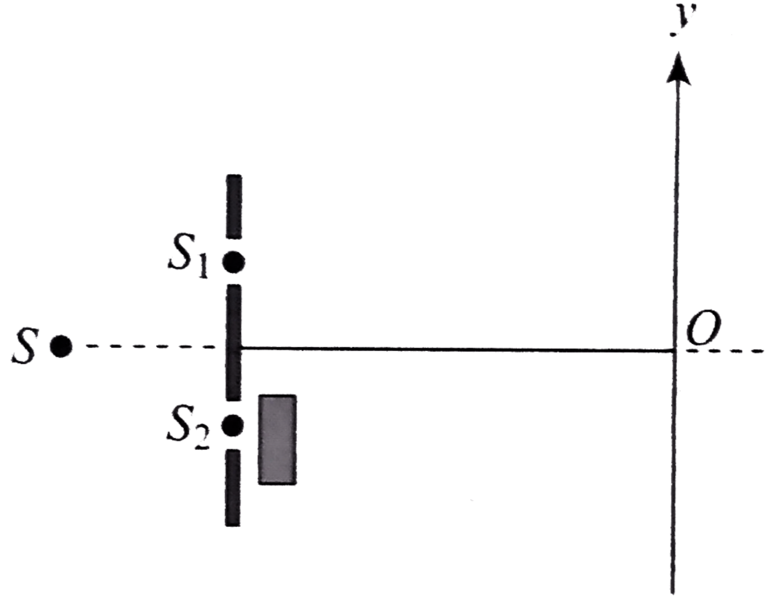
C. c. $\frac{3}{2\sqrt{7}}$ and $\frac{1}{\sqrt{15}} m$

D. d. $\frac{6}{\sqrt{7}}$ and $\frac{3}{\sqrt{15}} m$

Answer: b

Watch Video Solution

17. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



The location of the central maximum (bright fringe with zero path difference) on the y-axis will be

A. 2.33 mm

B. 4.33 mm

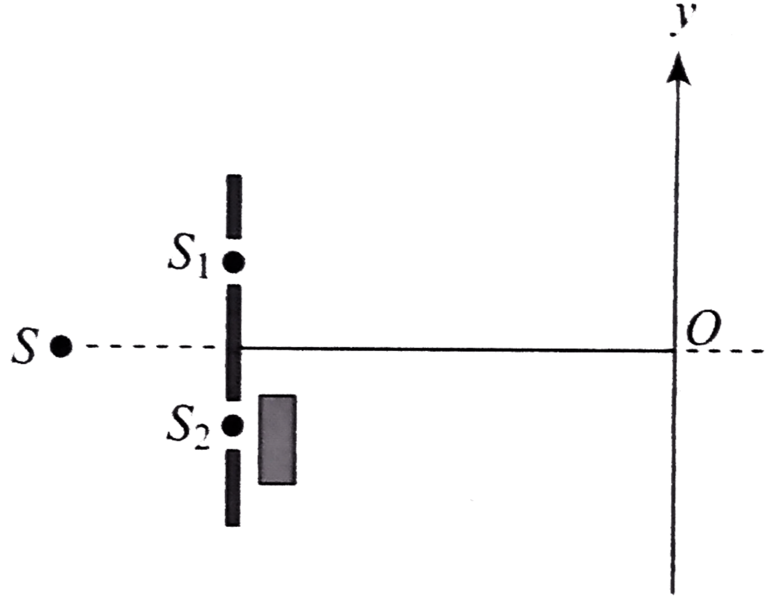
C. 6.33 mm

D. 4.43 mm

Answer: d

Watch Video Solution

18. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



Find the light intensity at point O relative t

maximum fringe intensity.

A. $\frac{1}{4} I_{\max}$

B. $\frac{5}{4} I_{\max}$

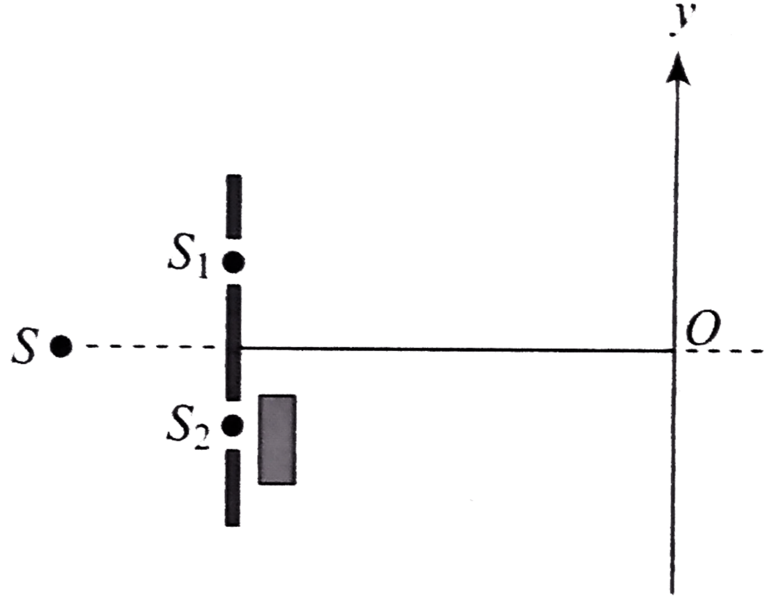
C. $\frac{1}{2} I_{\max}$

D. $\frac{3}{4} I_{\max}$

Answer: a

Watch Video Solution

19. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



Now, if 600 nm, find the wavelength of the ligth that forms maximum exactly at point O.

A. 650 nm, 433.3 nm

B. 550 nm, 750 nm

C. 450 nm, 645.3 nm

D. 375 nm, 525.3 nm

Answer: b

Watch Video Solution

20. In a YDSE perfromed with light of wavelength 600Å, the screen is placed 1 m from the slits. Fringes formed on the screen are observed by a student sitting close to the slits. The student's eye can distinguish two neighboring fringes. If they subtend an angle more then 1 minute of ace, then In order to have the clear visibility of the fringe, the maximum distance that can be maintained between the slits is

A. 3.06 mm

B. 2.06 mm

C. 1.31 mm

D. 3.31 mm

Answer: a

Watch Video Solution

21. In a YDSE perfromed with light of wavelength 600Å, the screen is placed 1 m from the slits. Fringes formed on the screen are observed by a student sitting close to the slits. The student's eye can distinguish two neighboring fringes. If they subtend an angle more then 1 minute of ace, then In order to have the clear visibility of the fringe, the maximum distance that can be maintained between the slits is

A. $8.74 \times 10^{-4} mm$

B. $6.74 \times 10^{-4} mm$

C. $5 \times 10^{-4} mm$

D. $8.74 \times 10^{-7} mm$

Answer: c

Watch Video Solution

22. In a double slit experiment using light of wavelength 600 nm, the angular width of a fringe on a distant screen is 0.1°. The spacing between the two slits is

A. $4.26\mu m$

B. $2.93\mu m$

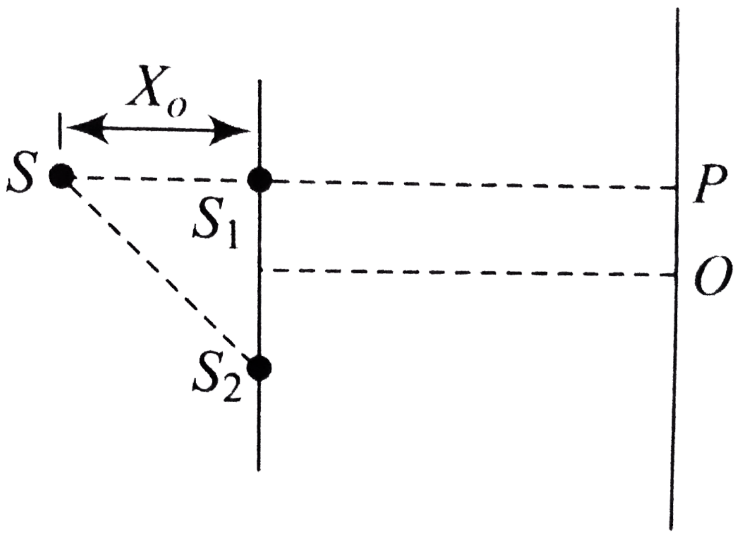
C. $1.31\mu m$

D. $3.14\mu m$

Answer: b

Watch Video Solution

23. In a modified YDSE, sources S is kept in front of slit S_1. Find the phase difference at point O that is equidistant from slits S_1 and S_2 and point P that is in front of slit S_1 in the following situations.



A liquid of refractive index μ is filled between the screen and slits.

A. $\frac{2\pi}{\lambda}\cdot\left[\left[\sqrt{d^2+x_0^2}+x_0\right]+\frac{\mu d^2}{2D}\right]$

B. $\frac{2\pi}{\lambda}\cdot\left[\left[\sqrt{d^2+x_0^2}-x_0\right]+\frac{\mu d^2}{2D}\right]$

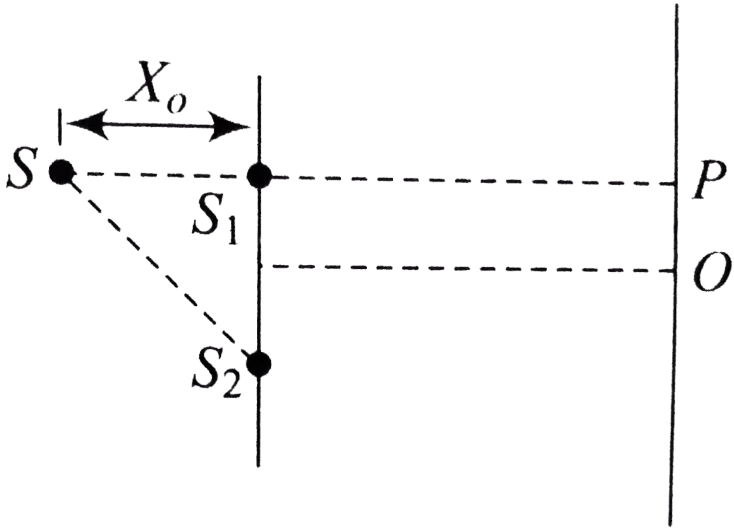
C. $\frac{2\pi}{\lambda}\cdot\left[\left[\sqrt{d^2-x_0^2}+x_0\right]+\frac{\mu d^2}{2D}\right]$

D. $\frac{2\pi}{\lambda}\cdot\left[\left[\sqrt{d^2-x_0^2}-x_0\right]+\frac{\mu d^2}{2D}\right]$

Answer: b

Watch Video Solution

24. In a midified YDESE, sources S is kept in front of slit S_1. Find the phase difference at point O that is equidistant from slits S_1 and S_2 and point P that is in front of slit S_1 in the following situations. ltgt



Liquid is filled between the slit and source S.

A. $\frac{2\pi}{\lambda} = \left[\mu\sqrt{d^2 + x_0^2} - x_0 - \frac{d^2}{2D}\right]$

B. $\frac{2\pi}{\lambda} = \left[\mu\sqrt{d^2 + x_0^2} - x_0 + \frac{d^2}{2D}\right]$

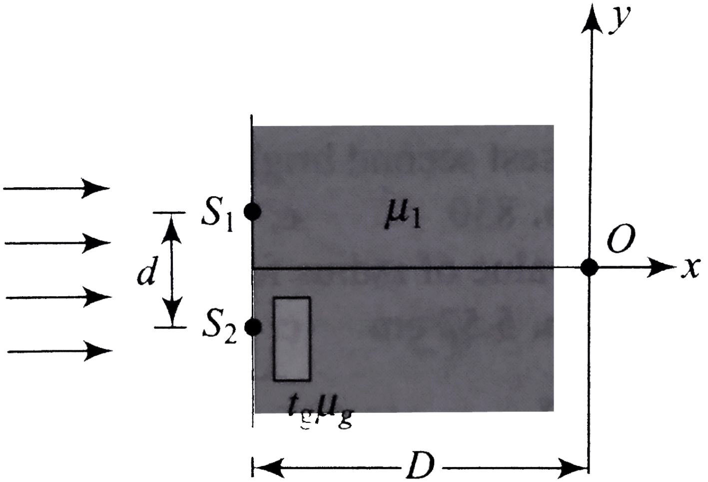
C. $\frac{2\pi}{\lambda}\left[\mu\sqrt{d^2 - x_0^2} + x_0 + \frac{d^2}{2D}\right]$

D. $\frac{2\pi}{\lambda} = \left[\mu\sqrt{d^2 + x_0^2} + x_0 + \frac{d^2}{2D}\right]$

Answer: b

View Text Solution

25. In a modified YDSE, the region between the screen and slits is immersed in a liquid whose refractive index varies with time as $\mu_1 = (5/2) - (T/4)$ until it reaches s steady state value of $5/4$. A glass plate of thickness 36 μm and refractive index $3/2$ is introduced in front of one of the slits.



$D = 1$ m
$d = 2$ mm

Find the time when central maxima is at point O. located symmetrically on the x-asix.

A. 2 s

B. 4 s

C. 6 s

D. 8 s

Answer: b

Watch Video Solution

26. In a modified YDSE, the region between the screen and slits is immersed in a liquid whose refractive index varies with time as $\mu_1 = (5/2) - (T/4)$ until it reaches s steady state value of $5/4$. A glass plate of thickness 36 μm and refractive index $3/2$ is introduced in front of one of the slits.

What is the speed of the central maxima when it is

at

A. $3 \times 10^{-3} ms_{-1}$

B. $4 \times 10^{-3} ms_{-1}$

C. $6 \times 10^{-3} ms_{-1}$

D. $1 \times 10^{-3} ms_{-1}$

Answer: a

Watch Video Solution

27. In a YDSE using monochromatic visible light, the distance between the plate of slits and the screen is 1.7 m. At point P on the screen which is directly in front of the upper slit, maximum path is observed. Now, the screen is moved 50 cm closer to the plane of slits. Point P now lies between third and fouth minima above the central maxima and the intensity at P in one-fourth of the maxima intensity on the screen.

Find the value of n.

A. 4

B. 6

C. 2

D. 8

Answer: c

Watch Video Solution

28. In a YDSE using monochromatic visible light, the distance between the plate of slits and the screen is 1.7 m. At point P on the screen which is directly in front of the upper slit, maximum path is observed. Now, the screen is moved 50 cm closer to the plane of slits. Point P now lies between third and fouth minima above the central maxima and the intensity at P in one-fourth of the maxima intensity on the screen. ltbr. Find the wavelength of light if the separation of slits is 2 mm.

A. $2.9 \times 10^{-7} m$

B. $3.9 \times 10^{-7} m$

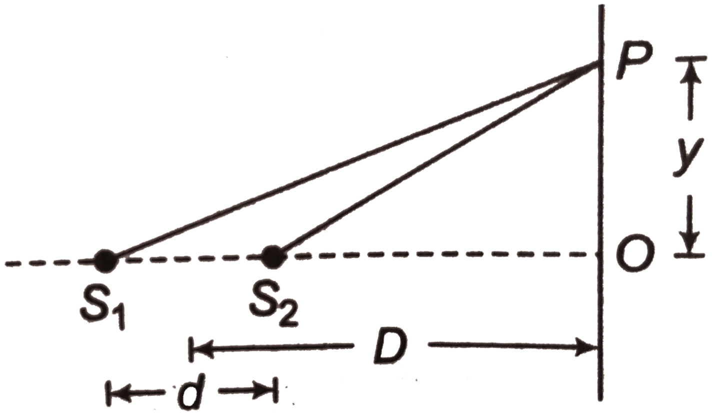
C. $5.9 \times 10^{-7} m$

D. $6.9 \times 10^{-7} m$

Answer: c

Watch Video Solution

29. In the figure shown, a screen is placed normal to the line joining the two point coherent sources S_1 and S_2. The interference pattern consists of concentric circles.



(a)Find the radius of the nth bright ring.

(b) If d=0.5 mm, $\lambda = 5000\text{Å}$ and D=100 cm, find the radius of the closest second bright ring.

(c) Also, find the value of n for this ring.

A. $D\sqrt{1\left(1-\frac{n\lambda}{d}\right)}$

B. $D\sqrt{2\left(1-\frac{n\lambda}{d}\right)}$

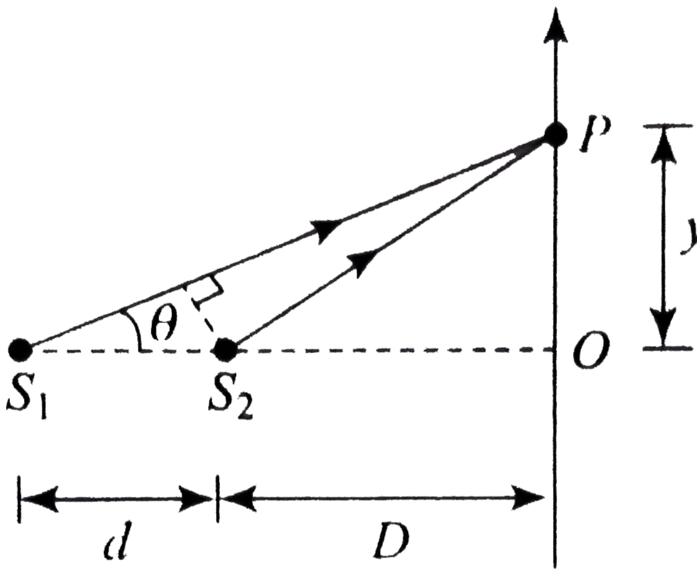
C. $2D\sqrt{2\left(1-\frac{n\lambda}{d}\right)}$

D. $D\sqrt{2\left(1-\frac{n\lambda}{2d}\right)}$

Answer: b

Watch Video Solution

30. In figure, a screen is placed normaol to the line joining the two point coherent sources S_1 and S_2. The interference pattern consists of concentric circles.



If $d = 0.5mm$, $\lambda = 5000Å$ and $D - 10cm$, find the value of n for the closest second bright ring.

A. 888

B. 830

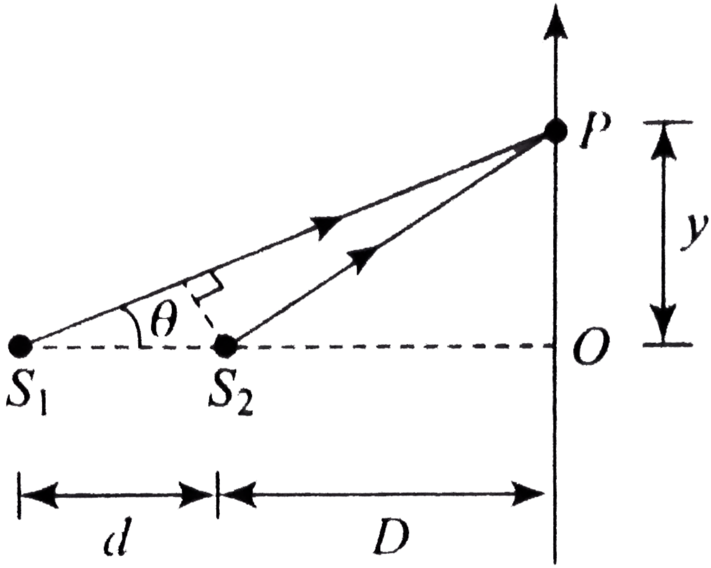
C. 914

D. 998

Answer: d

Watch Video Solution

31. In figure, a screen is placed normaol to the line joining the two point coherent sources S_1 and S_2. The interference pattern consists of concentric circles.



Also, find the value of radius for this ring.

A. 6.32 cm

B. 5.52 cm

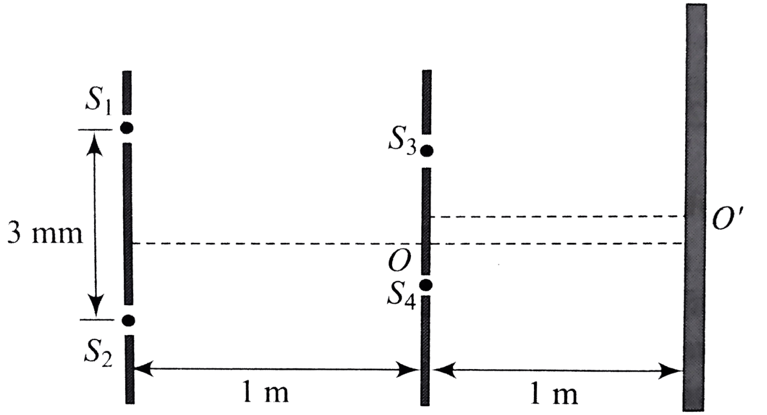
C. 4.7 cm

D. 3.25 cm

Answer: a

Watch Video Solution

32. In the arrangement shown in figure, light of wavelength 6000Å is incident on slits S_1 and S_2 have been opened such that S_3 is the position of first maximum above the central maximum and S_4 is the closest position where intensity is same as that of the ligth used, below the central maximum Point O is equidistant from S_1 and S_2 and O' is equidistant from S_3 and S_4. Then intensity of inciden light is I_0



Find the intensity at O' (on the screen).

A. $4.5I_0$

B. $3I_0$

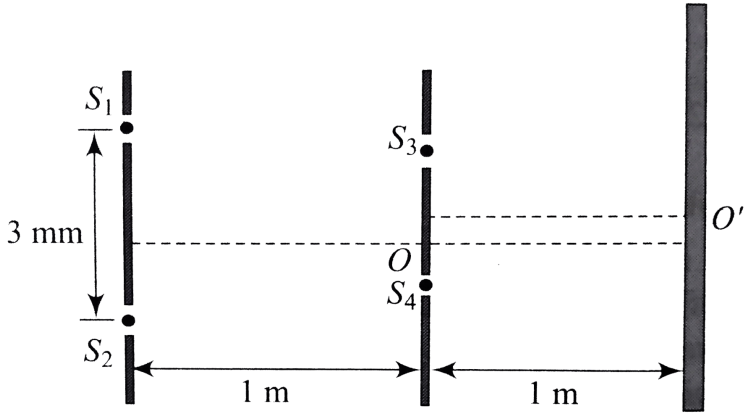
C. $2I_0$

D. $5I_0$

Answer: b

Watch Video Solution

33. In the arrangement shown in figure, light of wavelength 6000Å is incident on slits S_1 and S_2 have been opened such that S_3 is the position of first maximum above the central maximum and S_4 is the closest position where intensity is same as that of the ligth used, below the central maximum Point O is equidistant from S_1 and S_2 and O' is equidistant from S_3 and S_4. Then intensity of inciden light is I_0



Find the intensity of the brightest fringe.

A. $9I_0$

B. $5I_0$

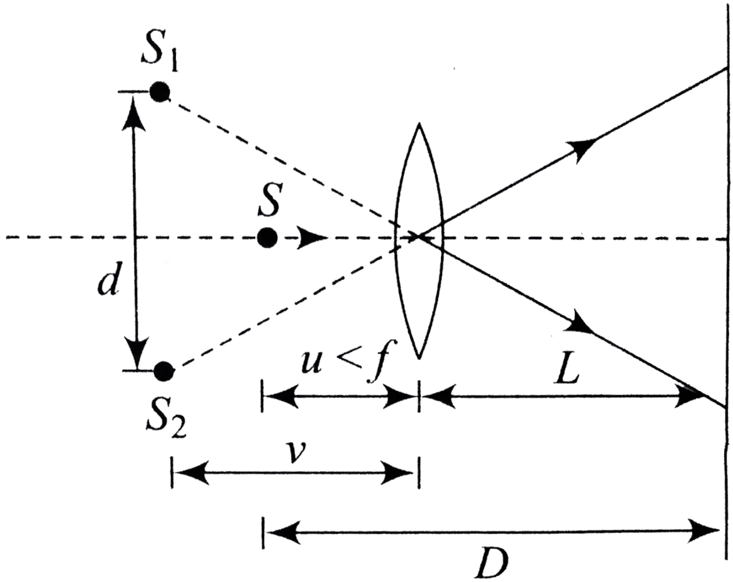
C. $3I_0$

D. $7I_0$

Answer: a

Watch Video Solution

34. A lens of focal length f is cut along the diameter into two identical halevs. In this process, a layer of the lens t in thickness is lost, then the halves are put together to form a composite lens. In between the focal plane and the composite lens, a narrow slit is placed near the focal plane. The slit is emitting monochromatic λ. Behind the lens, a screen is located at a distance L front it.



Find the fringe width for the pattern obtained under given arrangement on the screen.

A. $\frac{\lambda f}{2t}$

B. $\frac{\lambda f}{t}$

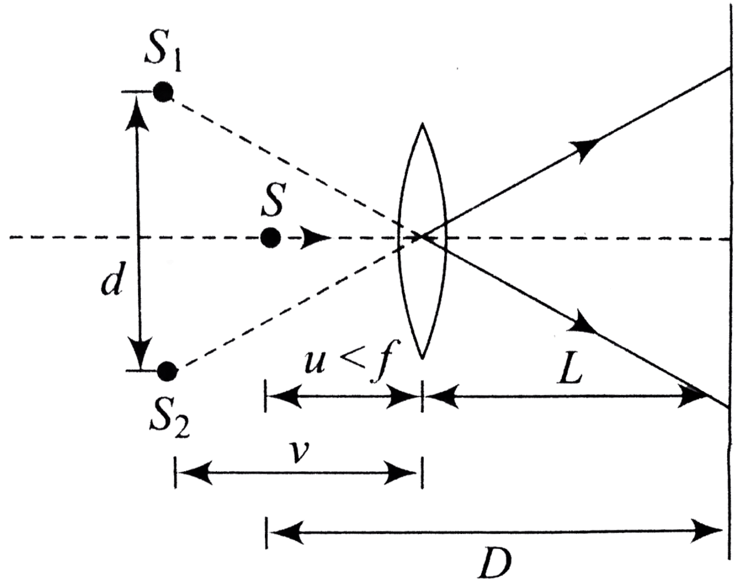
C. $\frac{tf}{\lambda}$

D. $\frac{tf}{\lambda 2}$

Answer: b

Watch Video Solution

35. A lens of focal length f is cut along the diameter into two identical halevs. In this process, a layer of the lens t in thickness is lost, then the halves are put together to form a composite lens. In between the focal plane and the composite lens, a narrow slit is placed near the focal plane. The slit is emitting monochromatic λ. Behind the lens, a screen is located at a distance L front it.



The expression for the number of visible maxima which are obtained through above said arrangement will turn out to be

A. $\dfrac{Lt^2}{\lambda f^2}$

B. $\dfrac{2Lt^2}{\lambda f^2}$

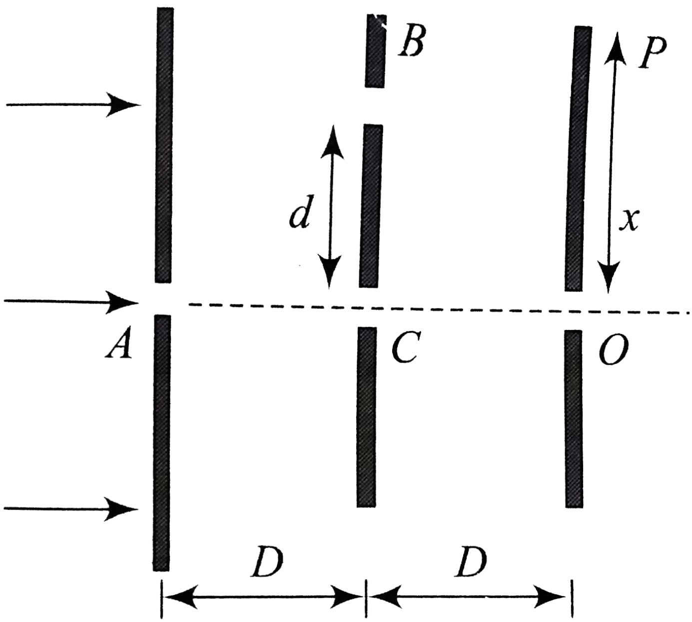
C. $\dfrac{Lt}{2\lambda f^2}$

D. $\frac{Lt^2}{2\lambda f^2}$

Answer: d

Watch Video Solution

36. In the arrangment shown in fin.



For what minimum value of d is there a dark bant at point O on the screen?

A. $\sqrt{\frac{D\lambda}{4}}$

B. $\sqrt{\frac{3D\lambda}{4}}$

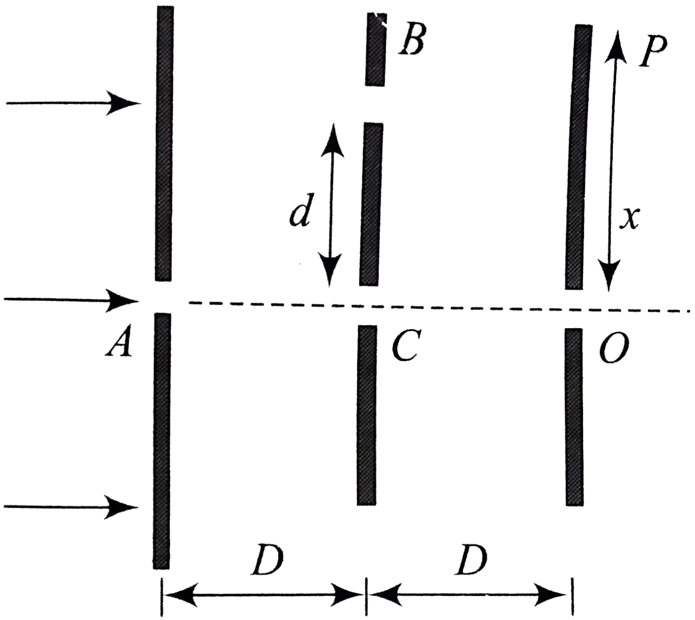
C. $\sqrt{\frac{D\lambda}{8}}$

D. $\sqrt{\frac{2D\lambda}{43}}$

Answer: a

Watch Video Solution

37. In the arrangment shown in fin.



Find the distance x at which the next fringe is formed.

A. $\frac{3\lambda}{2}$

B. $\frac{\lambda}{4}$

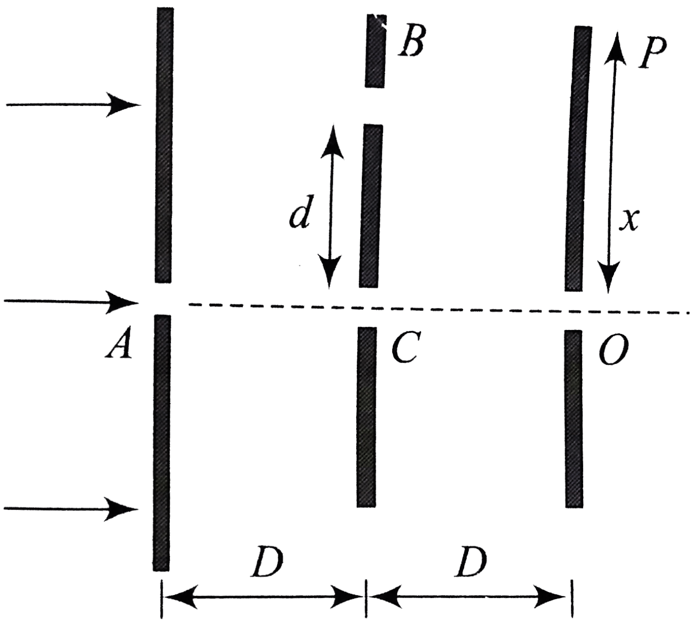
C. $\frac{\lambda}{2}$

D. $\frac{5\lambda}{2}$

Answer: c

Watch Video Solution

38. In the arrangment shown in fin.



Find the

fringe width.

A. d

B. 2d

C. 4d

D. 3d

Answer: b

Watch Video Solution

39. Consider the situation shown in figure. The two slite S_1 and S_2

placed symmetrically around the centre line are illuminated by a monochromatic light of wavelength lambda. The separation between the slits is d. The light transmitted by the slits falls on a screen M_1 placed at a distance D from the slits. The slit S_3 is at the centre line and the slit S_4 is at a distance y form S_3. Another screen M_2 is placed at a further distance D away from M_1. Find the ration of the maximum to minimum intensity observed on M_2 if y is equal to $(d < < D)$.

$(\#\#DCP_V05_C32_S01_{022} - Q01.png \text{ width}=80\% >$

(a) $\frac{\lambda D}{2d}$ (b) $\frac{\lambda D}{d}$ (c) $\frac{\lambda D}{4d}$

A. 1

B. $1/2$

C. $3/2$

D. 2

Answer: a

Watch Video Solution

40. Consider the situation shown in figure. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by a monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted by the slits falls on a screen Σ_1 placed at a distance D from the slits. The slit S_3 is at the placed central line and the slit S_4, is at a distance z from S_3. Another screenΣ_2 is placed a further distance D away from 1,1. Find the ratio of the maximum to minimum intensity observed on Σ_2 if z is equal to a. $z = \frac{\lambda D}{2d}$ b. $\frac{\lambda D}{d}$ c. $\frac{\lambda D}{4d}$

A. 4

B. 2

C. ∞

D. 1

Answer: c

Watch Video Solution

41. Consider the situation shown in figure. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by a monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted by the slits falls on a screen Σ_1 placed at a distance D from the slits. The slit S_3 is at the placed central line and the slit

S_4, is at a distance z from S_3. Another screenΣ_2 is placed a further distance D away from 1,1. Find the ratio of the maximum to minimum intensity observed on Σ_2 if z is equal to a. $z = \frac{\lambda D}{2d}$ b. $\frac{\lambda D}{d}$

c. $\frac{\lambda D}{4d}$

A. $\left[3 - 2\sqrt{2}\right]^2$

B. $\left[3 + \sqrt{2}\right]^2$

C. $\left[3 - \sqrt{2}\right]^2$

D. $\left[3 + 2\sqrt{2}\right]^2$

Answer: d

Watch Video Solution

Watch Video Solution

42. The arrangement for a mirror experiment is shown in figure. S is a point source of frequency $6 \times 10^{14} Hz$. D and C represent the two ends of a mirror placed horizontally and LOM represents the screen.

Determine the width of the region where the fringes will be visible

A. 4 cm

B. 6 cm

C. 2 cm

D. 3 cm

Answer: c

View Text Solution

43. The arrangement for a mirror experiment is shown in figure. S is a point source of frequency $6 \times 10^{14} Hz$. D and C represent the two ends of a mirror placed horizontally and LOM represents the screen.

Find the fringe width of the fringe pattern ?

A. 0.05 cm

B. 0.25 cm

C. 0.01 cm

D. 0.1 cm

Answer: a

Watch Video Solution

44. The arrangement for a mirror experiment is shown in figure. S is a point source of frequency $6 \times 10^{14} Hz$. D and C represent the two ends of a mirror placed horizontally and LOM represents the screen.

Calculate the number of fringes

A. 10

B. 20

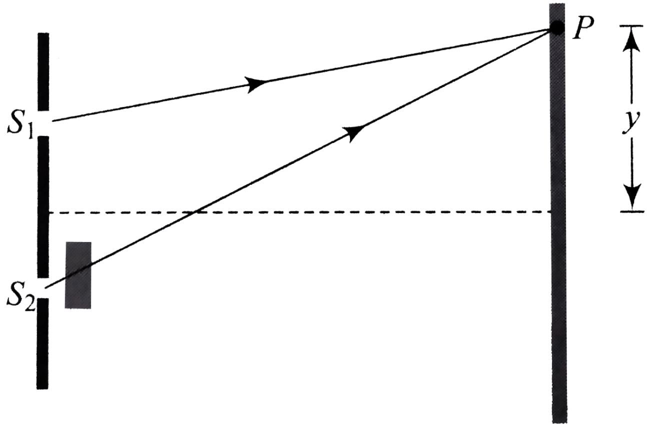
C. 30

D. 40

Answer: d

Watch Video Solution

45. Young's double-slit experiment setup with ligth of wavelength $\lambda = 6000 \text{Å}$, distance between two slit in 2 mm and distance between the plane of slits and the screen. Is 2 m. The slits are of equal intensity. When a sheet of glass of refractive index 1.5 (which permtis only a fraction η of the incident light to pass through) and thickness 8000Å is placed in front of the lower slit, it is observed that the intensity at a point P, 0.15 mm above the central maxima, does not change.



The phase difference at point P without inserting the slab is

A. $3\pi / 4$

B. $\pi / 4$

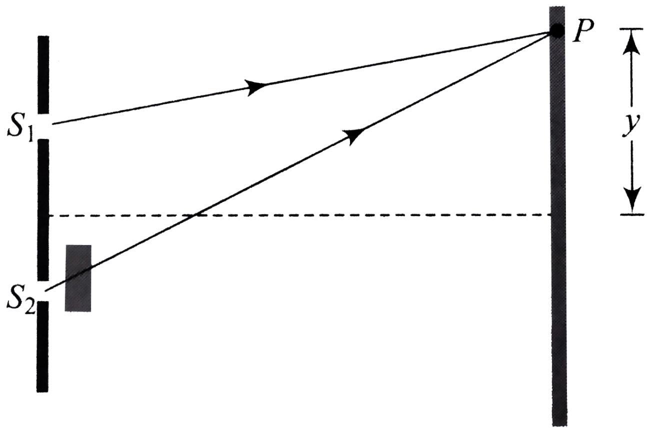
C. $\pi / 2$

D. $\pi / 3$

Answer: c

Watch Video Solution

46. Young's double-slit experiment setup with ligth of wavelength $\lambda = 6000 \text{Å}$, distance between two slit in 2 mm and distance between the plane of slits and the screen. Is 2 m. The slits are of equal intensity. When a sheet of glass of refractive index 1.5 (which permtis only a fraction η of the incident light to pass through) and thickness 8000Å is placed in front of the lower slit, it is observed that the intensity at a point P, 0.15 mm above the central maxima, does not change.



Intensity at point P is

A. $3I_0$

B. I_0

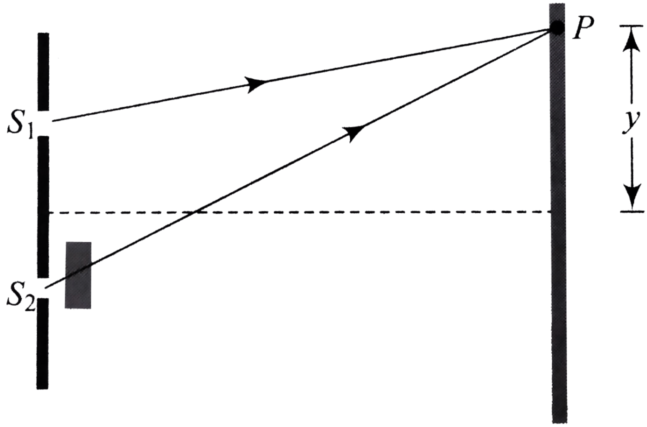
C. $2I_0$

D. $8I_0$

Answer: c

Watch Video Solution

47. Young's double-slit experiment setup with ligth of wavelength $\lambda = 6000 \text{Å}$, distance between two slit in 2 mm and distance between the plane of slits and the screen. Is 2 m. The slits are of equal intensity. When a sheet of glass of refractive index 1.5 (which permtis only a fraction η of the incident light to pass through) and thickness 8000Å is placed in front of the lower slit, it is observed that the intensity at a point P, 0.15 mm above the central maxima, does not change.



The value of η is

A. 0.21

B. 0.42

C. 0.12

D. 0.5

Answer: a

Watch Video Solution

48. An interference is observed due to two coherent sources S_1 placed at origin and S_2 placed at $(0, 3\lambda, 0)$. Here, lambda is the wavelength of the sources. A detector D is moved along the positive x-axis. Find x-coordinates on the x-axis (excluding $x = 0$ and $x = \infty$) where maximum intensity is observed.

A. two

B. four

C. three

D. five

Answer: b

Watch Video Solution

49. An interference is observed due to two coherent sources S_1 placed at origin and S_2 placed at $(0, 3\lambda, 0)$. Here, lambda is the wavelength of the sources. A detector D is moved along the positive x-axis. Find x-coordinates on the x-axis (excluding $x = 0$ and $x = \infty$) where maximum intensity is observed.

A. $x = 4\lambda$

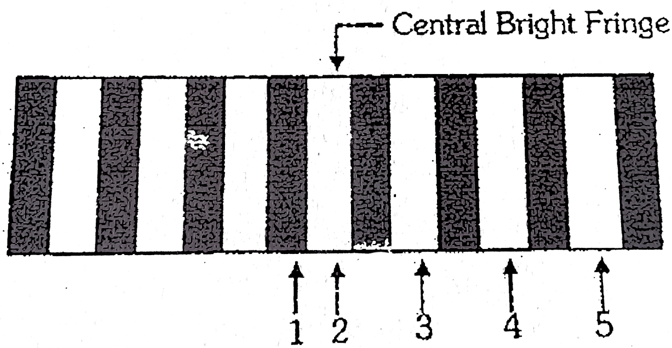
B. $x = 7\lambda/4$

C. $x = 5\lambda/4$

D. $x = 3\lambda$

Answer: a.,c

Watch Video Solution

50. 

The figure shows the interfernece pattern obtained in double slit experiment using light of wavelength

600 nm.

Q. The third order bright fringe is

A. 2

B. 3

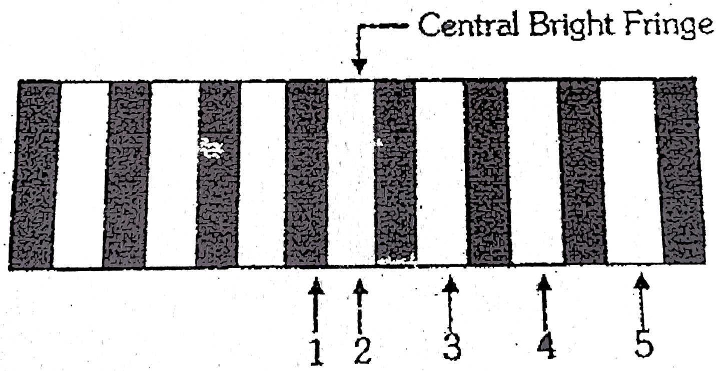
C. 4

D. 5

Answer: d

Watch Video Solution

51.



The figure shows the interfernece pattern obtained in double slit experiment using light of wavelength 600 nm.

Q. Which fringe results from a phase difference of 4π between the light waves incidenting from two slits?

A. a. 2

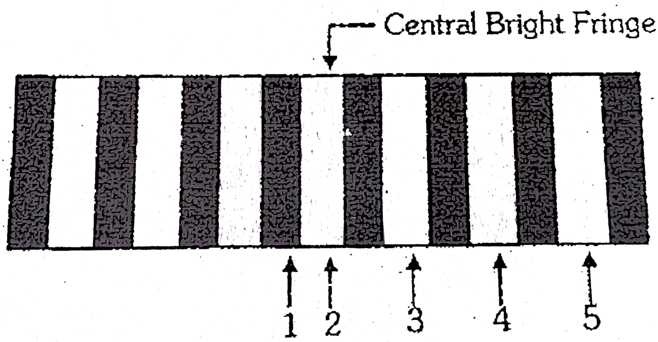
B. b. 3

C. c. 4

D. d. 5

Answer: c

Watch Video Solution

52. 

The figure shows the interfernece pattern obtained in double slit experiment using light of wavelength

600 nm.

Q. Let ΔX_A and ΔX_C represent path differences between waves interering at 1 and 3 respectively then $(|\Delta X_C| - (|\Delta X_A|)$ is equal to

A. 0

B. 300mn

C. 600nm

D. 900nm

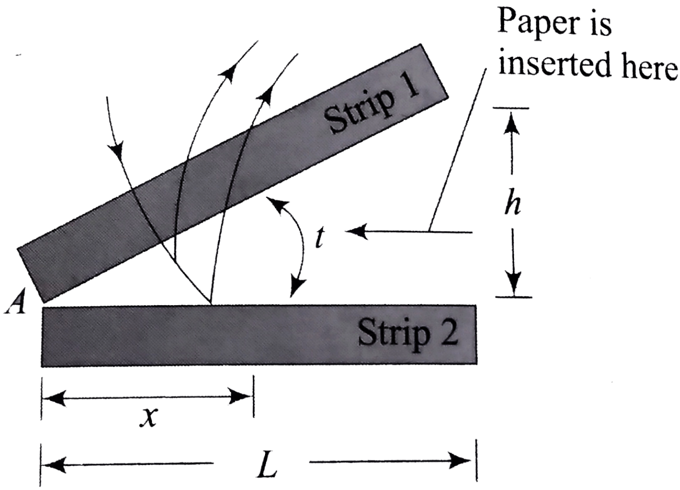
Answer: b

Watch Video Solution

53. This interference film is used to measure the thickness of slides, paper, etc. The arrangement is as shown in fig. For the sake of clarity, the two strips are shown thick. Consider the wedge formed in between strips 1 and 2. If the interference pattern because of the two waves reflected from wedge surface is observed, then from the observed data we can compute thickness of paper, refractive index of the medium filled in wedge, number of bonds formed, etc.

Considre the strips to be thick as compared to wavelength of ligth and light is incident normally. Neglect the effect due to reflection from top surface of strip 1 and bottom surface of strip 2.

Take $L = 5cm$ and $\lambda_{air} = 40nm$.



Consider an air wedge formed by two glass plates. having refractive index 1.5 by placing a piece of paper of thickness 20 mm. Determine the number of dark bands formed.

A. 1000

B. 500

C. 5000

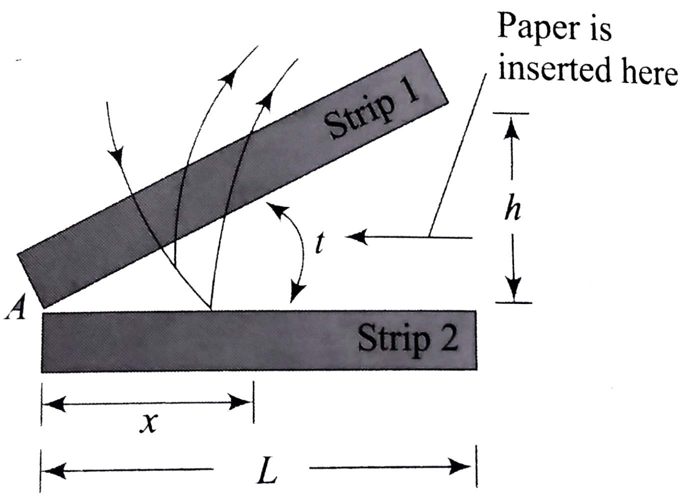
D. 500

Answer: b

Watch Video Solution

54. This interference film is used to measure the thickness of slides, paper, etc. The arrangement is as shown in fig. For the sake of clarity, the two strips are shown thick. Consider the wedge formed in between strips 1 and 2. If the interference pattern because of the two waves reflected from wedge surface is observed, then from the observed data we can compute thickness of paper, refractive index of the medium filled in wedge, number of bonds formed, etc.

Considre the strips to be thick as compared to wavelength of ligth and light is incident normally. Neglect the effect due to reflection from top surface of strip 1 and bottom surface of strip 2. Take $L = 5cm$ and $\lambda_{air} = 40nm$.



For strip 1 refractive index is 1.34 abd for strip 2 refractive index is 1.6 The wedge. is filled with a medium having refractive index 1.5. Then

A. the band jat contact point would be dark

B. the band at contact point would be bright

C. at contact point, maxima or minima occurs

D. at contact point, uniform illumination would be there

Answer: b

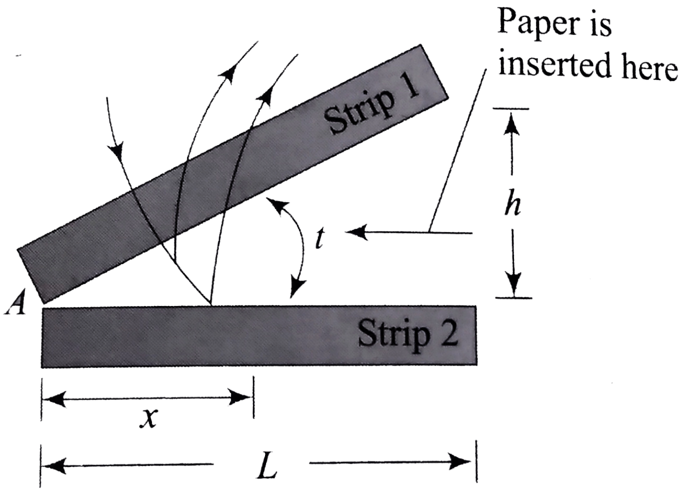
Watch Video Solution

55. This interference film is used to measure the thickness of slides, paper, etc. The arrangement is as shown in fig. For the sake of clarity, the two strips are shown thick. Consider the wedge formed in between strips 1 and 2. If the interference pattern because of the two waves reflected from wedge surface is observed, then from the observed data we can compute thickness of paper, refractive index of the medium filled in wedge, number of bonds formed, etc.

Considre the strips to be thick as compared to wavelength of ligth and light is incident normally.

Neglect the effect due to reflection from top surface of strip 1 and bottom surface of strip 2.

Take $L = 5cm$ and $\lambda_{\text{air}} = 400nm$,h=20mm.



In question 53, if air wedge has been filled with a medium having refractive index 1.3 then find the number of bright bands.

A. 199

B. 99

C. 499

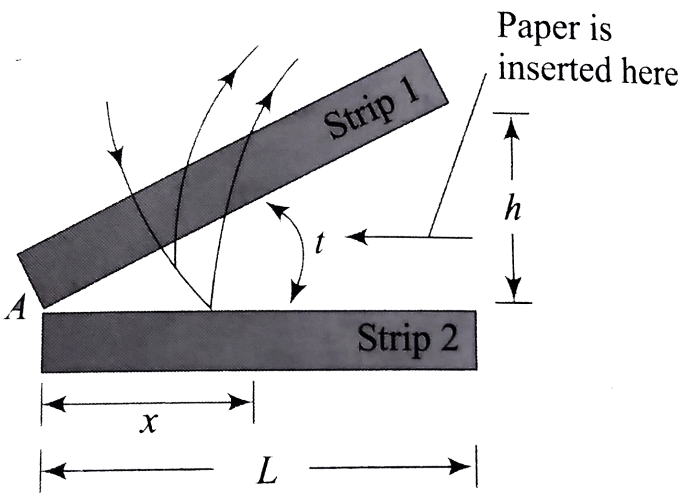
D. 130

Answer: d

Watch Video Solution

56. This interference film is used to measure the thickness of slides, paper, etc. The arrangement is as shown in fig. For the sake of clarity, the two strips are shown thick. Consider the wedge formed in between strips 1 and 2. If the interference pattern because of the two waves reflected from wedge surface is observed, then from the observed data we can compute thickness of paper, refractive index of the medium filled in wedge, number of bonds formed, etc.

Considre the strips to be thick as compared to wavelength of ligth and light is incident normally. Neglect the effect due to reflection from top surface of strip 1 and bottom surface of strip 2. Take $L = 5cm$ and $\lambda_{air} = 40nm$.



For data in question53 determine the distance of point B from the 20th dark band. Counting of dark point has to start from the contact point.

A. 4 cm

B. 3 cm

C. 5 cm

D. 2cm

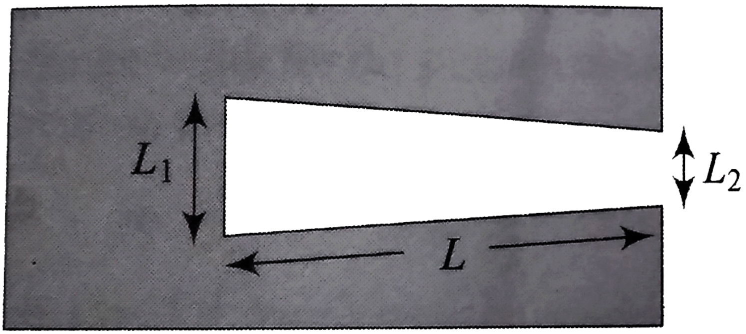
Answer: a

Watch Video Solution

57. A block o plastic having a thin air cavity (whose thickenss is comparable to wavelength of light waves) is shown in fig. The thickness of air cavity (which can be considered as air wedge for interference pattern) is varying linearly from one end to other as shown.

A broad beam of monochromatic light is incident normally from the top of the plastic box. Some ligth lis reflected back above and below the cavity .The plastic layers than wavelength of incident light . An observer when looking down from top sees an interference pattern consisting of eight dark fringes and seven bright fringe along the wedge. Take wavelength of incident light in air as λ_0 and refractive index of plastic as μ

Assume that the thickness of the ends of air cavity are such that formation of fringe takes place there.



Determine of difference $L_1 - L_2 = \Delta L)$ in terms of λ_0.

A. $\dfrac{4\lambda_0}{\mu}$

B. $\dfrac{7\lambda_0}{2\mu}$

C. $\dfrac{3\lambda_0}{\mu}$

D. None of the above

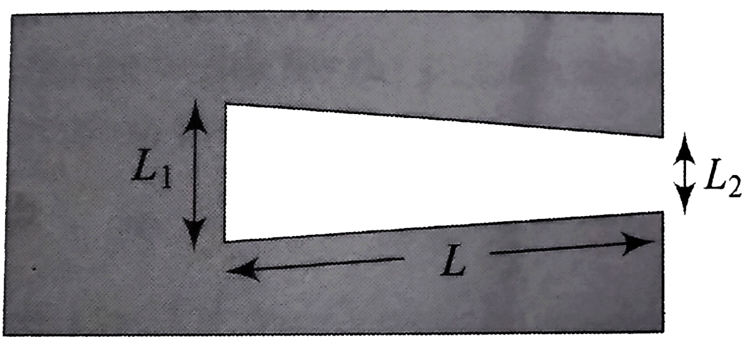
Answer: b

Watch Video Solution

58. A block o plastic having a thin air cavity (whose thickenss is comparable to wavelength of light waves) is shown in fig. The thickness of air cavity (which can be considered as air wedge for interference pattern) is varying linearly from one end to other as shown.

A broad beam of monochromatic light is incident normally from the top of the plastic box. Some ligth lis reflected back above and below the cavity .The plastic layers than wavelength of incident light . An observer when looking down from top sees an interference pattern consisting of eight dark fringes and seven bright fringe along the wedge. Take wavelength of incident light in air as λ_0 and refractive index of plastic as μ

Assume that the thickness of the ends of air cavity are such that formation of fringe takes place there.



Determine the distance of 4th dark fringe from the left end of air cavity.

A. $\frac{2L}{6} + \lambda_0$

B. $L_1 + \frac{3L}{4}$

C. $\frac{4L}{7}$

D. $\frac{5L}{7}$

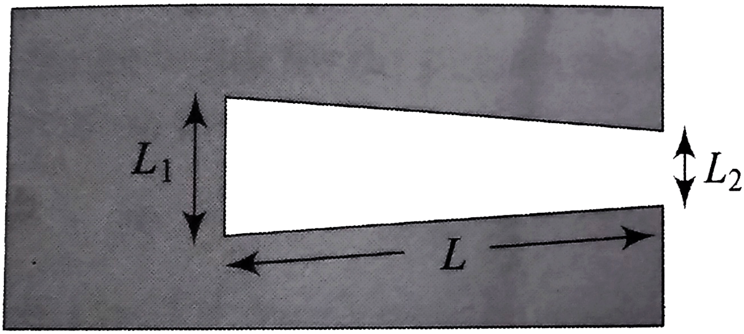
Answer: c

Watch Video Solution

59. A block o plastic having a thin air cavity (whose thickenss is comparable to wavelength of light waves) is shown in fig. The thickness of air cavity (which can be considered as air wedge for interference pattern) is varying linearly from one end to other as shown.

A broad beam of monochromatic light is incident normally from the top of the plastic box. Some ligth lis reflected back above and below the cavity .The plastic layers than wavelength of incident light . An observer when looking down from top sees an interference pattern consisting of eight dark fringes and seven bright fringe along the wedge. Take wavelength of incident light in air as λ_0 and refractive index of plastic as μ

Assume that the thickness of the ends of air cavity are such that formation of fringe takes place there.



Determine the separation between 1st and 2nd dark fringes form the left end of air cavity

A. $\frac{3L}{7} + \frac{2\lambda_0}{\mu}$

B. $\frac{5L}{7}$

C. $\frac{4L}{7}$

D. $\frac{6L}{7}$

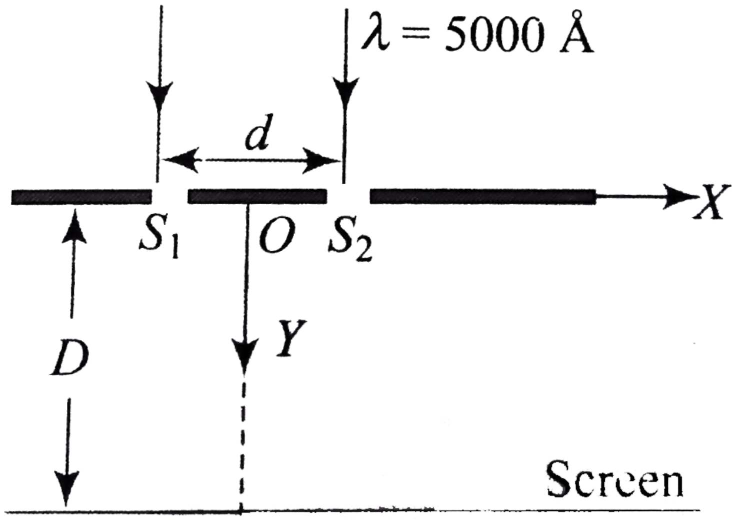
Answer: d

Watch Video Solution

60. In fig., light of wavelength $\lambda = 5000\text{Å}$ is incident on the slits (in a horizontally fixed place).

Here, $d = 1mm$ and $D = 1m$

Take origin at O and XY plane as shown in the figure. The screen is released from rest from the initial position as shown



The velocity of central maxima at $t = 5$s is

A. $50 ms^{-1}$ along Y-axis

B. $50 ms^{-1}$ along negative Y-axis

C. $25 ms^{-1}$ along Y-axis

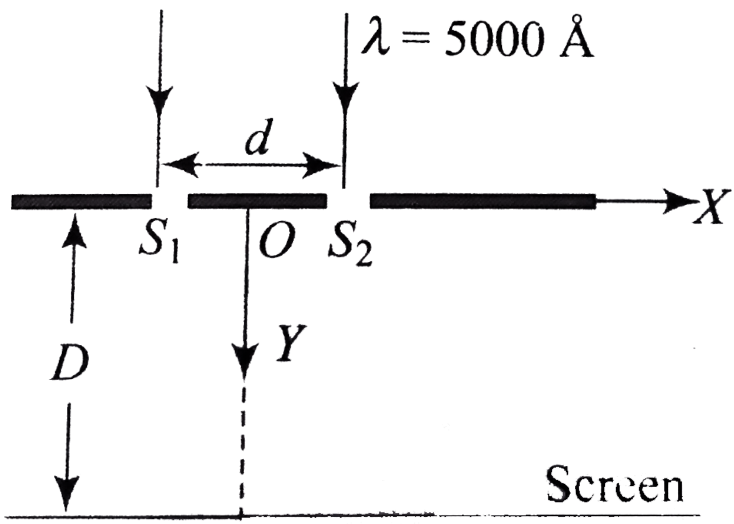
D. $3 \times 10^8 ms^{-1}$ along Y-axis

Answer: a

Watch Video Solution

61. In fig., light of wavelength $\lambda = 5000Å$ is incident on the slits (in a horizontally fixed place). Here, $d = 1mm$ and $D = 1m$

Take origin at O and XY plane as shown in the figure. The screen is released from rest from the initial position as shown



Velocity of 2nd maixma w.r.t central maxima at $t = 2$s is

A. $\left(8cms^{-1}\right)\hat{i} + 20ms^{-1}\hat{j}$

B. $8cms^{-1}\hat{i}$

C. $2cms^{-1}\hat{i}$

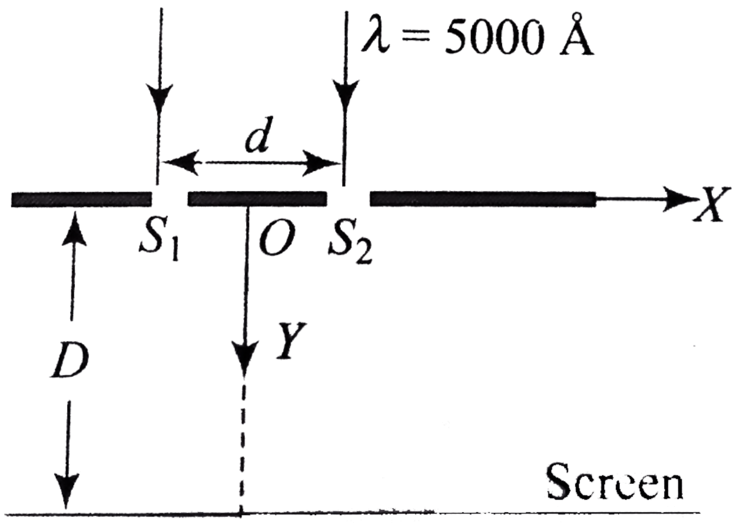
D. $86ms^{-1}\hat{i}$

Answer: c

Watch Video Solution

62. In fig., light of wavelength $\lambda = 5000 \text{Å}$ is incident on the slits (in a horizontally fixed place). Here, $d = 1mm$ and $D = 1m$

Take origin at O and XY plane as shown in the figure. The screen is released from rest from the initial position as shown



Acceleration of 3rd maxima w.r.t. 3rd maxiam on other side of central maxima at $t = 3$ s is

A. $0.02ms^{-1}\hat{i}$

B. $0.03ms^{-1}\hat{i}$

C. $10ms^{-1}\hat{j}$

D. $0.6ms^{-2}\hat{i}$

Answer: a

Watch Video Solution

63. When two coherent sources interact with each other, there will be production of alternate bright and dark fringes on the screen . Young's double-slit experiment domonstrates the idea of making two coherent sources. For better visibility, one has to choose proper amplitude for the sources. The phenomena is good enough to satisfy the conservation of energy principle. The pattern formed in YDSE is of uniform thickness and is nicely placed on a long distance screen.

Law of convervation of energy is satisfied because

A. equal loss and gain in intensity is observed

B. all bright fringes are equally brigth

C. all dark frings are of zero brigthness

D. the average intensity on screen is equal to the sum of intensities of the two sources

Answer: d

Watch Video Solution

64. When two coherent sources interact with each other, there will be production of alternate bright and dark fringes on the screen . Young's double-slit experiment domonstrates the idea of making two coherent sources. For better visibility, one has to choose proper amplitude for the sources. The phenomena is good enough to satisfy the conservation of energy principle. The pattern formed in YDSE is of uniform thickness and is nicely placed on a long distance screen.

For better visibility of fringe pattern

A. amplitude of the sources are equal

B. the width of the slits should not be equal

C. dark should be the darkest and bright should be the brightest

D. the widths should be same

Answer: a.,c.,d

Watch Video Solution

65. When two coherent sources interact with each other, there will be production of alternate bright and dark fringes on the screen . Young's double-slit experiment domonstrates the idea of making two coherent sources. For better visibility, one has to choose proper amplitude for the sources. The phenomena is good enough to satisfy the conservation of energy principle. The pattern formed in YDSE is of uniform thickness and is nicely placed on a long distance screen.

The best combination of independent sources to produce sustained pattern among the following is

$Y_1 = a \sin \omega t \; Y_2 = a \cos \omega t$

$Y_3 = a \sin\left(\omega t + \frac{\pi}{4}\right) \; Y_4 = 2a \sin(\omega t + \pi)$

A. Y_1, Y_2 only

B. Y_2, Y_3 only

C. Y_3, Y_4 only

D. none of these

Answer: d

Watch Video Solution

66. When a light wave passes from a rarer medium to a denser medium, there will be a phase change of π radians. This difference brings change in the conditions for constructive and destructive interference. This phenomena also reasons the fromation of interference pattern in thin films like, oily layer, soap film, etc., but has no reason on the shifting of fringes from the central portion outward. The shift is dependent on the refractive index of the material as per the relation,

$\Delta y = (\mu - 1)t$

The condition for constructive interference in

Lloyd's single mirror experiment is the path difference which is equal to

A. point or spherical source

B. broad source

C. film thickness of the order of $10, 000\text{Å}$

D. very thick transparent slabs

Answer: b., c

Watch Video Solution

67. When a light wave passes from a rarer medium to a denser medium, there will be a phase change of π radians. This difference brings change in the conditions for constructive and destructive interference. This phenomena also reasons the fromation of interference pattern in thin films like, oily layer, soap film, etc., but has no reason on the shifting of fringes from the central portion outward. The shift is dependent on the refractive index of the material as per the relation,

$\Delta y = (\mu - 1)t$

On introducing a transparent slab (μ) the central fringe shifts to the point originally occupied by the fifth bright fringe. The thickness of the slab is

A. $\frac{5\lambda}{\mu - 1}$

B. $\frac{4\lambda}{\mu - 1}$

C. $\frac{\mu - 1}{4\lambda}$

D. $\frac{\mu - 1}{5\lambda}$

Answer: a

Watch Video Solution

68. When a light wave passes from a rarer medium to a denser medium, there will be a phase change of π radians. This difference brings change in the conditions for constructive and destructive interference. This phenomena also reasons the fromation of interference pattern in thin films like, oily layer, soap film, etc., but has no reason on the shifting of fringes from the central portion outward. The shift is dependent on the refractive index of the material as per the relation, $\Delta y = (\mu - 1)t$

The condition for constructive interference in

Lloyd's single mirror experiment is the path difference which is equal to

A. $N\lambda$

B. $(2N-1)\frac{\lambda}{2}$

C. $(N-1)\frac{\lambda}{2}$

D. $\frac{\lambda}{2(2N-1)}$

Answer: b

Watch Video Solution

69. When light from two sources (say slits S_1 and S_2) interfere, they form alternate dark and bright fringes. Bright fringe is formed at all point where the path difference is an odd multiple of half wavelength. At the condition of equal amplitudes, $A_1 = A_2 = a$, the maximum intensity will be $4a^2$ and the visibility improves, The resultant intensity can also be indicated with phase factor as $I = 2a^2 \cos^2(\phi / 2)$.Using this passage, answer the following questions.

If the path difference between the slits S_1 and S_2 is $\frac{\lambda}{2}$ the central fringe will have an intensity of

A. 0

B. a^2

C. $2a^2$

D. $4a^2$

Answer: a

Watch Video Solution

70. When light from two sources (say slits S_1 and S_2) interfere, they form alternate dark and bright fringes. Bright fringe is formed at all point where the path difference is an odd multiple of half wavelength. At the condition of equal amplitudes, $A_1 = A_2 = a$, the maximum intensity will be $4a^2$ and the visibility improves, The resultant intensity can also be indicated with phase factor as $I = 2a^2 \cos^2(\phi/2)$.Using this passage, answer the following questions.

At point having a path difference of $\frac{\lambda}{4}$, the intensity

A. 0

B. a^2

C. $2a^2$

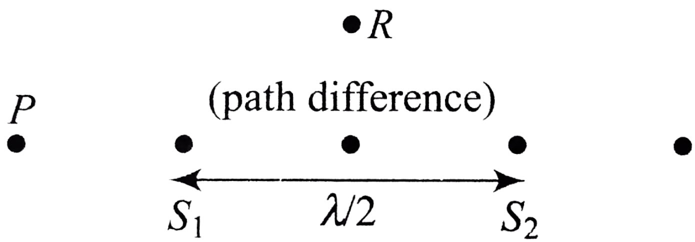
D. $a^2/2$

Answer: b

Watch Video Solution

71. When light from two sources (say slits S_1 and S_2) interfere, they form alternate dark and bright fringes. Bright fringe is formed at all point where the path difference is an odd multiple of half wavelength. At the condition of equal amplitudes, $A_1 = A_2 = a$, the maximum intensity will be $4a^2$ and the visibility improves, The resultant intensity can also be indicated with phase factor as $I = 2a^2 \cos^2(\phi/2)$.Using this passage, answer the following questions.

If the slits S_1 and S_2 are arranged as shown in Fig. the ratio of intensity of fringe at P and R is



A. 0

B. ∞

C. $1:1$

D. $1:2$

Answer: a

Watch Video Solution

72. A film with index of refraction 1.50 coats a glass lens with index of refraction 1.80. What is the minimum thickness of the thin film that will strongly reflect light with wavelength 600 nm?

A. 150 nm

B. 200 nm

C. 300 nm

D. 450 nm

Answer: b

Watch Video Solution

73. A thin film with index of refraction 1.33 coats a glass lens with index of refraction 1.50. Which of the following choices is the smallest film thickness that will not reflect light with wavelength 640 nm?

A. 160 nm

B. 240 nm

C. 360 nm

D. 480 nm

Answer: c

Watch Video Solution

74. A soap film of thickness t is surrounded by air and is illuminated at near normal incidence by monochromatic light wavelength λ in the film. With respect to the wavelength of the monochromatic light in the film, what film thickness will produce maximum constructive interference

A. $\frac{1}{4}\lambda$

B. $\frac{1}{2}\lambda$

C. 1λ

D. 2λ

Watch Video Solution

75. Thin films, including soap bubbles and oil show patterns of alternative dark and bright regions resulting from interference among the reflected ligth waves. If two waves are in phase, their crests and troughs will coincide. The interference will be cosntructive and the amlitude of resultant wave will be greater then either of constituent waves. If the two wave are not of phase by half a wavelength

(180°), the crests of one wave will coincide width the troughs of the other wave. The interference will be destructive and the ampliutde of the resultant wave will be less than that of either consituent wave.

1. When incident light I, reaches the surface at point a, some of the ligth is reflected as ray R_a and some is refracted following the path ab to the back of the film.

2. At point b, some of the light is refracted out of the film and part is reflected back through the film along path bc. At point c, some of the light is reflected back into the film and part is reflected out of the film as ray R_c.

R_a and R_c are parallel. However, R_c has travelled the extra distance within the film fo abc. If the angle of incidence is small, then abc is approxmately twice the film's thickness .

If R_a and R_c are in phase, they will undergo constructive interference and the region ac will be bright. If R_a and R_c are out of phase, they will undergo destructive interference and the region ac will be dark.

I. Refraction at an interface never changes the phase of the wave.

II. For reflection at the interfere between two media 1 and 2, if $n_1 > n_2$, the reflected wave will change phase. If $n_1 < n_2$, the reflected wave will not undergo a phase change.

For reference, $n_{air} = 1.00$.

III. If the waves are in phase after reflection at all intensities, then the effects of path length in the film are:

Constrictive interference occurs when $2t = m\lambda/n$, $m = 0, 1, 2, 3,...$

Destrcutive interference occurs when

$$2t = \left(m + \frac{1}{2}\right)\frac{\lambda}{n},$$

$m = 0, 1, 2, 3,...$

If the waves are 180° out of the phase after reflection at all interference, then the effects of path length in the film ara:

Constructive interference occurs when

$$2t = \left(m + \frac{1}{2}\right)\frac{\lambda}{n}, m = 0, 1, 2, 3,...$$

Destructive interference occurs when

$$2t = \frac{m\lambda}{n}, m = 0, 1, 2, 3,...$$

The average human eye sees colors with wavelength between 430 nm to 680 nm. For what visible wavelength (s) will a 350 nm thick $(n = 1.35)$ soap film produce maximum destructive interference?

A. 945 nm

B. 473 nm

C. 315 nm

D. None of these

Answer: b

Watch Video Solution

76. A 600 nm light is perpendicularly incident on a soap film suspended air. The film is $1.00\mu m$ thick with $n = 1.35$. Which statement most accurately describes the interference of light reflected by the two surfaces of the film?

A. The waves are close to destructive interference.

B. The waves are closed to constructive interference.

C. The waves how complete destructive interference.

D. The waves how complete constructive interference.

Answer: d

Watch Video Solution

77. A thin of liquid polymer, $n = 1.25$, coats a slab of Pyrex, $n = 1.50$. White light is incident perpendicularly on the film. In the reflection, full destructive interference occurs for $\lambda = 600nm$ and full constructive interference occurs for $\lambda = 700nm$ What is the thickness of the polymer film?

A. 120 nm

B. 280 nm

C. 460 nm

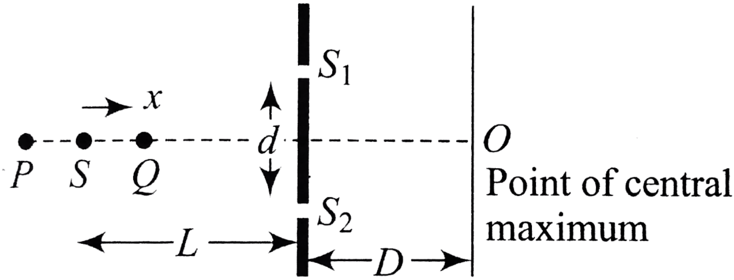
D. 840 nm

Answer: d

Watch Video Solution

78. In YDSE set up (see fig.), the light sources executes SHM between P and Q according to the equation $x = A\sin\omega t$, S being the mean position. Assume $d \to 0$ and $A < < L$. ω is small enough to neglect Doppler effect. If the sources were stationary at S, intenstiy at O would be I_0

Read the paragraph carefully and answer the following questions.



The fractional change in intensity of the central maximum as function of time is

A. $\dfrac{A\sin\omega t}{L}$

B. $\dfrac{2A\sin\omega t}{L}$

C. $\dfrac{3A\sin\omega t}{L}$

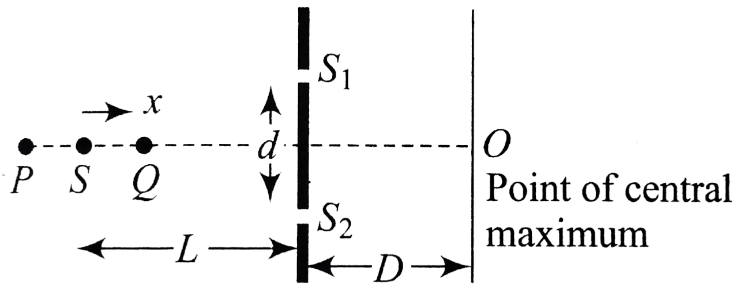
D. $\dfrac{4A\sin\omega t}{L}$

Answer: b

Watch Video Solution

79. In YDSE set up (see fig.), the light sources executes SHM between P and Q according to the equation $x = A \sin \omega t$, S being the mean position. Assume $d \to 0$ and $A < < L$. ω is small enough to neglect Doppler effect. If the sources were stationary at S, intenstiy at O would be I_0

Read the paragraph carefully and answer the following questions.



When the source comes toward the point Q,

A. the bright fringe will be less bright.

B. the dark fringe will no longer remain dark

C. the fringe width will increase

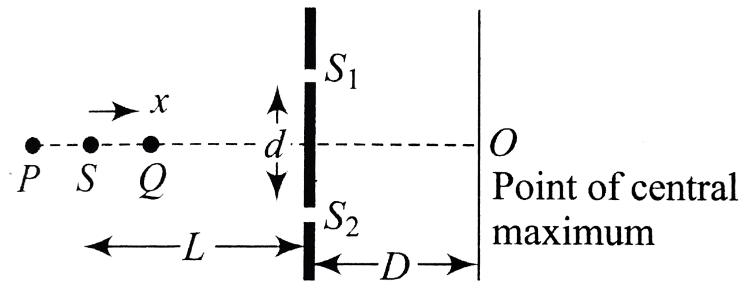
D. none of these

Answer: d

Watch Video Solution

80. In YDSE set up (see fig.), the light sources executes SHM between P and Q according to the equation $x = A \sin \omega t$, S being the mean position. Assume $d \to 0$ and $A < < L$. ω is small enough to neglect Doppler effect. If the sources were stationary at S, intenstiy at O would be I_0

Read the paragraph carefully and answer the following questions.



The fringe width β can be expressed as

A. $\beta = \beta_0 \sin \omega t$

B. $\beta = \beta_0 \cos \omega t$

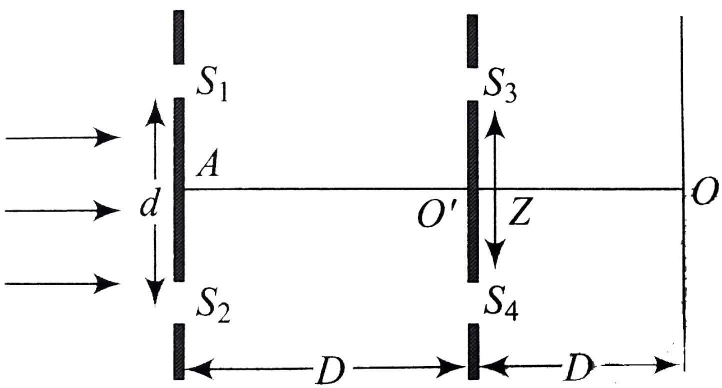
C. $\beta = \beta_0 \sin 2\omega t$

D. none of these

Answer: d

Watch Video Solution

81. In the arrangement shown in Fig., slits S_1 and $S_4$are having a variable separation Z. Point O on the screen is at the common perpendicular bisector of S_1S_2 and S_3S_4.



When $Z = \frac{\lambda D}{2d}$, the intensity measured at O is I_0.

The intensity at O When $Z = \frac{2\lambda D}{d}$ is

A. I_0

B. $2I_0$

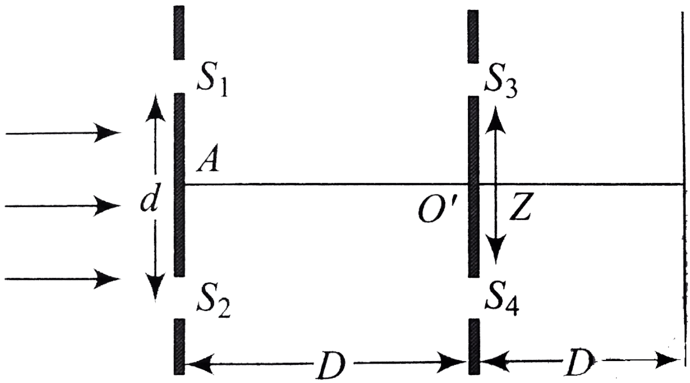
C. $3I_0$

D. $4I_0$

Answer: b

Watch Video Solution

82. In the arrangement shown in Fig., slits S_1 and $S_4$are having a variable separation Z. Point O on the screen is at the common perpendicular bisector of S_1S_2 and S_3S_4.



The minimum value of Z for which the intensity at O is zero is

A. $\frac{2\lambda D}{d}$

B. $\frac{\lambda D}{2d}$

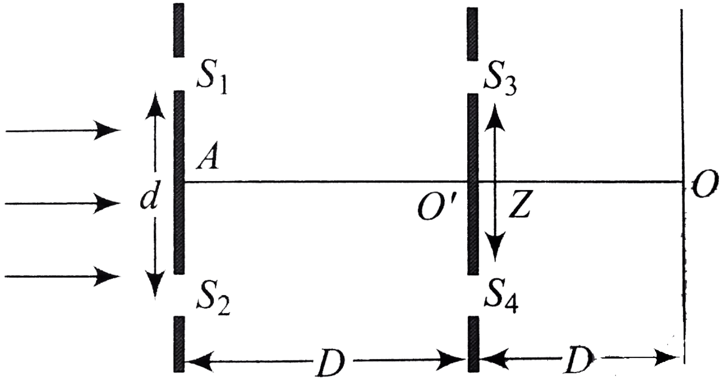
C. $\frac{\lambda D}{3d}$

D. $\frac{\lambda D}{d}$

Answer: d

Watch Video Solution

83. In the arrangement shown in Fig., slits S_1 and $S_4$are having a variable separation Z. Point O on the screen is at the common perpendicular bisector of S_1S_2 and S_3S_4.



If a hole is made at O' on AO' O and the slit S_4 is closed, then the ratio of the maximum to minimum observed on screen at O , if $O'S_3$ is equal to $\frac{\lambda D}{4d}$, is

A. 1

B. infinity

C. 34

D. 4

Answer: c

Watch Video Solution

84. In Young's double-slit experiment $\lambda = 500nm, d = 1mm,$ and $D = 4m.$ The minimum distance from the central maximum for which the intensity is half of the maximum intensity is $' * ' \times 10^{-4}m.$ What is the value of $' * '$?

Watch Video Solution

85. A monochromatic light of $\lambda = 5000 \text{Å}$ is incident on two identical slits separated by a distance of 5×10^{-4} m. The interference pattern is seen on a screen placed at a distance of 1 m from the plane of slits. A thin glass plate of thickness 1.5×10^{-6} m and refractive index $\mu = 1.5$ is placed between one of the slits and the screen . Find the intensity at the center of the screen.

Watch Video Solution

86. A screen is at distance $D = 80$ cm form a diaphragm having two narrow slits S_1 and S_2

which are $d = 2$ mm apart.

Slit S_1 is covered by a transparent sheet of

thickness

$t_1 = 2.5\mu m$ slit S_2 is covered by another sheet of

thickness

$t_2 = 1.25\mu m$ as shown if Fig. 2.52.

Both sheets are made of same material having

refractive index $\mu = 1.40$

Water is filled in the space between diaphragm and

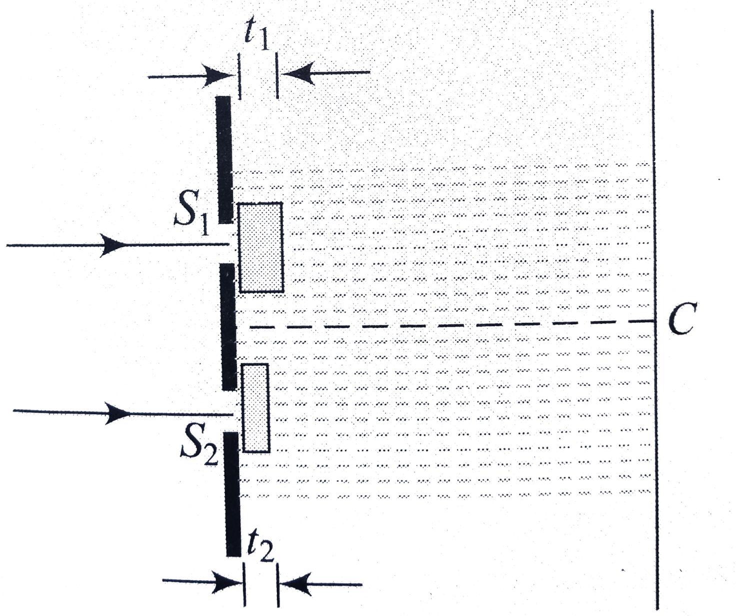
screen. A monochromatic light beam of wavelength

$\lambda = 5000Å$ is incident normally on the diaphragm.

Assuming intensity of beam to be uniform,

calculate ratio of intensity of C to maximum

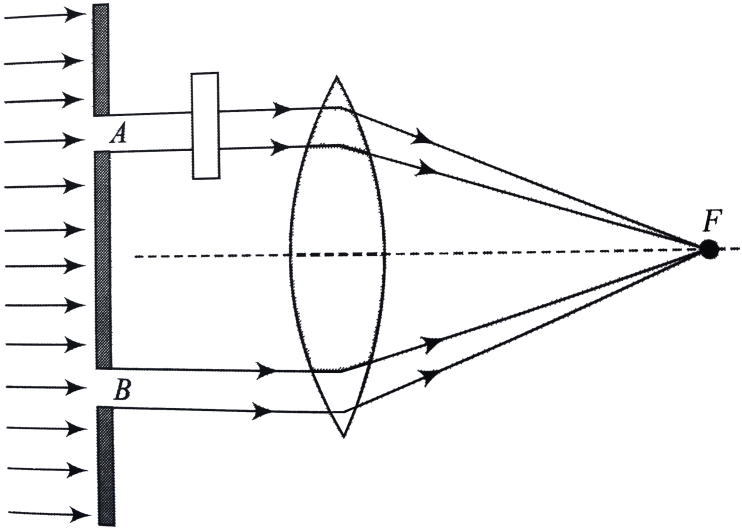
intensity of interference pattern obtained on the screen $(\mu_w = 4/3)$



Watch Video Solution

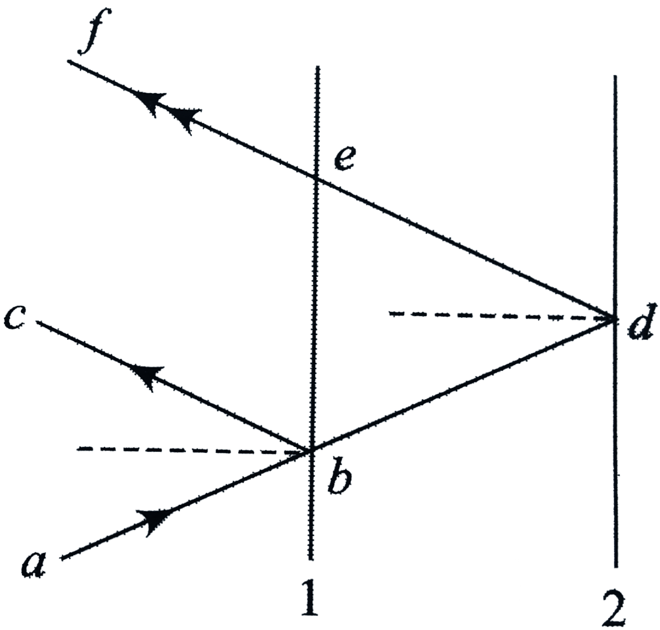
87. In a modified Young's double-slit experiment, a monochromatic uniform and parallel beam of light of wavelength 6000Å and intensity $(10/\pi)$ W m^{-2}

is incident normally on two circular apertures A and B of radii 0.001 m and 0.002 m, respectively. A perfectly transparent film of thickness 2000Å and refractive index 1.5 for the wavelength of 6000Å is placed in front of aperture A (see figure) Calculate the power (in watt) received at the focal spot F of the lens. The lens is symmetrically placed with respect to the apertur. Assume that 10% of the power received by each aperture goes in the original direction and is brought to the focal spot.



Watch Video Solution

88. A narrow monochromatic beam of light of intensity 1 is incident on a glass plate as shown in figure Another identical glass plate is kept close to the first one and parallel to it. Each glass plate reflects 25% of the light incident on it and transmits intensities in the interference pattern formed by two beams obtained after one reflection at each plate.



Watch Video Solution

Integer

1. A glass of refractive index 1.5 is coated with a thin layer of thickness t and refractive index 1.8 Light of wavelength λ travelling in air is incident normally on the layer. It is partly reflected at the upper and the lower surfaces of the layer and two reflected rays interfere. Write the condition for their constructive interfere. If the $\lambda = 648nm$, obtain the least value of t for which the rays interfere constrcutively.

Watch Video Solution

2. In YDSE, find the thickness of a glass slab $(\mu = 1.5)$ which should be placed in front of the upper slit S_1 so that the central maximum now lies at a point where 5th bright fringe was lying earlier (before inserting the slab). Wavelength of light used is $5000 Å$.

Watch Video Solution

3. A monochromatic beam of bright of light of wavelength $5000 Å$ is used in Young's double slit experiment. If one of the slits is covered by a transparent sheet of thikness $1.4 \times 10^{-5} m$, having refractive index of its medium 1.25. Then the number of fringes shifted is

Watch Video Solution

Archives

1. A light wave of frequency $5 \times 10^{14} Hz$ enters a medium of refractive index 1.5. In the velocity of the light wave is ..... And its wavelength is ......

Watch Video Solution

2. A monochromatic beam of light of wavelength $6000A$ in vacuum enters a medium of refractive index 1.5. In the medium its wavelength is...., its frequency is.....

Watch Video Solution

3. In Young's double slit experiment, the two slits acts as coherent sources of equal amplitude A and wavelength λ. In another experiment with the same set up the two slits are sources of equal amplitude A and wavelength λ but are indoherent. The ratio of the intensity of light at the mid point of the screen in the first case to that in the second case is

Watch Video Solution

4. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at the distance of $9 meters$ and 25 meters respectively from the source. The ratio of amplitudes of the waves at P and Q is.....

Watch Video Solution

True/False

1. The two slits in Young's double slit experiment are illuminated by two different sodium lamps emitting light of the same wavelength. No interference pattern will be observed on the screen.

Watch Video Solution

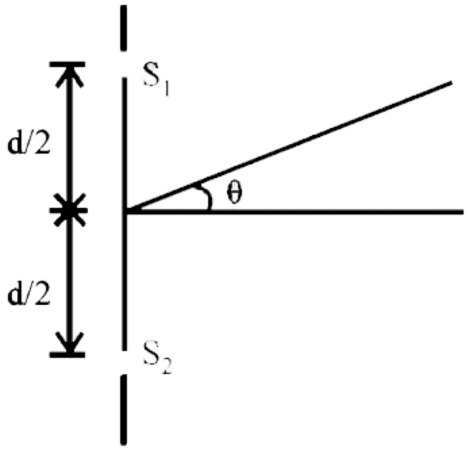
2. In a Young's double slit experiment performed with a source of white light, only black and white fringes are observed.

Watch Video Solution

Single correct Answer Type

1. In an interference arrangement similar to Young's double-slit experiment, the slits S_1 and S_2 are illuminated with coherent microwave sources, each of frequency 10^6 Hz. The sources are synchronized to have zero phase difference. The slits are separated by a distance d=150.0 m. The intensity I (theta) is measured as a function of theta, where theta is defined as shown. If I_0 is the maximum intensity, then I (theta) for

Olethetale90degree is given by



A. $I(\theta) = I_0 / 2$ for $\theta = 30^\circ$

B. $I(\theta) = I_0 / 4$ for $\theta = 90^\circ$

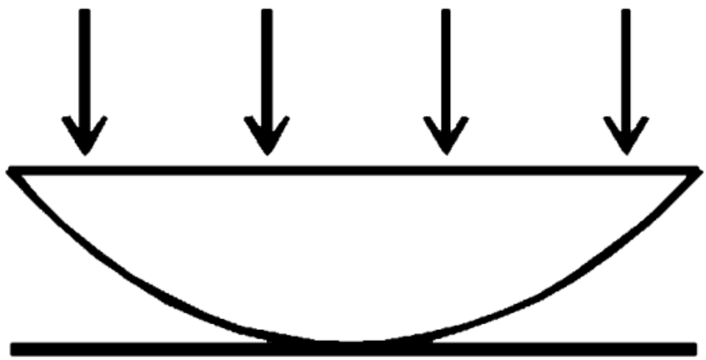
C. $I(\theta) = I_0$ for $\theta = 0^\circ$

D. $I(\theta)$ is constant for all value of θ

Answer: c

Watch Video Solution

2. A thin slice is cut out of a glass cylinder along a plane parallel to its axis. The slice is placed on a flat glass plate as shown in Figure. The observed interference fringes from this combination shall be



A. straight

B. circular

C. equally spaced

D. having fringe spacing which increases as we go outward

Answer: a

Watch Video Solution

3. In a double-slit experiment, instead of taking slits of equal width, one slit is made twice as wide as the other Then in the interference pattern

A. the intensities of both the maxima and the minima increases

B. the intensity of maxima increases and the minima has zero intensity

C. the intensity of the maxima decreases and that of minima increases

D. the intensity of the maxima decreases and the minima has zero intensity

Answer: a

Watch Video Solution

4. Two beams of ligth having intensities I and 4I interface to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. Then the difference between the resultant intensities at A and B is

A. 2 I

B. 4 I

C. 5 I

D. 7 I

Answer: b

Watch Video Solution

5. In Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen, when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

A. 12

B. 18

C. 24

D. 30

Answer: b

Watch Video Solution

6. In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

A. 2λ

B. $2\lambda/3$

C. $\lambda/3$

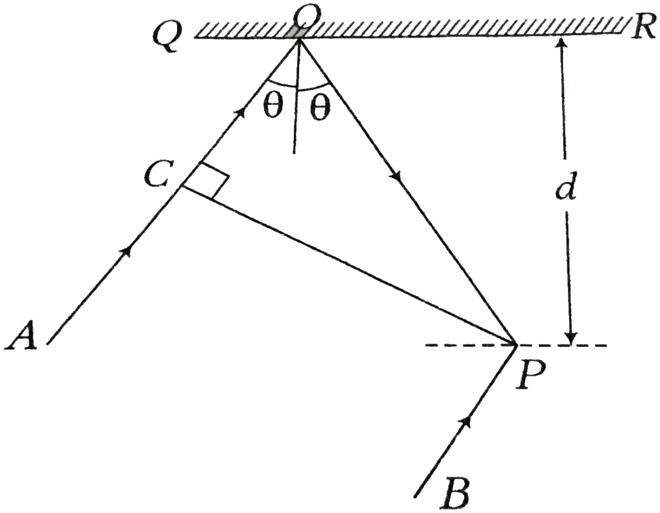
D. λ

Answer: a

Watch Video Solution

7. In the below diagram, CP represents a wavefront and AO and BP, the corresponding two rays. Find the condition of θ for constructive interference at

P between the rays BP and reflected ray AOP



A. $\cos\theta = 3\lambda/2d$

B. $\cos\theta = \lambda/4d$

C. $\sec\theta - \cos\theta = \lambda/d$

D. $\sec\theta - \cos\theta = 4\lambda/2d$

Answer: b

Watch Video Solution

8. Monochromatic light of walelength 400nm and 560nm are incident simultaneously and normally on double slits apparatus whose slit sepation is 0.1 mm and screen distance is 1m. Distance between areas of total darkness will be

A. 4 mm

B. 5.6 mm

C. 14 mm

D. 25 mm

Answer: d

Watch Video Solution

9. In Young's double slit experiment intensity at a point is $\left(\frac{1}{4}\right)$ of the maximum intensity. Angular position of this point is

A. $\sin^{-1}(\lambda/d)$

B. $\sin^{-1}(\lambda/2d)$

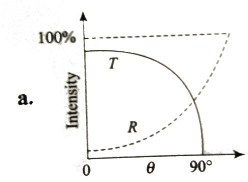
C. $\sin^{-1}(\lambda/3d)$

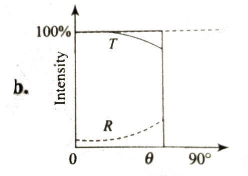
D. $\sin^{-1}(\lambda/4d)$

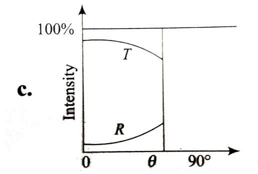
Answer: c

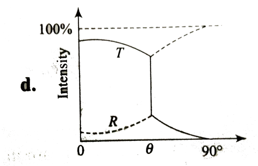
Watch Video Solution

10. A light ray travelling in glass medium is incident of glass- air interface at an angle of incidence θ. The reflected (R) and transmitted (T) intensities, both as function of θ, are plotted The correct sketch is

A. 

B. 

C. 

D. 

Answer: c

Watch Video Solution

11. Young's double slit experiment is carried out by using green, red and blue light, one color at a time.

The fringe width recorded are b_G, b_R and b_B respectively. Then,

A. $\beta_G > \beta_B > \beta_R$

B. $\beta_B > \beta_G > \beta_R$

C. $\beta_R > \beta_B > \beta_G$

D. $\beta_R > b\eta_G > \beta_B$

Answer: d

Watch Video Solution

12. In the Young's double slit experiment using a monochromatic light of wavelength λ, the path difference (in terms of an integer n) corresponding to any point having half the peak

A. $(2n+1)\frac{\lambda}{2}$

B. $(2n+1)\frac{\lambda}{4}$

C. $(2n+1)\frac{\lambda}{8}$

D. $(2n+1)\frac{\lambda}{16}$

Answer: b

Watch Video Solution

13. The ratio of intensities of two waves is $9:1$ When they superimpose, the ratio of maximum to minimum intensity will become :-

A. $10:8$

B. $9:1$

C. $4:1$

D. $2:1$

Answer: C

Watch Video Solution

14. For different independent waves are represented by

a) $Y_1 = a_1 \sin \omega_1 t$, b) $Y_2 = a_2 \sin \omega_2 t$

c) $Y_3 = a_3 \sin \omega_3 t$, d) $Y_4 = a_4 \sin\left(\omega_4 t + \frac{\pi}{3}\right)$

The sustained interference is possible between which two waves ?

A. In (i) and (iii)

B. In (i) and (iv)

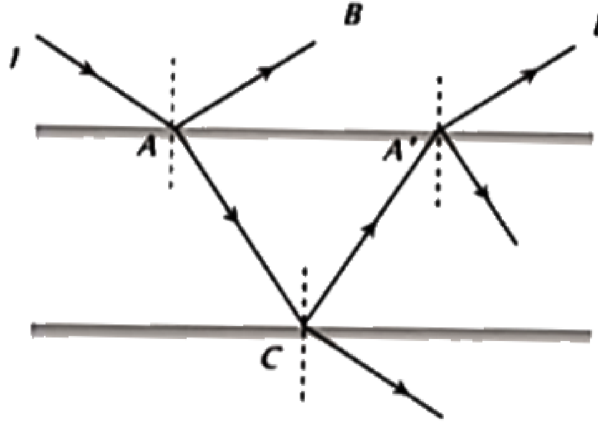
C. In (iii) and (iv)

D. Insufficient data to predict.

Answer: D

Watch Video Solution

15. A ray of light of intensity I is incident on a parallel glass-slab at the point A and it undergoes partial reflection and refraction as shown in the figure. At each reflection 25% of the incident energy is reflected and the rest is transmitted. If the rays AB and A'B' undergo interference, then the ratio $\frac{I_{\max}}{I_{\min}}$ is



A. $4:1$

B. $8:1$

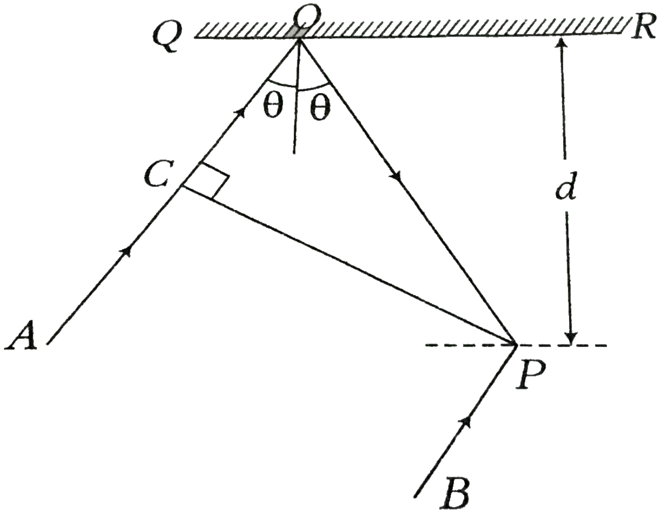
C. $7:1$

D. $49:1$

Answer: D

Watch Video Solution

16. In the below diagram, CP represents a wavefront and AO and BP, the corresponding two rays. Find the condition of θ for constructive interference at P between the rays BP and reflected ray AOP



A. $\cos \theta = 3\lambda / 2d$

B. $\cos \theta = \lambda / 4d$

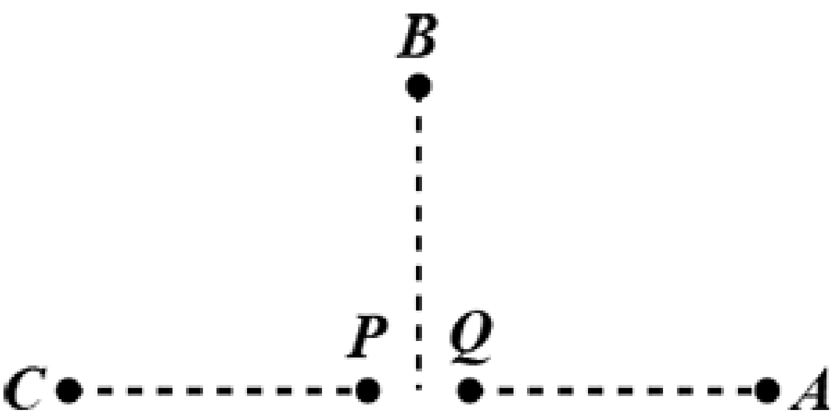
C. $\sec \theta - \cos \theta = \lambda / d$

D. $\sec \theta - \cos \theta = 4\lambda / d$

Answer: B

Watch Video Solution

17. Fig, here shows P and Q as two equally intense coherent sources emitting radiations of wavelength 20m. The separation PQ si 5m, and phase of P is ahead of the phase Q by 90°. A, B and C are three distant points of observation equidistant from the mid - point of PQ. The intensity of radiations of A, B, C will be in the ratio



A. $0:1:4$

B. $4:1:0$

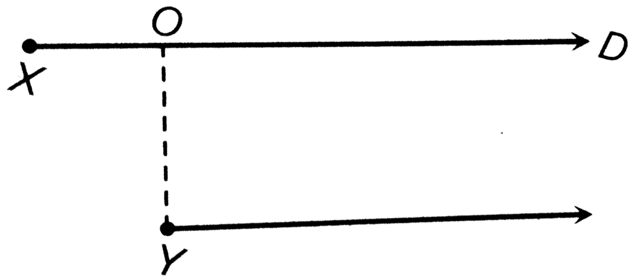
C. $0:1:2$

D. $2:1:0$

Answer: D

Watch Video Solution

18. Two point sources X and Y emit waves of same frequency and speed but Y lags in phase behind X by $2\pi / radian$. If there is a maximum in direction D the distance XO using n as an integer is given by



A. $\frac{\lambda}{2}(n-1)$

B. $\lambda(n+1)$

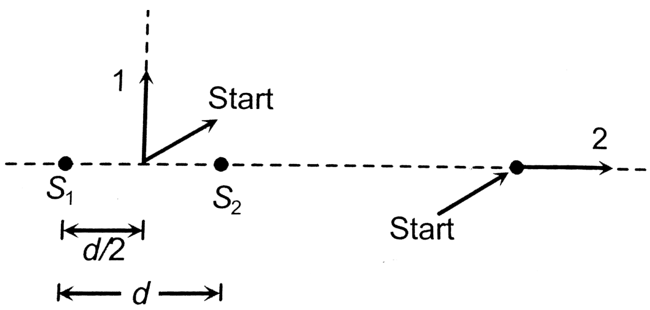
C. $\frac{\lambda}{2}(n+l)$

D. $\lambda(n-l)$

Answer: B

Watch Video Solution

19. Following figures shows sources S_1 and S_2 that emits light of wavelength λ in all directions. The sources are exactly in phase and are separated by a distance equal to 1.5λ. If we start at the indicated start point and travel along path 1 and 2, the interference produce a maxima all along



A. Path 1

B. Path 2

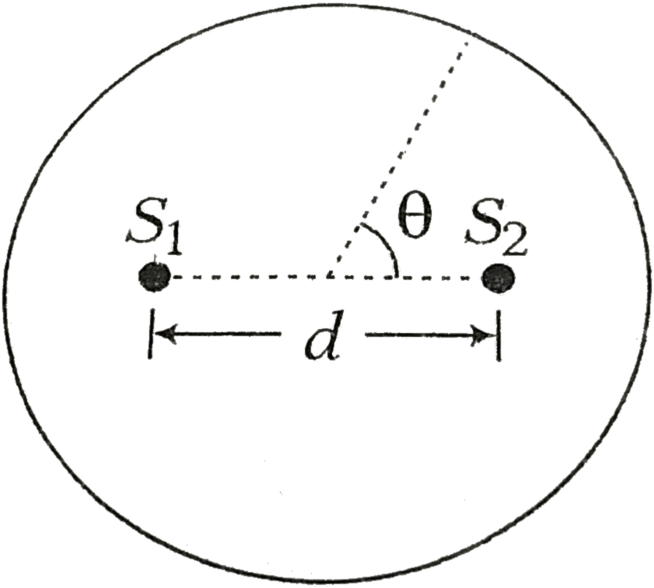
C. Any path

D. None of these

Answer: A

Watch Video Solution

20. Two coherent sources separated by distance d are radiating in phase having wavelength λ A detector moves in a big circle around the two sources in the plane of the two sources. The angular position of n=4 interference maxima is given as



A. $\sin^{-1}\left(\frac{n\lambda}{d}\right)$

B. $\cos^{-1}\left(\frac{4\lambda}{d}\right)$

C. $\tan^{-1}\left(\frac{d}{4\lambda}\right)$

D. $\cos^{-1}\left(\frac{\lambda}{4d}\right)$

Answer: B

Watch Video Solution

21. Two coherent sources S_1 and S_2 area separated by a distance four times the wavelength λ of the source. The sources lie along y axis whereas a detector moves along +x axis. Leaving the origin and far off points the number of points where maxima are observed is

A. 2

B. 3

C. 4

D. 5

Answer: B

Watch Video Solution

22. Three wave of equal frequency having amplitude $10\mu m$, $4\mu m$ and $7\mu m$ arrive at a given point with a succesive phase difference of $\pi/2$. The amplitude of the resulting wave in μm is

A. 4

B. 5

C. 6

D. 7

Answer: B

Watch Video Solution

23. Two identical radiators have a separation of $d = \lambda / 4$ where λ is the wavelength of the waves emitted by either source. The initial phase difference between the sources is $\pi / 4$. Then the intensity on the screen at a distant point situated at an angle $\theta = 30^\circ$ from the radiators is (here I_0 is intensity at that point due to one radiator alone)

A. I_o

B. $2l_o$

C. $3l_o$

D. $4l_o$

Answer: B

Watch Video Solution

24. In Young's double slit experiment, if the two slits are illuminated with separate sources, no interference pattern is observed because

A. there will be no constant phase difference between the two waves

B. the wavelength are not equal

C. the amplitudes are not equal

D. none of the above

Answer: A

Watch Video Solution

25. In Young's double slit experiment if monochromatic light is replaced by white light

A. All bright fringes become white

B. All bright fringes have colours between violet and red

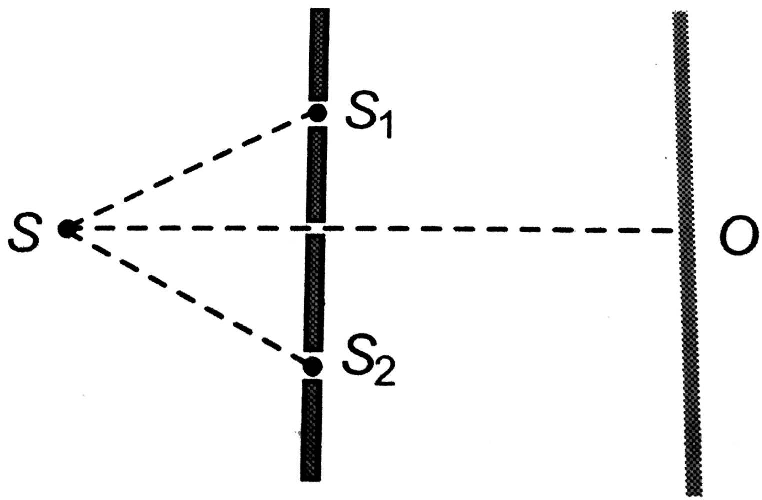
C. Only the central fringe is white, all other fringes are coloured.

D. No fringes are observed.

Answer: C

Watch Video Solution

26. In the set up shown in figure, the two slits S_1 and S_2 are not equidistant from the slit S. The central fringe at O is then



A. always right

B. always dark

C. either dark or bright depending on the position of S.

D. neither dark nor bright.

Answer: C

Watch Video Solution

27. The maximum intensity of fringes in Young's experiment is I. If one of the slit is closed, then the intensity at that place becomes I_o. Which of the following relation is true?

A. $I = I_o$

B. $I = 2I_o$

C. $I = 4I_o$

D. There is not relation bertween I and I_o

Answer: C

Watch Video Solution

28. In Young's double slit experiment, if the slit widths are in the ratio $1:9$, then the ratio of the intensity at minima to that at maxima will be

A. 1

B. $9/1$

C. $4/1$

D. $3/1$

Answer: C

Watch Video Solution

29. In Young's double slit experiment, the intensity on the screen at a point where path difference is λ is K. What will be the intensity at the point where path difference is $\lambda/4$?

A. $\frac{K}{4}$

B. $\frac{K}{2}$

C. K

D. $zero$

Answer: B

Watch Video Solution

30. The intensity at the maximum in a Young's double slit experiement is I_0 Distance between teo slits is $d = 5\lambda$ where λ is the wavelength of light used in the experiment What will be the intensity in front of the one of the slits on the screen planed

at a distance, D=10 d?

A. $\frac{I_0}{2}$

B. $\frac{3}{4}I_0$

C. I_0

D. $\frac{I_0}{4}$

Answer: A

Watch Video Solution

31. Two coherent sources of equal intensity produce maximum intensity of 100 units at a point. If the intensity of one of the sources is reduced by 36% reducing its width, then the intensity of light at the same point will be

A. 90

B. 98

C. 67

D. 81

Answer: D

Watch Video Solution

32. In a Young's double slit experiment, I_0 is the intensity at the central maximum and β is the fringe width. The intensity at a point P distant x from the centre will be

A. $I_o \cos\left(\frac{\pi x}{\beta}\right)$

B. $4I_o \cos^2\left(\frac{\pi x}{\beta}\right)$

C. $I_o \cos^2\left(\frac{\pi x}{\beta}\right)$

D. $\frac{I_0}{4} \cos^2\left(\frac{\pi x}{\beta}\right)$

Answer: C

Watch Video Solution

33. The path difference between two interfering waves of equal intensities at a point on the screen is $\lambda/4$. The ratio of intensity at this point and that at the central fringe will be

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: B

Watch Video Solution

34. In Young,s double slit experiment, 60 fringes are observed in the central view zone with light of wavelength 4000Å, The number of fringes that will be observed in the same view zone with the light of wavelength 6000Å, is

A. 60

B. 90

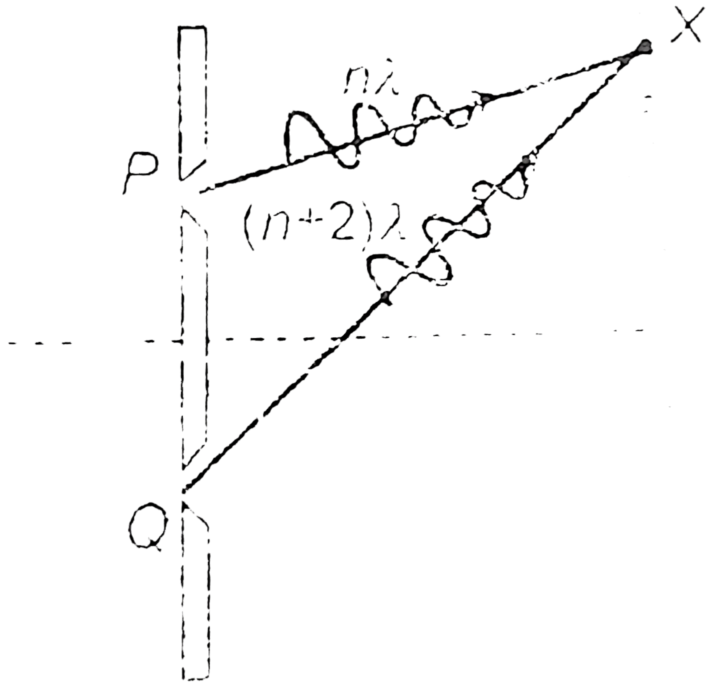
C. 40

D. 1.5

Answer: C

Watch Video Solution

35. The figure shows a double slit experiment P and Q are the slits. The path lengths PX and QX are $n\lambda$ and $(n+2)\lambda$ respectively. Where n is a whole number and λ is the wavelength. Taking the central fringe as zero. What is formed at X



A. first bright

B. first dark

C. second bright

D. second dark

Answer: C

Watch Video Solution

36. In a two slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits . If the screen is moved by $5 \times 10^{-2} m$, towards the slits, the change in fringe width is 3×10^{-5}m. If separation between the slits is 10^{-3}m, the wavelength of light used is

A. 6000 Å

B. 5000Å

C. 3000Å

D. 4500Å

Answer: A

Watch Video Solution

37. In Young's double slit experiment, how many maximum can be obtained on a screen (including the central maximum) on both sides of the central fringe if $\lambda = 2000\text{Å}$ and $d = 7000\text{Å}$?

A. 12

B. 7

C. 18

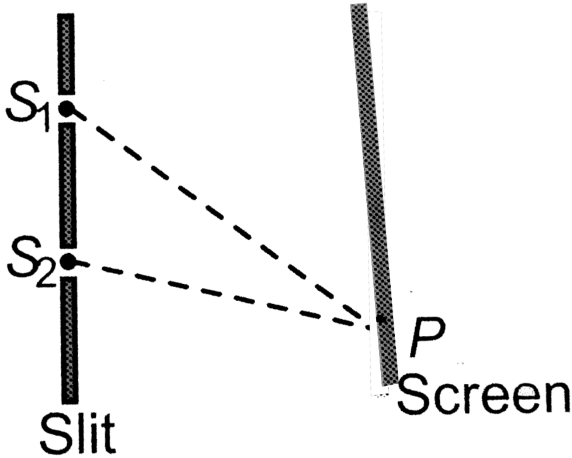
D. 4

Answer: B

Watch Video Solution

38. In a Young's double slit experimental arrangement shown here, if a mica sheet of thickness t and refractive indec μ is placed in front of the slit S_1, then the path difference

$(S_1P - S_2P)$ is



A. Decreases by $(\mu - 1)t$

B. Increases by $(\mu - 1)t$

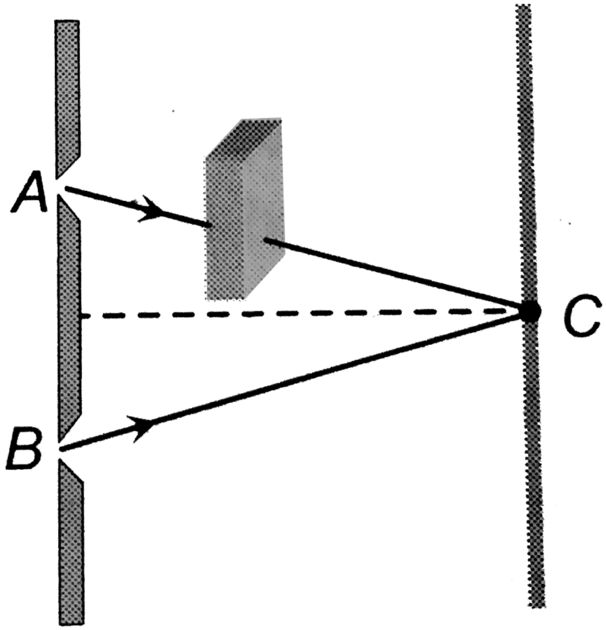
C. Does not change

D. Increases by μt

Answer: B

Watch Video Solution

39. In Young's experiment, monochromatic light is used to illuminate the two slits A and B. Interference fringes are observed on a screen placed in front of the slits. Now if a thin glass plate is placed normally in the path of the beam coming from the slit



A. the fringes will disappear

B. the fringe width will increase

C. the fringe width will increase

D. there will be no change In the fringe width

but the pattern shifts

Answer: D

Watch Video Solution

40. A thin mica sheet of thickness $2 \times 10^{-6} m$ and refractive index $(\mu = 1.5)$ is introduced in the path of the first wave. The wavelength of the wave used is 5000Å. The central bright maximum will shift

A. 2 fringes upward

B. 2 fringes downward

C. 10 fringes upwards

D. none of these

Answer: A

Watch Video Solution

41. When one of the slits of Young's experiment is covered with a transparent sheet of thickness $4.8mm$, the central fringe shifts to a position originally occupied by the 30th bright fringe. What should be the thickness of the sheet if the central fringe has to shift to the position occupied by 20th bright fringe?

A. 3.8 mm

B. 1.6 mm

C. 7.6 mm

D. 3.2 mm

Answer: D

Watch Video Solution

42. Light of wavelength $500nm$ is used to form interference pattern in Young's double slit experiment. A uniform glass plate of refractive index 1.5 and thickness $0.1mm$ is introduced in the path of one of the interfering beams. The number of fringes which will shift the cross wire due to this is

A. 100

B. 200

C. 300

D. 400

Answer: A

Watch Video Solution

43. A flake of glass (refractive index 1.5) is placed over one of the opening of a double-slit apparatus. The interference pattern displaced itself through seven successive maxima toward the side where the flake is placed. If wavelength of the light is $\lambda = 600nm$, then the thickness of the flake is

A. 2100 nm

B. 4200 nm

C. 8400 nm

D. none of these

Answer: C

Watch Video Solution

44. In Young's double slit experiment, the fringes are displaced index 1.5 is introduced in the path of one of the beams. When this plate in replaced by another plate of the same thickness, the shift of fringes is $(3/2)x$. The refractive index of the second plate is

A. 1.75

B. 1.5

C. 1.25

D. 1

Answer: A

Watch Video Solution

45. In a double-slit experiment, fringes are produced using light of wavelength $4800A^{\circ}$. One slit is covered by a thin plate of glass of refractive index 1.4 and the other slit by another plate of glass of double thickness and of refractive index 1.7. On doing so, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the center. find the thickness of the glass plates.

A. $8\mu m$

B. $6\mu m$

C. $4\mu m$

D. $10\mu m$

Answer: A

Watch Video Solution

46. The Youn'g double slit experiment is performed with blue and green light of wavelength 4360Å and 5460Å respectively, if x is the distance of 4th maxima from the central one, then

A. $x(\text{blue}) = x(\text{green})$

B. $x(\text{Blue}) > x(\text{Green})$

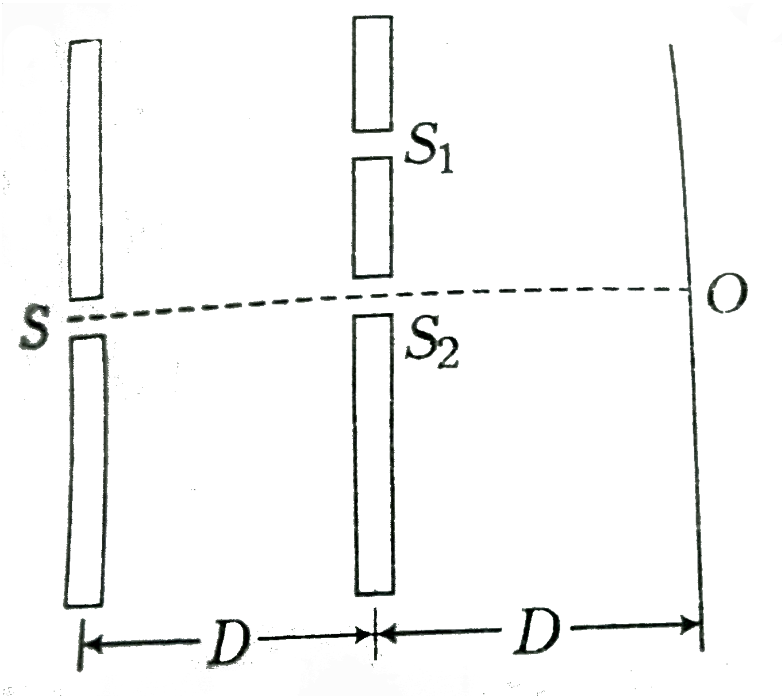
C. $x(\text{Blue}) < x(\text{Green})$

D. $\dfrac{x(\text{Blue})}{x(\text{Green})} = \dfrac{5460}{4360}$

Answer: C

Watch Video Solution

47. Two ideal slits S_1 and S_2 are at a distance d aprt and illuminated by light of wavelength λ passing through an ideal source slit S placed on the line throught S_2 as shown. The distance between the planes of slits and the source slit of D. A screen is held at a distance D from the plane of the slits. The minimum value of d for which there is darkness at O is



A. $\sqrt{\frac{3\lambda D}{2}}$

B. $\sqrt{\lambda D}$

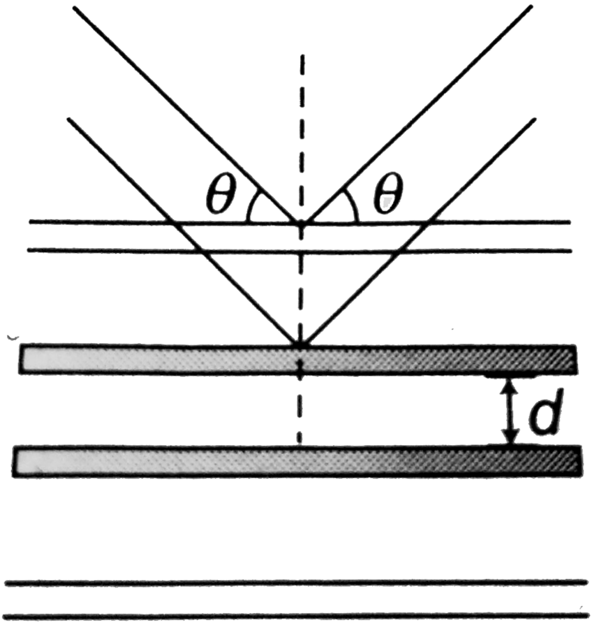
C. $\left(\sqrt{\frac{\lambda D}{2}}\right)$

D. $\sqrt{3\lambda D}$

Answer: C

Watch Video Solution

48. A beam with wavelength λ falls on a stack of partially reflecting planes with separation d. The angle θ that the beam should make with planes so that the beams reflected from successive planes may interfere constructively is (where n=1, 2, ...)



A. $\sin^{-1}\left(\frac{n\lambda}{d}\right)$

B. $\tan^{-1}\left(\frac{n\lambda}{d}\right)$

C. $\sin^{-1}\left(\frac{n\lambda}{2d}\right)$

D. $\cos^{-1}\left(\frac{n\lambda}{2d}\right)$

Answer: C

Watch Video Solution

49. White light may be considered to be mixture of waves of λ ranging between 3900Å and 7800Å. An oil film of thickness $10,000\text{Å}$ is examined normally by the reflected light. If $\mu = 1.4$, then the film appears bright for

A. 4308Å, 5091Å,6222Å

B. 4000Å,5091Å,5600Å

C. 4667Å,6222Å,7000Å

D. 4000Å,4667Å,5600Å,7000Å

Answer: A

Watch Video Solution

50. A light of wavelength 5890Å falls normally on a thin air film. The minimum thickness of the film such that the film appears dark in reflected light is

A. $2.945 \times 10^{-7} m$

B. $3.945 \times 10^{-7} m$

C. $4.95 \times 10^{-7} m$

D. $1.945 \times 10^{-7} m$

Answer: A

Watch Video Solution

51. What is the effect on Fresnel's biprism experiment when the use of white light is made?

A. Fringes are affected

B. Diffraction pattern is spread more

C. Central fringe is white and all are coloured

D. None of these

Answer: C

Watch Video Solution

52. In a biprism experiement, by using light of wavelength $5000\text{Å}, 5mm$ wide fringes are obtained on a screen $1.0m$ away from the coherent sources. The separation between the two coherent sources is

A. 1.0 mm

B. 0.1 mm

C. 0.05 mm

D. 0.01 m

Answer: B

Watch Video Solution

53. In Fresnel's biprism $(\mu = 1.5)$ experiment the distance between source and biprism is $0.3m$ and that between biprism and screen is $0.7m$ and angle of prism is 1°. The fringe width with light of wavelength 6000Å will be

A. 3 cm

B. 0.011 cm

C. 2 cm

D. 4 cm

Answer: B

Watch Video Solution

MCQ

1. In Young's double slit experiment the ratio of intensitities of bright and dark fringes is 9 this means that

A. the intensities at the screen due to the two slits are 5 units and 4 units, respectively

B. the intensities at the screen due to the two slits are 4 unit and 1 units, respectively

C. the amplitude ratio is 3

D. the amplitude ratio is 2

Answer: b.,d

Watch Video Solution

2. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and the screen is at a distance $d(> > b)$ from the slits At a point on the screen directly in front of one of the slits, certain wavelengths are missing some of these missing wavelengths are

A. $\lambda = \frac{b^2}{d}$

B. $\lambda = \frac{2b^2}{d}$

C. $\lambda = \frac{b^2}{3d}$

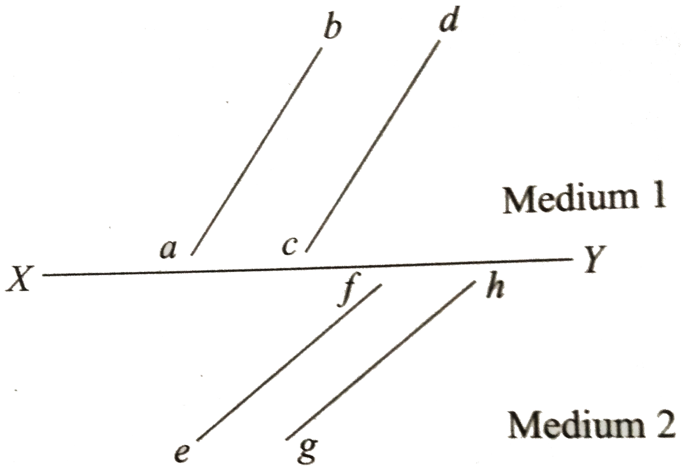
D. $\lambda = \frac{2b^2}{3d}$

Answer: a.,c

Watch Video Solution

Linked Comprehension type

1. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton.



Light travel as a

A. parallel beam in each medium

B. convergent beam in each medium

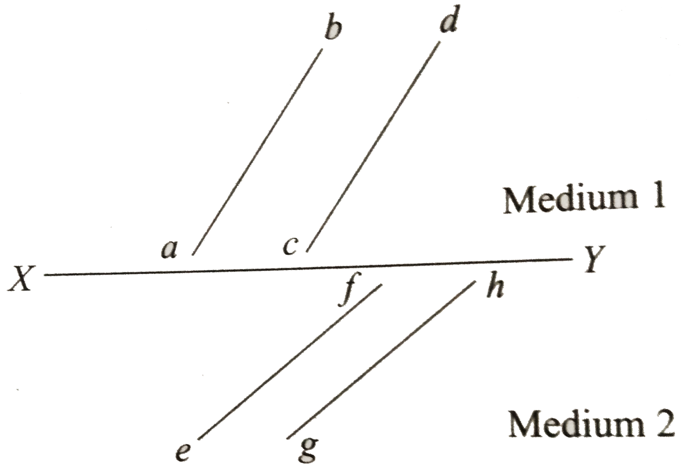
C. divergent beam in each medium

D. divergent beam in one medium and convergent beam in the other medium

Answer: a

Watch Video Solution

2. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton.



The phase of the ligth wave at c, d, e, and f are ϕ_c, phi_(d), ϕ_e and ϕ_f, respectively. It is given that $\phi_c \neq \phi_f$. Then

A. ϕ_c cannot be equal to ϕ_d

B. ϕ_d can be equal to ϕ_d

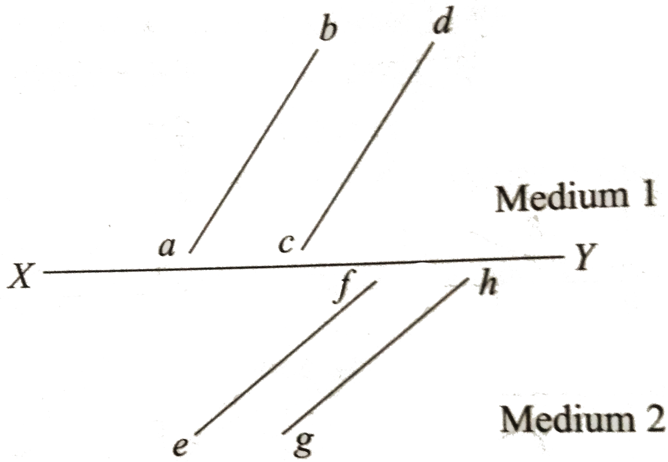
C. $\phi_d - \phi_f$ is equal to $\phi_c - \phi_e$

D. $\phi_d - \phi_c$ is not equal to $\phi_f - \phi_e$

Answer: c

Watch Video Solution

3. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton. Speed of light is



A. the same in medium 1 and medium 2

B. larger in medium 1 than in medium 2

C. larger in medium 2 than in medium 1

D. different at b and d

Answer: b

Watch Video Solution

4. Most materials have the refractive index, $n > 1$. So, when a light ray from air enters a naturally occuring material, then by Snell's law, $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_1}{n_2}$, it is understood that the refracted ray bends towards the normal. But it never emerges on the same side of the normal as the incident ray. According to electromagnetism, the refractive index of the medium is given by the relation, $n = (c/v) = \pm\sqrt{\varepsilon_r, \mu_r}$, where c is the speed of the electromagnetic waves in vacuum, v its speed in the medium, ε_r and μ_r are negative, one must choose the negative root of n. Such negative refractive index materials can now be artifically prepared and are called meta-materials. They exhibit significantly different optical behaviour, without violating any physical laws. Since n is negative, it results in a change in the direction of propagation of the refracted light. However, similar to normal materials, the frequency of light remains unchanged upon refraction even in meta-materials.

Answer the following questions :

Choose the correct statement.

A. The speed of ligth in the meta-material is

$$v = c|n|$$

B. The speed of ligth in the meta-material is

$$v = \frac{c}{|n|}$$

C. The speed of ligth in the meta-material is

$$v = c$$

D. The wavelength of the light in the meta-material (λ_m) is given by $\lambda_m = \lambda_{air}|n|$, Where `lambda_(air) is the wavelength of the ligth in air

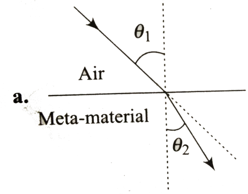
Answer: b

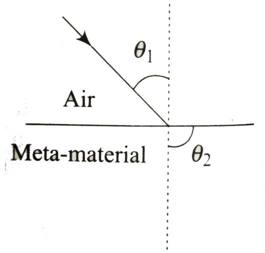
Watch Video Solution

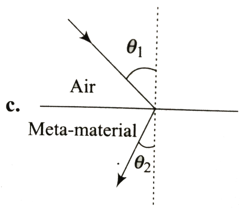
5. Most materials have the refractive index, $n > 1$. So, when a light ray from air enters a naturally occuring material, then by Snell's law, $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_1}{n_2}$, it is understood that the refracted ray bends towards the normal. But it never emerges on the same side of the normal as the incident ray. According to electromagnetism, the refractive index of the medium is given by the relation, $n = (c/v) = \pm\sqrt{\varepsilon_r, \mu_r}$, where c is the speed of the electromagnetic waves in vacuum, v its speed in the medium, ε_r and μ_r are negative, one must choose the negative root of n. Such negative refractive index materials can now be artifically prepared and are called meta-materials. They exhibit significantly different optical behaviour, without violating any physical laws. Since n is negative, it results in a change in the direction of propagation of the refracted light. However, similar to normal materials, the frequency of light remains unchanged upon refraction even in meta-materials.

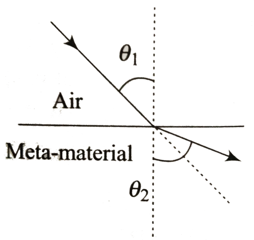
Answer the following questions :

For light incident from air on a meta-material, the appropriate ray diagram is

A. 

B. 

C. 

D. 

Answer: c

Watch Video Solution

Matching Column Type

1. Column I shows the optical devices on which parallel rays fall. Column II shows the shape of emergent wavefront match them.

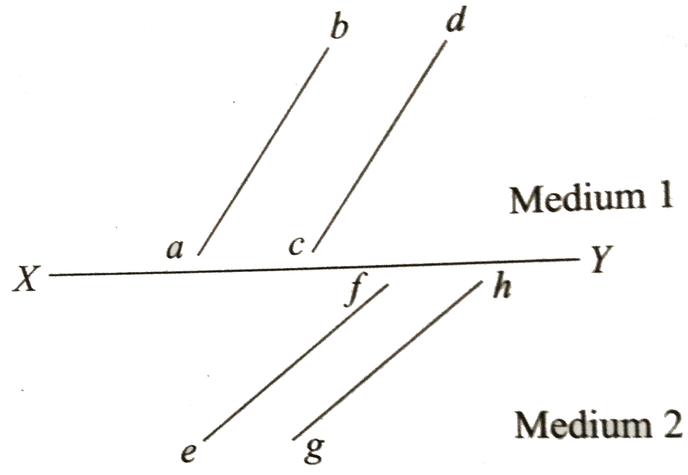
Watch Video Solution

2. In Young's double slit experiment, white light is used. The separation between the slits is b. The screen is at a distance d $(d > > b)$ from the slits, Some wavelengths are missing exactly in front of one slit. These wavelengths are

Watch Video Solution

Comprehension Type

1. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton.



Light travel as a

A. Parallel beam in eah medium

B. convergent beam in each medium

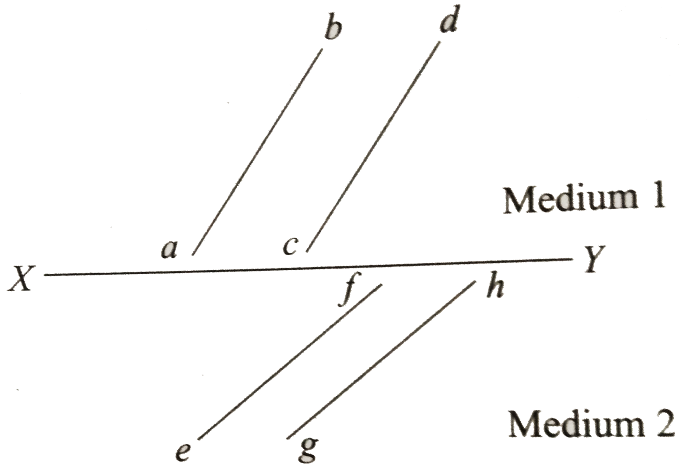
C. divergent beam in each medium

D. divergent beam in one medium and convergent beam in other medium.

Answer: A

Watch Video Solution

2. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton.



The phase of the ligth wave at c, d, e, and f are ϕ_c, phi_(d), ϕ_e and ϕ_f, respectively. It is given that $\phi_c \neq \phi_f$. Then

A. ϕ_c cannot be equal to ϕ_d

B. ϕ_d can be equal to ϕ_e

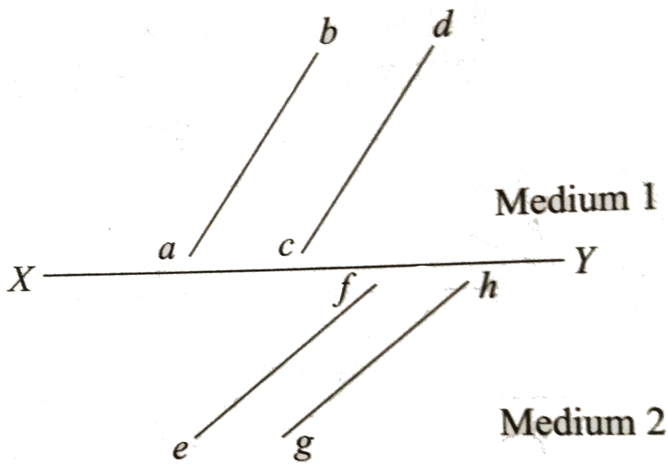
C. $\left(\phi_d - \phi_f\right)$ is equal to $(\phi_c - \phi_e)$

D. $(\phi_d - \phi_c)$ is not equal to $\left(\phi_f - phI_e\right)$

Answer: C

Watch Video Solution

3. Fig. shows a surface XY separating two transparent media, medium 1 and medium 2. Lines ab and cd represent wavefronts of a light wave travelling in medium 1 and incident on XY. Line ef and gh represent wavefront of the light wave in medium 2 after rafraciton. Speed of light is



A. the same in medium 1 and medium 2

B. larger I medium 1 than in medium 2

C. larger in medium 2 than in medium 1

D. different at b and d.

Answer: B

Watch Video Solution

4. What is the specific heat ratio of diatomic gases ?

Watch Video Solution

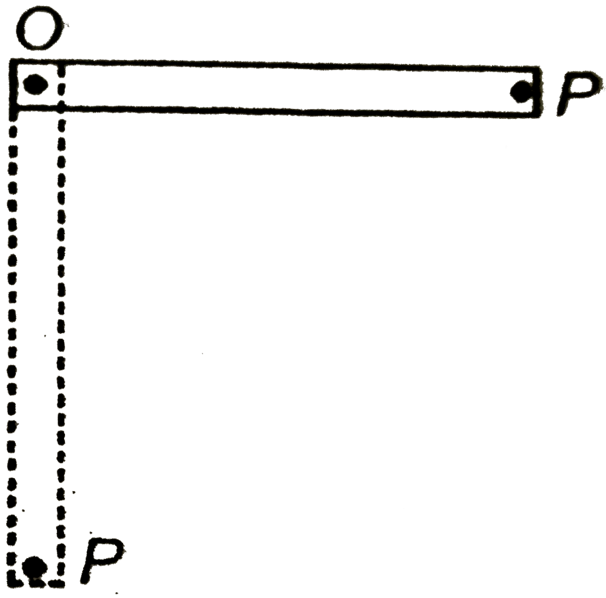
5. What is the specific heat ratio of triatomic gases ?

Watch Video Solution

6. If $\frac{I_1}{I_2}$ =4 then find the value of $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$

Watch Video Solution

7. A rod of mass m and length L is pivoted at a point O and kept in horizontal position as shown in figure. Now it is released from this position so that it can rotates freely about the point O in downward direction. When it becomes vertical



A. 30 cm

B. 20 cm

C. 38 cm

D. none of these

Answer: A

Watch Video Solution

8. If $\frac{I_1}{I_2}$ =9 then find the value of $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}} \bar{A}$

Watch Video Solution

9. A point source S emits light of wavelength 600 nm. It is palced at a very small distance from a flat reflecting mirror AB. Interface. Frignes as observed on the screen placed parallel to reflecting surface at very large distance D from it. The ratio of minimum to maximum intensities in the interference frignes formed near the point P is 1/6.

Q. What is the shape of interference fringes on the screen?

A. elliptical

B. paraboloid

C. circular

D. none of these

Answer: C

Watch Video Solution

10. A point source S emits light of wavelength 600 nm. It is palced at a very small distance from a flat reflecting mirror AB. Interface. Frignes as observed on the screen placed parallel to reflecting surface at very large distance D from it. The ratio of minimum to maximum intensities in the interference frignes formed near the point P is 1/6.

Q. What is the percentage intensity of the reflected light to the intensity of the reflectd light to the intensity of incident light?

A. 0.49

B. 0.64

C. 0.81

D. 0.36

Answer: D

Watch Video Solution

11. A point source S emits light of wavelength 600 nm. It is palced at a very small distance from a flat reflecting mirror AB. Interface. Frignes as observed on the screen placed parallel to reflecting surface at very large distance D from it. The ratio of minimum to maximum intensities in the interference frignes formed near the point P is 1/6.

Q. If the intensity of P correspoonds to a maximum, calculate the minimum distance through which the reflecting surface AB should so that intensity at P again becomes maximum.

A. 150 nm

B. 300 nm

C. 450 nm

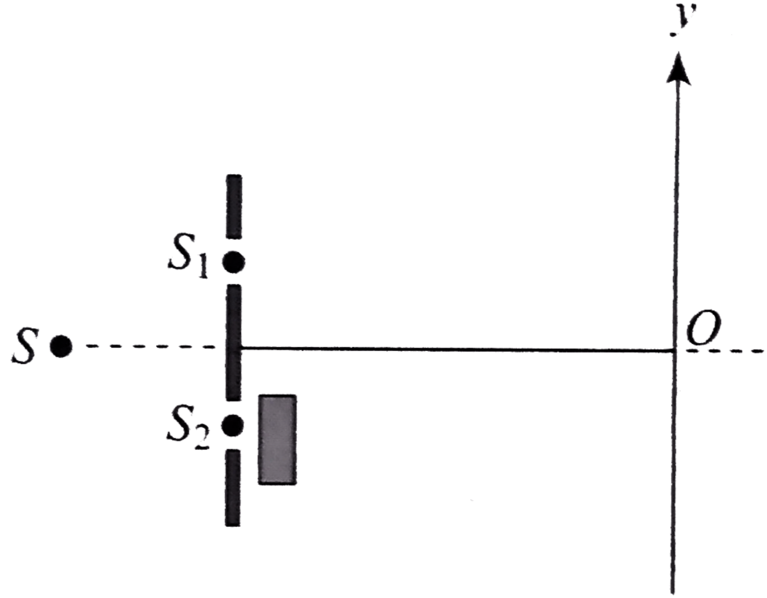
D. 575 nm

Answer: B

Watch Video Solution

Watch Video Solution

12. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



The location of the central maximum (bright fringe with zero path difference) on the y-axis will be

A. 5.37 mm

B. 4.33 mm

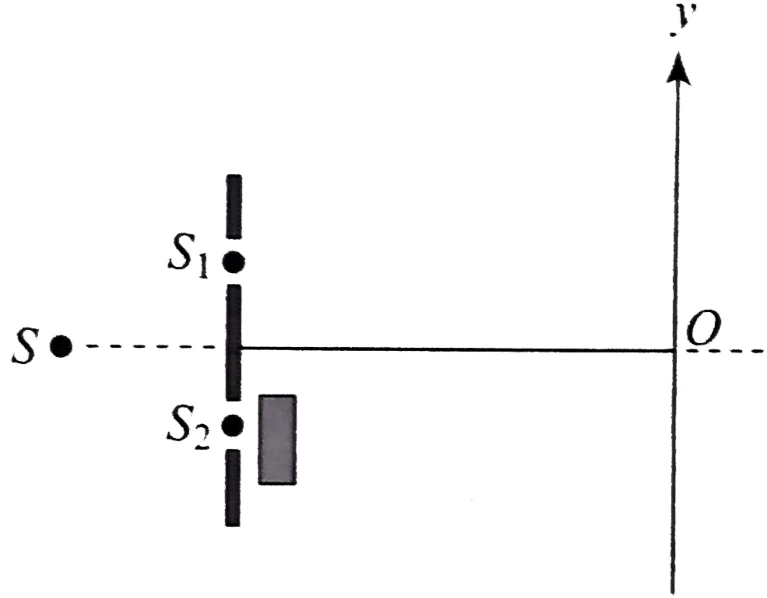
C. 3.78 mm

D. 3.15 mm

Answer: B

Watch Video Solution

13. A YDSE is performed in a medium of refractive index $4/3$, A light of 600 nm wavelength is falling on the slits having 0.45 nm separation . The lower slit S_2 is covered b a thin glass plate of thickness 10.4 mm and refractive index 1.5. The interference pattern is observed on a screen placed 1.5 m from the slits as shown in figure. (All the wavelengths in this problem are for the given medium of refractive index $4/3$, ignore absorption.)



Find the light intensity at point O relative t

maximum fringe intensity.

A. $0.6I_{\text{max}}$

B. $0.75I_{\text{max}}$

C. $0.8I_{\text{max}}$

D. $0.9I_{\text{max}}$

Answer: B

Watch Video Solution

14. In YDSE's experiment performed in a medium of refractive index (4/3), a light of 60 nm wavelength is falling ono the slits having 0.45 mm separation.t he lower slit S_2 is covered by a thin glass sheet of thickness $10.4\mu m$ and refractive index 1.5 the interference pattern is observed on a screen palced 1.5m from the slits as shown int hef ignore dispersion.

Q. If white light of range 400-700 nm has replaced

600 nm light, one of the wavelengths of light that forms maxima exactly at point O wll be:

A. 650 nm

B. 625 nm

C. 550 nm

D. 605 nm

Answer: A

Watch Video Solution