PHYSICS

BOOKS - MODERN PUBLISHERS PHYSICS (HINGLISH)

WAVE OPTICAL

Solved Examples

1. In a certain liquid , the speed of yellow light is $2.2 \times 10^{8} m / s$. Calculate the refractive index of the liquid.

Watch Video Solution

2. A monochromatic light of wavelength 500 nm travelling in air strikes a glass surfaces. Calculate the wavelength, frequency and speed of refracted light. Take $\mu_{\text{glass}} = 1.5$.

Watch Video Solution

3. Light coming from a sodium lamp has a wavelength of 632 nm. What will be its wavelength in water? Take refractive index of water = 1.33.

Watch Video Solution

4. The refractive index of a transparent material is 1.84 and that of glass is 1.52. By how much amount the light travels faster in a window glass than in the material ?

Watch Video Solution

5. A ray of light is travelling normally through a glass sheet. Calculate the time taken by the light to travel if the thickness of the glass sheet is 2 mm.

Take, $\mu_{\text{glass}} = 1.5$

Watch Video Solution

6. The number of waves in a 3 - cm- thick layer of a liquid is same as in 4 - cm - thick layer of another liquid. If the refractive index of the first liquid is 1.8, then what will be for that of another liquid?

Watch Video Solution

7. Number of light waves of some frequency in 8 cm thickness of glass is same as number of light waves of same frequency in 9 cm thickness of water. If refractive index of water is 4/3, then what should be the refractive index of glass?

Watch Video Solution

8. The wavelength of yellow light in vacuum is 6000 Å. If the absolute refractive index of air is 1.0002, then calculate the thickness of air column which will have one more wavelength of yellow light than in the same thickness of vacuum.

Watch Video Solution

9. Two plane monochromatic waves propagating in the same direction with amplitudes A and $2A$ and differing un phase by $\pi/3$

superimpose. Calculate the amplitude of the resulting wave.

Watch Video Solution

10. Waves from two sources of intensities I and 3I are used in an interference experiment. Calculate the intensity at point where the waves superimpose with a phase difference of $(i) \pi / 2$ and $(ii) \pi$.

Watch Video Solution

11. Two coherent monochromatic light beams of intensities I and 9I are superposed. What will be the maximum and minimum possible intensities?

Watch Video Solution

12. Calculate the ratio of slit width if the amplitudes of light waves coming from have a ratio of $\sqrt{3}:1$.

Watch Video Solution

13. In a Young's double slit experiment, using mono-chromatic light of wavelength λ, the intensity of light at a point on the screen where the path defference is λ is k units. Find the intensity at a point where the path difference is $\lambda/3$.

Watch Video Solution

14. Separation between the slits in Young's double-slit experiment is d and screen is placed at a distance D from the slits to observe the

interference pattern. Wavelength of light used is λ. Find the distance of point from centre of screen where intensity falls to (i) half the maximum and (ii) one-fourth of the maximum.

Watch Video Solution

15. Calculate the ratio of two points on a screen in a Young's double - slit experiment if the waves from two coherent sourcres have a phase difference of $\frac{\phi}{3}$ and $\frac{\phi}{2}$ respectively.

Watch Video Solution

16. Find the ratio of intensities of two points P and Q on a screen in Young's double-slit experiment when waves from sources S_1 and S_2 have path difference (i) zero and (ii) $\lambda / 3$ respectively.

Watch Video Solution

17. Two slits are made on an opaque surface at a separation of 1mm beetween them. A screen in placed at a distance of 1m from the plane of slits. Find the separation between two consecutive maxima. Wavelength of light being used in the experiment is 500 nm.

Watch Video Solution

18. Laser light of wavelength 640 nm incident on a pair of slits produces an interference patterns in which the bright fringes are separated by 8.1 mm. A second light produces an interference pattern in which the fringes and separated by 7.2 mm. Calculate the wavelength of the second light.

Watch Video Solution

19. A monochromatic light of wavelength 5100 Å from a narrow slits is incident on a Young's double-slit in an experiment. The overall separation of 10 fringes on a screen in 2 cm. If the screen is 200 cm away, calculate the slit separation.

Watch Video Solution

20. Yellow light of wavelength 6000Å produces fringes of width $0.8mm$ in YDSE. What will be the fringe width if the light source is replaced by another monochromatic source of wavelength 7500Å and the separation between the slits is doubled ?

Watch Video Solution

21. State two conditions to obtain sustained interference of light. In young's double slit experiment, using light of wavelength 400 nm, interference fringes of width X are obtained. The wavelength of light is increased to 600 nm and the separation between the slits is halved. if one wants the observed fringe width on the screen to be the same in the two cases, find the ratio of the distance between the screen and the plane of the slits in the two arrangements.

Watch Video Solution

22. In Young's double slip experiment ,the width of fringes obtained from a source of light of wavelength 5000 Å is 3.6mm Calculate the frings width if the apparatus is immersed in a liquid of refractive index 1.2.

Watch Video Solution

23. Red light of wavelength 6000 Å is used in a Young's double-slit experiment. At a point P on the screen n^{th} bright fringe is obtained . When red light is replaced with blue light of wavelengh $4000\text{Å}, (n+1)^{th}$ bright fringe is obtained at the same point P. Calculate the value of n.

Watch Video Solution

24. The two slits in Young's double slit experiment are separated by a distance of 0.03 mm. An interference pattern is produced on a screen 1.5 m away. The 3^{rd} bright fringe is at a distance of 1 cm from the central maximum. Calculate the wavelength of light used.

Watch Video Solution

25. In Young's double -slit experiment, the slits are 0.5 cm apart and screen is 1m away. The slits are illuminated by sodium light of wavelength

6890Å. What will be the distance between 3^{rd} bright fringe on one side and 4^{th} bright fringe on other side of central fringe.

Watch Video Solution

26. A double -slit is illuminated by light of wavelength 5000Å. The slits are 0.1 cm apart and the screen is placed 1m away. Calculate (i) the angular position of 10^{th} maximum in radian and (ii) separation of the adjacent minima.

Watch Video Solution

27. If the ratio of amplitude of wave is $2:1$, then the ratio of maximum and minimum intensity is

Watch Video Solution

28. If two slits in Young's double-slit experiment have width ratio 9:1, deduce the ratio of intensity at maxima and minima in the interference pattern.

Watch Video Solution

29. If ratio of intensities of two waves is 64 : 9. Calculate the ratio of maximum and minimum intensity in the interference pattern formed by these two waves.

Watch Video Solution

30. The ratio of intensities at amxima and minima is $25:16$. What will be ratio of the widths of two slits in YDSE ?

Watch Video Solution

31. In a wedge-shaped film, between two points X and Y, nine friges are observed with light of wavelength 4800Å. How many fringes will be observed between the same two points if the wavelength of light is changed to 6400Å ?

Watch Video Solution

32. A thin air film is between two points A and B. When light of wavelength 5400Å is used, 5 fringes appear between the two points. Find the difference in the thickness of the film between the two points.

Watch Video Solution

33. White light is incident normally on a thin glass plate of refractive index 1.5. Calculate the minimum thickness of the film for which the wavelength 4200Å is absent for the reflected light.

Watch Video Solution

34. White light is incident on a soap film at an angle of 60°. On examining the reflecting light by a spectroscope, a dark band corresponding to wavelength 6200Å is found. Find the minimum thickness of the film. Take refractive index of film = 1.33.

Watch Video Solution

35. White light is incident on a very thin glass plate of thicness $1\mu m$. Index of refraction for the glass is 1.5. Which wavelengths in the visible region (400 nm to 700 nm) are strongly transmitted by the glass plate ?

Watch Video Solution

36. White light incident perpendicular on a soap film gets reflected . It has an interference maximum at 5800Å and a minimum at 4200Å in a visible spectrum. If there is no minimum in between the two bands, find the thickness of the soap film. Take refractive index of film = $4/3$.

Watch Video Solution

37. White light is incident on a soap film of $\mu = 4/3$ at an angle of 45°. On examining the transmitted light with a spectrometer, a bright band of wavelength 5400Å is found. What will be the minimum thickness of the soap film?

Watch Video Solution

38. White light is incident on water film of thickness $1\mu m$. Refractive index of water is 1.33. Which wavelengths in visible region (400 nm to

700 nm) will be strongly reflected by the water film ? Assume air on both sides of the film.

Watch Video Solution

39. A thin glass plate of refractive index 1.5 is introduced in the path of one of the interfering beam. As a result, the central bright fringe moves to a position previously occupied by the fifth bright fringe. If the wavelength of beam is $6.2 \times 10^{-5} cm$, calculate the thickness of glass plate.

Watch Video Solution

40. A transparent sheet of thickness 0.018 mm is pasted on one of the slits of a Youngs slit experiment. If the set - up uses monochromatic light of wavelength 6800Å, how many fringes will shift due to pasting of the sheet? Take μ sheet = 1.6.

Watch Video Solution

41. Light of wavelength 500 nm falls normally on a slit of width $1\mu m$ producing Fraunhofer diffraction pattern on a screen. Calculate the angular position of the first minimum and the angular width of the central maximum.

Watch Video Solution

42. A parallel beam of monochromatic light is incident on a slit of width 0.1 mm. Find the angle in which most of the light is diffracted. Wavelength of light used is 500 nm.

Watch Video Solution

43. The slit of width 'b' is illuminated by light of wavelength 6000Å. For what value of 'b' will be first maximum fall at angle of diffraction of 30° ?

Watch Video Solution

44. Light of frequency 25 GHz is incident normally on a rectangular slit of width 4 cm. Calculate the angular width of the central maximum of the diffraction pattern formed by the slit.

Watch Video Solution

Watch Video Solution

45. Light of $\lambda = 550nm$ is incident as parallel beam on a slit of width $0.1mm$. Find the angular width and linear width of the principal maximum in the diffraction pattern on a screen at a distance of $1.1m$ from thw slit. Which of these widths will not change if the screen were moved to a distance of $2.2m$ from the slit ?

Watch Video Solution

46. Light of wavelength 600 nm falls from a distant source on a slit 0.6 mm wide. Find the distance between the two dark bands, on either side of the central bright band of the diffraction pattern observed , on a screen placed 2 m from the slit.

Watch Video Solution

47. Fraunhofer diffraction from a single slit of width 'a' is observed with a parallel beam of light of 500 nm and the resulting diffraction pattern is observed on a screen 1.2 m away. The first minimum is observed at a distance of 2.5 mm from the centre of the screen. Find the value of 'a' .

Watch Video Solution

48. Determine the angular spread between central maximum and first order maximum of the diffraction pattern due to a single slit of width $0.25mm$, when light of wavelength 5890Å is incident on it normally ?

Watch Video Solution

49. Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperature $2 \times 10^{-4} m$. The distance between the slit and the screen is 1.5 m. Calcualate the separation between the positions of first maximum of the diffractions patterns obtained in two cases.

Watch Video Solution

50. A laser operates at a frequency of $5 \times 10^{14} Hz$. If the laser has an aperture of 10 mm, what will be the angular spread?

Watch Video Solution

51. Parallel beam of light of wavelength 420 nm is focused on a screen at a distance of 50 cm from the lens. What would be the radius of the central bright spot formed? Diameter of the lens is 10 cm.

Watch Video Solution

52. Light of wavelength 620 nm goes through a pinhole of diameter 0.1 mm. Screen is placed at a distance 5 m from the hole. What will be the radius of the central bright spot formed ?

Watch Video Solution

53. Estimate the limit of resolution of a human eye, for the light of wavelength 500 nm. (Take diameter of human eye equal to 2 mm).

Watch Video Solution

54. Assume that light of wavelength 6000Å is coming from a star. What is the limit of resolution of a telescope whose objective has a diameter of 100 inch ?

Watch Video Solution

55. A telescope of diameter 500 cm is used to resolve two points on the moon. Calculate the separation between the points . Take distance of the moon from the Earth $= 4 \times 10^{10} cm$, and

wavelength of light most sensitive to eye

$$= 5.5 \times 10^{-5} cm.$$

Watch Video Solution

56. The numerical aperture of a microscope is 0.31. If the wavelength of light used in 600 nm, calculate the resolving power of the microscope.

Watch Video Solution

57. The width of an aperture is 4 mm and wavelength of light illuminating it is 600 nm. Find the distance up to which ray optics is valid.

Watch Video Solution

58. Two polaroids are kept initially with their axes parallel to each other. One of the palaroid is then rotated through various angles. How would the intensity of light coming from the rotating polaroid be affected, compared to initial intensity if it is ratated through

$(i)45^\circ (ii)90^\circ (iii)180^\circ$.

Watch Video Solution

59. Polarizer and analyzer are placed in such a manner that their transmission axes are inclined at an angle 30° . If intensity of light emerging from the polarizer is I, then what should be the intensity of unpolarised light ?

Watch Video Solution

60. Two ploarising sheets are kept with their polarising direction parallel such that the intensity of transmitted light is maximum. Calculate the angle through which one of the sheets must be turned if the intensity of transmitted light is to drop by $\frac{1}{4}$?

Watch Video Solution

61. Two polarioids P_1 and P_2 are placed in crossed positions. A third polaroid P_3 is kept between P_1 and P_2 such that the axis of P_3 is parallel to that of P_1. How would the intensity of

light (I_2) transmitted through P_2 vary as P_3 is rotated? Draw a plot of intensity $'I_2'$ vs the angle $'\theta'$ between the axes of P_1 and P_3. In which orientation will the transmitted intensity be (i) minimum and (ii) maximum?

Watch Video Solution

62. Two polaroids are kept crossed to each other. Now one of them is rotated through an angle of 45° . The percentage of incident light now transmitted through the system is

Watch Video Solution

63. Unpolarised light of intensity I_0 passes through two polaroids P_1 and P_2 such that pass axis of P_1. A third polaroid P_3 is placed between P_1 and P_2 with pass axis of P_3 making an angle 60° with that of P_1. Determine the intensities of light transmitted by P_1, P_2 and P_3.

Watch Video Solution

64. Two polaroids are placed at 90° to eachother. What happens when $(N-1)$ more polaroids are inserted between them ? Their axes are equally spaced. How does the transmitted intensity behave for large N ?

Watch Video Solution

65. Unpolarized light is incident on a plane glass surface. What should be the angle of incidence so that the reflected and refracted rays are perpendicular to eachother ?

Watch Video Solution

66. A ray of light is incident on the surface of a glass plate of refractive index 1.6 at polarzing angle. Calculate the angles of reflection and refraction.

Watch Video Solution

67. Light is incident on a plane glass sheet at an angle of 70°. Find the refractive index of glass

sheet if the reflected and refracted rays are perpendicular to each other.

Watch Video Solution

68. If the polarising angle for a given medium is 60°, then the refractive index of the medium is

Watch Video Solution

69. A beam of light travelling in water enters a glass plates. Calculate the angle of incidence for which the reflected light will be completely plane polarised. Take $\mu_{\text{water}} = 1.33$ and $\mu_{\text{glass}} = 1.5$.

Watch Video Solution

70. Light from a galaxy, having wavelength 6000Å is found to be shifted towards red by 50Å. Calculate velocity of recession of the galaxy.

Watch Video Solution

71. The spectral line for a given element in the light received from a distant star is shifted towards longer wavelength side by $0.025\,\%$. Calculate the velocity of star in the line of sight.

Watch Video Solution

72. A star is moving away from the obsever on the Earth with a speed of 400 km/s. What will be the Doppler shift if the wavelength of light emitted by the star is 5800Å ?

Watch Video Solution

Practice Problems 1

1. The refactive index of diamond and a glass slab is 2.47 and 1.68, respectively. Determine the ratio of speed of light in diamond and glass slab.

Watch Video Solution

2. Wavelength of blue in vacuum is 5000Å. What will be the thickness of an air column of same thickness which have 20 more wavelengths of blue light ? Given the refractive index of air column is 1.003.

Watch Video Solution

3. Blue light of wavelength 470 nm emerges through a liquid column of refractive index 1.42. Calculate the wavelength and frequency of blue light in the liquid.

Watch Video Solution

4. A pair of monochromatic waves of amplitude A and 2 A are travelling in same direction. Determine the amplitude of the resultant wave if both the waves are superimposed and phase difference of 45°.

Watch Video Solution

5. Two coherent monochromatic light beam of intensitites I and$4I$ are superposed.The maximum and minimum possible intensities in the resulting beam, is

Watch Video Solution

6. In a Young's slit experiment, the slit widths are in ratio 1:2. Determine the ratio of intensity of minima and maxima in the obtained interference pattern.

Watch Video Solution

7. In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path diff. is λ is K units. Find the intensity of light at a point where path difference is $\lambda/3$.

Watch Video Solution

8. In Young's double-slit experiment (Y.D.S.E), light of intesity I_0, is used at both slits. Calculate the intensity on screen at a point for which the phase difference is 60°.

Watch Video Solution

9. In a Y.D.S.E, light of wavelength 500 nm is used. The separation between brigh fringes is 7.5 mm. Calculate the separation between the bright fringes if the light is replaced by another light of wavelength 650 nm.

Watch Video Solution

10. In a Y.D.S.E, light of wavelength 500 nm is used. The separation between bright fringes is 7.5 mm., calculate the fringe width if light is replaced by another light of wavelength 650 nm and separation between the slits is increased to 1.5 times.

Watch Video Solution

11. In Y.D.S.E. , distance between both the slits is 2 mm. When a light of frequency $5.5 \times 10^{14} Hz$ is used, the fringes width is 1 mm. Determine the distance between screen and slit.

Watch Video Solution

12. In Y.D.S.E. , distance between both the slits is 2 mm. When a light of frequency 5.5 × 10 14 H z is used, the fringes width is 1 mm, calculate the distance second bright fringe and central fringe.

Watch Video Solution

13. In Y.D.S.E., light of wavelength 5500Å is used. If the slits are at a distance of $10^{-3}m$ and interference pattern is formed at a distance of 100 cm.

Calculate the distance between central fringe and second dark fringe.

Watch Video Solution

14. Two slits are made one millimeter apart and the screen is placed one metre away. When blue-green light of wavelength 500 nm is used, the fringe separation is

Watch Video Solution

15. In Young's double-slit experiment, interference pattern is observed at a distance of 1m. If light used has a frequency of 6×10^{14} Hz and slit separation distance is equal to 0.05 mm, calculate the distance between fourth bright fringe and centre.

Watch Video Solution

16. In Young's double-slit experiment, interference pattern is observed at a distance of 1m. If light used has a frequency of 6 × 10 14 Hz

and slit separation distance is equal to 0.05 mm,, calculate the angular position of 8^{th} maximum.

Watch Video Solution

17. In Young's double-slit, experiment, light of 6000Å is used. What will be the distance between two adjacent minima if distance between both the slits is 0.2 cm and interference pattern is observed at a distance of 1m.

Watch Video Solution

18. In Y.D.S.E., slits are at a distance of 0.5 mm and light of wavelength λ is used. Determine the value of λ if interference pattern is formed at a distance 1.2 m away and third dark fringe is at a distance of 1.2 cm from the central fringe.

Watch Video Solution

19. In Y.D.S.E., slits are at a distance of 0.5 mm and light of wavelength λ is used, if interference pattern is formed at a distance 1.2 m away and third dark fringe is at a distance of 1.2 cm from the central fringe, calculate the distance between central fringe and third dark frings if whole set-up is immersed in a liquid of refractive index 1.33.

Watch Video Solution

20. In Y.D.S.E., light of wavelength 600 nm is used. When slits are 1.2 mm apart, interference pattern of span $5 \times 10^{-3} m$ is observed on a screen placed 2m away. Calculate the number of fringes observed in the interference pattern.

Watch Video Solution

21. In double slit experiment using light of wavelength $600nm$, the angular width of a fringe formed on a distant screen is 0.1°. What is the spacing between the two slits ?

Watch Video Solution

22. In Young's double-slit experiment, light of wavelength 600 nm is used. When the slits are kept at a distance of 1mm, interference pattern is observed at a diatance of 1m. What will be the distance between central maxima and fringe with intensity equal to one-forth of maximum intensity.

Watch Video Solution

23. In an experiment, four identical coherent waves of intensity I_0 are interfered. Calculated the maximum intensity in the interference pattern.

Watch Video Solution

Practice Problems 2

1. Light of wavelength 6328 Å is incident normally on a slit of width 0.2 mm. Calculate the angular width of central maximum on a screen distance 9 m?

Watch Video Solution

2. Light of wavelength $5,000\text{Å}$ is normally illuminates a 0.2 mm wide slit. Calculate the angular spread between central maximum and first order maximum of the formed diffraction pattern.

Watch Video Solution

3. A parallel beam of light of 500 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 1 m away. It is observed that the first minimum is at a distance of 2.5 mm from the centre of the screen. Calculate the width of the slit.

Watch Video Solution

4. Light of wavelength $6,000\text{Å}$ falls on a single slit and diffracts. It is observed that the first maximum in diffraction pattern subtends an angle of 45°. Calculate the slit width.

Watch Video Solution

5. Light of wavelength 6 , 000 Å falls on a single slit and diffracts. It is observed that the first maximum in diffraction pattern subtends an angle of 45º, calculate the angular separation

between central maxima and secondary maxima of first order in observed diffraction pattern.

Watch Video Solution

6. A laser beam of $7,500\text{Å}$ is sent from a lunar rover on the moon. If laser beam passes through an aperture of 0.8 cm, calculate the angular spread of diffracted beam on reaching the Earth. The distance between the Earth and the moon is $4 \times 10^5 km$.

Watch Video Solution

7. (a) Write two characteristics features distinguishing the diffraction pattern from the interference fringes obtained in Young's double slit experiment.

(b) Two wavelengths of sodium light 590 nm and 596 nm are used , in turn, to study the diffraction taking place due to a single slit of aperture $1 \times 10^{-4} m$. The distance between the slit and the screen is 1.8m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

Watch Video Solution

8. Light of wavelength $5000 \times 10^{-10} m$ is incident normally on a slit. The first minimum of the diffraction pattern is observed to lie at a distance of 5 mm from the central maximum on a screen placed at a distance of 3m from the slit. Then the width of the slits is

Watch Video Solution

9. In a single slit diffraction set-up, the screen is placed at a distance of 80 cm from a slit. Light of $5, 000\text{Å}$ is illuminated on the slit, the diffraction pattern is oberved on the screen. Determine the aperture of the slit if distance between first and second minima is 2.1 mm.

Watch Video Solution

10. Light beams of wavelengths λ and λ' are illuminated on a single slit of aperture a. If the value of λ is $5 \times 10^{-7} m$, the first maxima formed coincides with the first minima formed light of wavelength λ'. Calculate the value of λ'.

Watch Video Solution

Practice Problems 3

1. Light of wavelength $5,000\text{Å}$ is used in a microscope of numerical aperture 0.10. Calculate the resovlving power of the microscope.

Watch Video Solution

2. A microscope is used to resolved two objects placed at a distance of $2 \times 10^{-4} cm$. Calculate the numerical aperture of the microscope if light of wavelength $6,000Å$ is used.

Watch Video Solution

3. A binary star system is observed using a telescope. The angular separation between both the stars is 5×10^{-6} radians. Calculate the aperture of objective of the telescope if light of wavelength $5,500Å$ is used.

Watch Video Solution

4. A telescope has an objective lens of diameter 5 inch. Calculate the resolving power of the telescope when light of wavelength $5,500\text{Å}$ is used.

Watch Video Solution

5. A telescope has an objective lens of diameter 5 inch, determine the minimum angular separation between two distant objects for light of wavelength $6,000\text{Å}$

Watch Video Solution

6. Light of wavelength $5,000\text{Å}$ is falling on a microscope objective lens with a cone angle of 60°. Calculate the resolving power of the microscope.

Watch Video Solution

7. Human eye is sensitive to light of wavelength $5,500\text{Å}$. Calculate the limit resolution of eye if diameter of pupil in the eye is nearly 2 mm.

Watch Video Solution

8. A slit of aperture 1.8 mm is illuminated by light of wavelength $5,000\text{Å}$. Calculate the minimum distance light can travel before the diffraction is noticed.

Watch Video Solution

9. For what distance is ray optics a good approximation when the aperture is $3mm$ wide and wavelength is $500nm$? (NCERT Solved Example)

Watch Video Solution

10. Light of wavelength $5, 500\text{Å}$ is illuminated on a slit. Calculate the slit width if Fresnel distance for diffraction set-up is 4 m.

Watch Video Solution

Practice Problems 4

1. Unpolarized light is incident on a plane glass surface. What should be the angle of incidence so that the reflected and refracted rays are perpendicular to eachother ?

Watch Video Solution

2. If the angle between the pass axes of a polariser and analyser is 45° . Write the ratio of the intensities of original light and the transmitted light after passing through the analyser.

Watch Video Solution

3. A light is incident on a refractive medium. The light is partially reflected and partially refracted. If both the reflected and refracted rays are mutually perpendicular, then determine the angle of refraction. Refractive index of medium is 1.47.

Watch Video Solution

4. A pair of nicols is used to polarise light. The analyser is rotated through an angle of 60°. Determine the reduction in maximum value of light transmitted.

Watch Video Solution

5. A distant star is moving constantly towards the Earth at a speed of $2.3 \times 10^{4} ms^{-1}$. A shift of 0.5Å in wavelengths is observed from the Earth. Calculate the actual value of wavelength emitted from the star if the Earth is considered at rest with respect to the distant star.

Watch Video Solution

6. A red shift of 60Å is observed in light of wavelength 5000Å coming from a distant red gaint star. Calculate the velocity of the distant nebula.

Watch Video Solution

7. The spectrum of distant nebula is taken in an observatory. A shift of 0.025% is observed in the spectral lines. Calculate the velocity of the distant nebula.

Watch Video Solution

8. What speed should a galaxy move with respect to us so that the sodium line at $589.0nm$ is observed at $589.6nm$?

Watch Video Solution

9. A pole light is situated near a still water pond. Calculate the angle subtended by the pole light to the pond surface such that light reflected from the water surface is completely polarised. Use $\mu = 1.23$.

Watch Video Solution

Conceptual Questions

1. Is it possible to produce interference using two different sources of white light held close ?

Watch Video Solution

2. Young's double-slit experiment is performed in a medium with refractive index greater than that of air. How will the interference pattern differ from the one performed in air as the medium?

Watch Video Solution

3. What type of interference pattern will be observed if two light sources of same wavelengths are used in Young's double-slit experiment ?

Watch Video Solution

4. How does wavelength and frequency of a monochromatic light changes while travelling from one medium to another ?

Watch Video Solution

5. In Young's double -slit experiment butter paper is placed convering one of the slit. How will the interference pattern on a distant screen change if butter paper partially refracts the light through it?

Watch Video Solution

6. Why there is no interference pattern observed when two coherent sources are placed far apart?

Watch Video Solution

7. What type of interference pattern will be observed if two coheret sources are placed very close to each other?

Watch Video Solution

8. When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequecy as the incident frequecy. Explain why ?

Watch Video Solution

9. How do energy and speed of the light wave change when it travels from a rarer to denser medium?

Watch Video Solution

10. What is effect on the interference fringes in a Young's double slit experiment due to each of the following operations :

(a) the screen is moved away from the plane of the slits,

(b) the monochromatic source is replaced by another monochromatic source of shorter wavelength,

(c) the separation between the two slits is increased,

(d) the source slit is moved closer to the double slit plane,

(e) the width of the source slit is increased.

(f) the width of two slits are increased,

(g) the monochromatic source is replaced by a source of white light ?

(In each operation, take all parameters, other than the one specified, to remain unchanged) NCERT Solved Example

Watch Video Solution

11. In Young's double-slit experiment, four lights- red, blue, green and yellow- are used. Which colour will have an interference with maximum fringe width?

Watch Video Solution

12. In Young's double slit experiment, if the two slits are illuminated with separate sources, no interference pattern is observed because

Watch Video Solution

13. Why a thin oil film spread over water appears colourful in light?

Watch Video Solution

14. A thin oil film spread over water appears colourful in light, will the oil film appear colourful if it is thick ?

Watch Video Solution

15. Light can be blocked by using a cardboard or other obstacle while sound wave cannot be blocked in similar way. Exaplain.

Watch Video Solution

16. Shadows formed from a point light source or distant light source are usually blurred at the edges. Comment.

Watch Video Solution

17. In broadcasting radios, there are two modes of receiving signals, AM and FM. In which mode, the signals will be smooth while the broadcasting radio is crossing an underground passage.

Watch Video Solution

18. How will the patterns in the single slit diffraction change if the width of the slit is decreased?

Watch Video Solution

19. Answer the following questions

(a) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?

(b) In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?

(c) When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why?

(d) Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily

(e) Ray optics is based on the assumption that light travels in a straight line. Diffraction effects (observed when light propagates through small apertures/slits or around small obstacles) disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments. What is the justification?

Watch Video Solution

20. In a single slit diffraction pattern, distance between the slit and the screen is doubled. Will

there be any change in the angular separation between the fringes of pattern?

Watch Video Solution

21. Why do we not encounter diffraction effects of light in everyday observations ?

Watch Video Solution

22. How will the diffraction pattern change if the single slit diffraction set-up is immersed in a medium with refractive index greater than air ?

Watch Video Solution

23. Discuss the intensity of transmitted light when a polaroid sheet is rotated between two crossed polaroids?

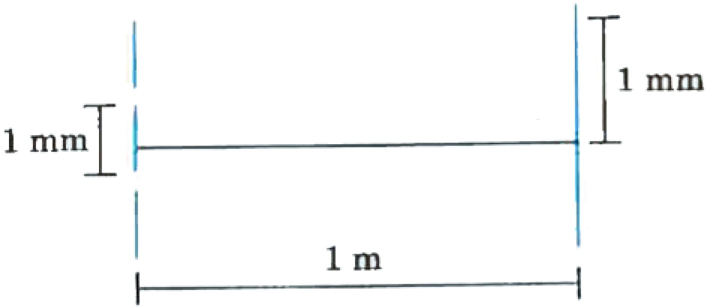
Watch Video Solution

Tough Tricky Problems

1. Two thin glass plates are placed parallel to each other such that distance between them is very small. Each glass plate reflects 25% of incident energy and transmits remaining 75% Light beam is incident on this system. Consider the interference of two light beams obtained after one reflection from each glass plate. Calculate ratio of the maximum to minimum intensity.

Watch Video Solution

2. Two slits are made on an opaque surface at a separation of 1 mm from each other. A screen is placed at a distance 1 m from the plane of the slits. A small hole is made on the screen at a distance 1 mm from the centre of the screen as shown in the figure. If we observe the light coming out from hole on the other side, then which wavelengths in the visible region will be absent and which will show strong presence ? Wavelength of visible light ranges from 400 nm to 700 nm.

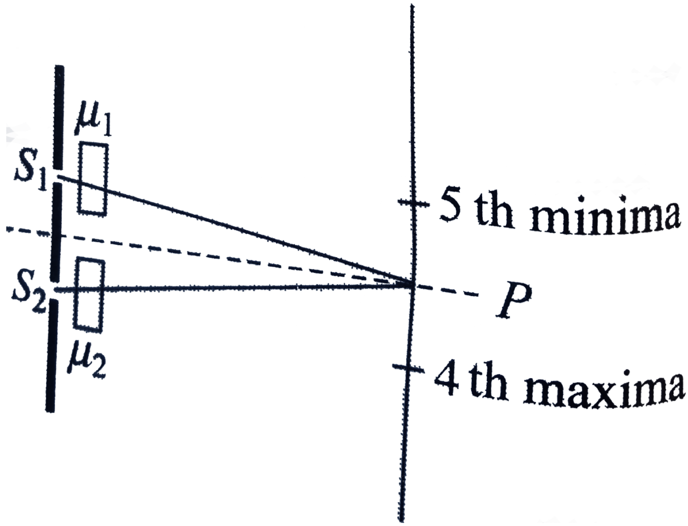


Watch Video Solution

3. 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.

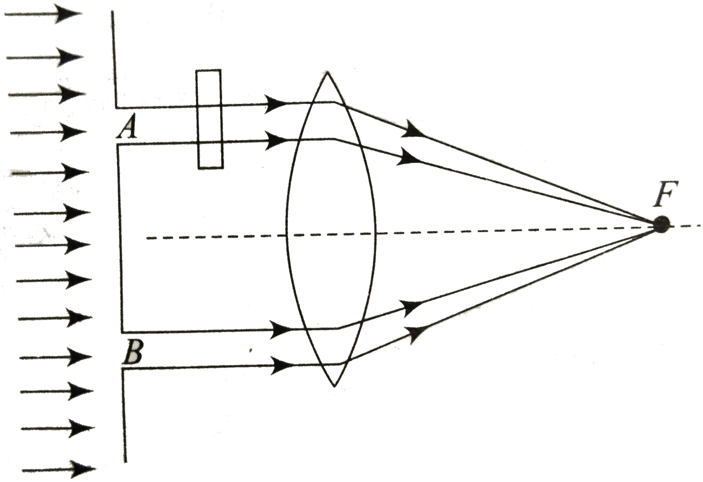
Calculate the thickness of glass plate. (Absorption of light by glass plate may be neglected.



Watch Video Solution

4. 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

5. White light is incident on water film of thickness $1\mu m$. Refractive index of water is 1.33. Which wavelengths in visible region (400 nm to

700 nm) will be strongly reflected by the water film ? Assume air on both sides of the film.

Watch Video Solution

6. Soap film of thickness $1\mu m$ appears bright when seen through reflected light of wavelength 700 nm. What should be the index of refraction of soap solution if it is somewhere between 1.2 and 1.3 ?

View Text Solution

7. White light is incident on a very thin glass plate of thickness $1\mu m$. Index of refraction for the glass is 1.5. Which wavelengths in the visible region (400 nm to 700 nm) are strongly transmitted by the glass plate ?

Watch Video Solution

Ncert File Solved Text Book Exercises

1. Monochromatic light of wavelength 589 nm is incident from air on a water surface. What are the wavelength, frequency and speed of (a) reflected, and (b) refracted light ? Refractive index of water is 1.33.

Watch Video Solution

2. What is the shape of the wavefront in each of the following cases ?

(a) light diverging from point source.

(b) light emerging out of a convex lens when a point source is placed at its focus.

(c) the portion of the wavefront of light from a distant star intercepted by earth.

Watch Video Solution

3. (a) The refractive index of glass is 1.5. What is the speed of light in glass?

(b) Is the speed of light in glass independent of the colour of light ? If not, which of the two colours red and violet travels slower in a glass prism?

Watch Video Solution

4. In a Young's double-slit experiment, the slits are separated by 0.28 mm and the screen is placed 1.4m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm . Determine the wavelength of light used in the experiment.

Watch Video Solution

5. In Young's double-slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. What is the intensity of lgight at a point where path difference is $\frac{\lambda}{3}$.

Watch Video Solution

6. A beam of light consisting of two wavelengths $650nm$ and $520nm$ is used to obtain interference fringes in a Young's double slit experiment.

(a) Find the distance of the third bright fringe on the screen from the central maximum for the wavelength $650nm$.

(b) What is the least distance from the central maximum where the bright fringes due to both the wavelengths coincide? The distance between the slits is $2mm$ and the distance between the plane of the slits and screen is $120cm$.

Watch Video Solution

7. In a double slit experiment the angular width of a fringe is found to be 0.2° on a screen placed I m away. The wavelength of light used in 600 nm. What will be the angular width of the fringe if the entire experimental apparatus is immersed in water ? Take refractive index of water to be $4/3$.

Watch Video Solution

8. What is Brewster angle for air to glass transtion ? (μ of glass is 1.5)

Watch Video Solution

9. Light of wavelength 5000 Å falls on a plane reflecting surface. What are the wavelength and

frequency of reflected light? For what angle of incidence is the reflected ray normal to the incident ray?

Watch Video Solution

10. Estimate the distance for which ray optics is good approximation for an aperature of 4 mm and wavelength 400 nm.

Watch Video Solution

Ncert File Solved Additional Exercises

1. The $6563\text{Å}H_2$ line emitted by hydrogen in a star is found to be red shifted by 15Å. Estimate the speed with which the star is receding from earth.

Watch Video Solution

2. Explain how Corpuscular theory predicts the speed of light in a medium, say, water, to be greater than the speed of light in vacuum. Is the prediction confirmed by experimental determination of the speed of light in water ? If

not, which alternative picture of light is consistent with experiment?

Watch Video Solution

3. You have learnt in the text how Huygens' principle leads to the laws of reflection and refraction. Use the same principle to deduce directly that a point object placed in front of a plane mirror produces a virtual image whose distance from the mirror is equal to the object distance from the mirror.

Watch Video Solution

4. Let us list some of the factors which could possibly influence the speed of wave propagation : (i) Nature of source (ii) direction of propagation (iii) motion of source and//or observer (iv) wave length (v) intensity of the wave.

On which of these factors, if any does (a) the speed of light in vaccum (b) speed of light in a medium (say glass or water) depend ?

Watch Video Solution

5. For sound waves, the Doppler's formula for frequency shift differs slightly between the two situation :

(i) source at rest , observer moving (ii) source moving , observer at rest.

The exact Doppler formulae for the case of light waves in vacuum, are however, strictly identical for the two situations in case of light travelling in a medium ?

Watch Video Solution

6. In double slit experiment using light of wavelength $600nm$, the angular width of a fringe formed on a distant screen is 0.1°. What is the spacing between the two slits ?

Watch Video Solution

7. Answer the following questions :

(a) In a single-slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band ?

(b) In what way is diffraction from each slit related to the interference pattern in a double-slit experiment?

(c) When a tiny circular obstacle is placed in the path of light from a distant source,a bright spot is seen at the centre of the shadow of the obstacle. Explain why?

(d) Two students are separated by a 7 m partition wall in a room 10 m high. If both ligth and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily ?

(e) Ray optics is based on the assumption that light travels in a straight line. Diffraction effects (observed when light propagates through small apertures/slits or around small obstacles) disprove this assumption. Yet the ray optics assumption is so commonly used in understanding location and several other properties of locaiton and several other properties of images in optical instruments. What is the justification?

View Text Solution

8. Two towers on top of the two hills are 40 km part. The line joining them passes 50 m above the hill half way between the towers. What is the longest wavelength of radio waves, which can be sent between the towers without appreciable diffraction effects?

Watch Video Solution

9. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observe on screen 1 m away. It is observed that the first minimum is at a distance of $2.5mm$ from the centre of the screen. Find the width of the slit.

Watch Video Solution

10. Answer the following questions :

(a) When a low flying aircraft passes overhead, we sometimes notice a slight shaking of the piture on our TV screen. Suggest a possible expanation.

(b) As you have learnt in the text, the principle of linear superposition of wave displacement is basic to understanding intensity distributions in diffractions and interference patterns. What is the justification of this principle ?

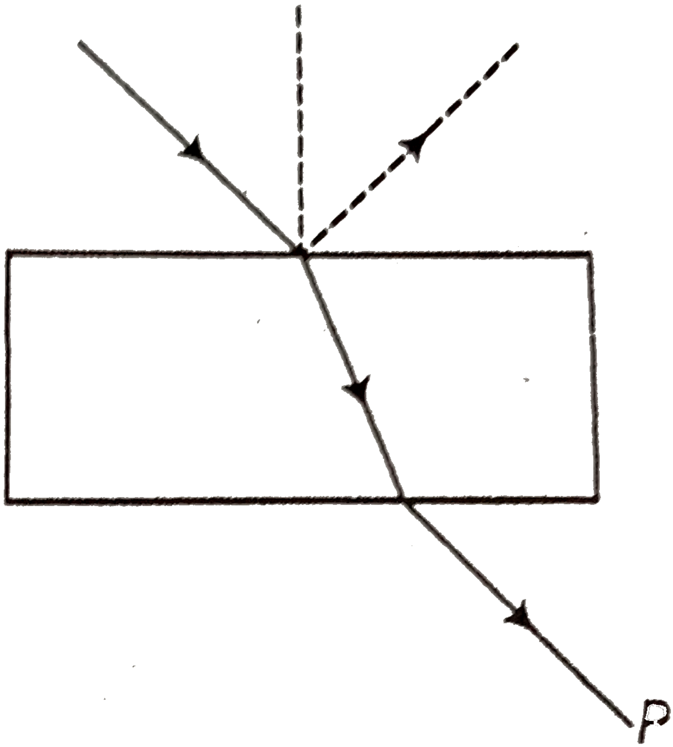
Watch Video Solution

11. In deriving the single slit diffraction pattern, it was stated that the intensity is zero at angle $n\lambda / a$. Justify this by suitable dividing the slit to bring out the cancellation.

Watch Video Solution

Ncert Exemplar Problems Obejective Questions Multiple Choice Questions Type I

1. Consider a light beam incident from air to a glass slab at Brewster's angle as shown in figure. A polaroid is placed in the path of the emergent ray at point P and rotated about an axis passing through the centre and pependicular to the plane of the plaroid.



A. For a particular orientation, there shall be darkness as observed thorugh the polaroid.

B. The intensity of light as seen thorugh the polaroid shall be independient of the rotation.

C. The intensity of light as seen through the polaroid shall go through a minimum but not zero for two orientations of the polaroid.

D. The intensity of light as seen through the polaroid shall go through a minimum for four orientations of the polaroid.

Answer: C

Watch Video Solution

2. Consider sunlight incident on a slit of width 10^4Å. The image seen through the slit shall

A. be a fine sharp slit white in colour at the centre

B. a bright slit white at the centre diffusing to zero intensities at the edges.

C. a bright slit white at the centre diffusing to regions of different colours

D. only be diffused slit white in colour.

Answer: A

View Text Solution

3. Consider a ray of light incident from air onto a slab of glass (refractive index n) of width d, at an angle θ . The phase difference between the ray reflected by the top surface of the glass and the bottom surface is

A. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+\pi$

B. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}$

C. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+\frac{\pi}{2}$

D. $\frac{4\pi d}{\lambda}\left(1-\frac{1}{n^2}\sin^2\theta\right)^{1/2}+2\pi$

Answer: A

Watch Video Solution

4. In a Young's double slit experiment, the source is white light. One of the holes is covered by a red filter and another by a blue filter. In this case

A. there shall be alternate interference patterns of red and blue

B. there shall be an interference pattern for red distinct from that for blue

C. there shall be no interference fringes

D. there shall be an interference pattern for red mixing with one for blue

Answer: C

Watch Video Solution

5. Figure shows a standard two slit arrangement with slits S_1, S_2. P_1, P_2 are the two minima points on either side of P (Figure). At P_2 on the screen, there is a hole and behind P_2 is a second 2-slit arrangement with slits S_3, S_4 and a second screen behind them.

A. There would be no interfernece pattern on the second screen but it would be lighted

B. The second screen would be totally dark.

C. There would be a single bright point on the second screen

D. There would be a regular two-slit pattern on the second screen.

Answer: D

Watch Video Solution

Ncert Exemplar Problems Obejective Questions Multiple Choice Questions Type Ii

1. Two source S_1 and S_2 of intensity I_1 and I_2 are placed in front of a screen [Figure a]. The pattern of intensity distribution see in the central portion is given by Figure b. In this case which of the following statement are true.

A. S_1 and S_2 have the same intensities

B. S_1 and S_2 have a constant phase difference

C. S_1 and S_2 have the same phase

D. S_1 and S_2 have the same wavelength.

Answer: A::B::D

Watch Video Solution

2. Consider sunlight incident on a pinhole of width 10^3 Å. The image of the pinhole seen on a screen shall be

A. a sharp white ring

B. different from a geometrical image

C. a diffused central spot, white in colour

D. diffused coloured region around a sharp central white spot.

Answer: B::D

Watch Video Solution

3. Consider the diffraction pattern for a small pinhole. As the size of the hole is increased

A. the size decreases

B. the intensity increases

C. the size increases

D. the intnesity decreases

Answer: A::B

Watch Video Solution

4. For light diverging from a point source

A. the wavefront is spherical

B. the intensity decreases in proportion to the distance squared

C. the wavefront is parabolic

D. the intensity at the wavefront does not depend on the distance

Answer: A::B

Watch Video Solution

Ncert Exemplar Problems Subjective Questions Very Short Answer Type Questions

1. Is Huygen's principle valid for longitudinal sound waves?

Watch Video Solution

2. Consider a point at the focal point of a convex lens. Another convex lens of short focal length is placed on the other side. Then the nature of wavefront emerging from the final image.

Watch Video Solution

Watch Video Solution

3. What is the shape of the wavfront on the Earth for sunlight?

Watch Video Solution

4. Why is the diffraction of sound wave more evident in daily experience than that of light wave ?

Watch Video Solution

5. The human eye has an approximate angular resolution of $\phi = 5.8 \times 10^{-4}$ rad and a typical photo printer prints a minimum of 300 dpi (dots per inch, $= 2.54cm$). Aminimum distance 'z' should a printed page be held so that one doesnot see the indivdual dots is ______ .

Watch Video Solution

6. A polariod (I) is placed in front of a monochromatic source. Another polariod (II) is placed in front of this polariod (I) and rotated till no light passes. A third polariod (III) is now placed in between (I) and (II), then

Watch Video Solution

Ncert Exemplar Problems Subjective Questions Short Answer Type Questions

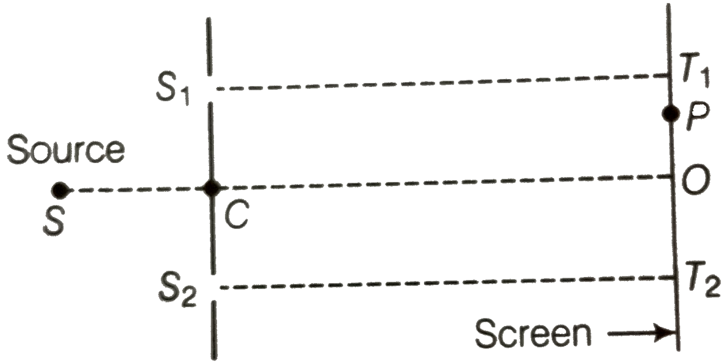
1. Can reflection result in plane polarised light if the light is incident on interface from the side with higher refractive index?

Watch Video Solution

2. For the same objective, what is the ratio of the least separation between two points to be distinguished by a microscope for light of 5000 Ã... and electrons accelerated through 100 V used as an illuminating substance?

Watch Video Solution

3. Consider a two slit interference arrangements (figure) such that the distance of the screen from the slits is half the distance between the slits. Obtain the value of D in terms of λ such that the first minima on the screen falls at a distance D from the centre O.



Watch Video Solution

Higher Order Thinking Skills Advanced Level Questions With Answers

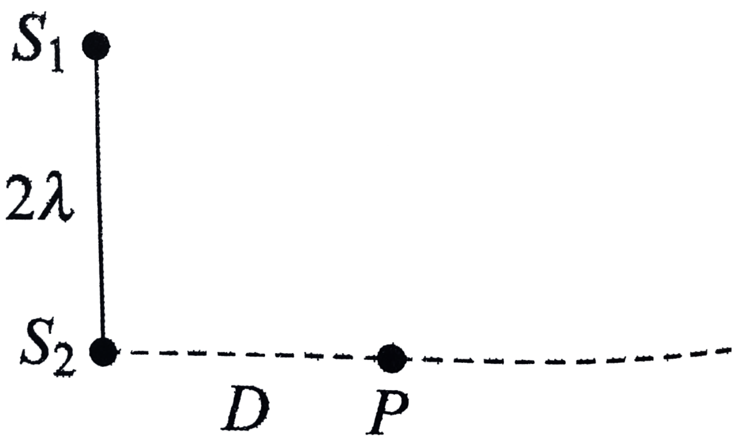
1. Let I_1 and I_2 be intensities of two sources such that $\frac{I_1}{I_2} = k$. Find value of $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$.

Watch Video Solution

2. 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

3. 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

4. Calculate the smallest angular separation between two stars which are just resolved by the telescope having objective lens of diameter 25 cm. Assume 555 nm as mean wavelength of light.

View Text Solution

5. Oil film of thickness $1 \mu m$ is deposited on a glass plate. Refractive index of oil is 1.25 and that of the glass is 1.5. Which wavelength in the visible region (400 nm to 700 nm) will be strongly reflected by this film?

View Text Solution

6. Separation between the slits of YDSE set-up is 0.1 cm. Films of same thickness 0.5 mm is pasted on both the slits. Refractive index of one of the films 1.52 and for the other it is 1.48 Wavelength of the light used is 600 nm. Sereen is placed at a distance 1 m from the slits. Calculate fringe width. What will be the distance of first available maxima from the centre?

View Text Solution

7. In Young's double-slit experiment, two coherent source are used. Intensity of one of the sources is I but for the other it is slightly different $I + dI$. Show that intensity at the minima is approximately $\frac{(\delta I)^2}{4I}$.

Watch Video Solution

8. 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 .

Watch Video Solution

Revision Exercises Very Short Answer Questions

1. Define a wavefront.

Watch Video Solution

2. what type of wavefront will emerge from (i) a point source and (ii) distant light source ?

Watch Video Solution

3. What will be the nature of the wavefront of light emitted from a line source ?

Watch Video Solution

4. What is the phase difference between any two points on a spherical wavefront?

Watch Video Solution

5. What is the shape of the wavelength in case Light emerging out of a convex lens when a point source is placed at its focus.

Watch Video Solution

6. What is sustained interference ? Write necessary conditions for it.

Watch Video Solution

7. What are coherent sources?

Watch Video Solution

8. State two conditions to obtain sustained interference of light. In young's double slit experiment, using light of wavelength 400 nm, interference fringes of width X are obtained. The wavelength of light is increased to 600 nm and the separation between the slits is halved. if one wants the observed fringe width on the screen to be the same in the two cases, find the ratio of the distance between the screen and the plane of the slits in the two arrangements.

Watch Video Solution

9. What are coherent sources of light ? Why are coherent sources required to obtain sustained interference pattern ?

Watch Video Solution

10. What is diffraction of light?

Watch Video Solution

11. The refractive index of plastic is $\sqrt{3}$. Calculate the angle of refraction for a ray of light incident at polarizing angle.

Watch Video Solution

12. State Huygens' principle of diffraction of light.

Watch Video Solution

13. What happens to interference fringes when the distance between the two coherent sources is decreased?

Watch Video Solution

14. If one of the slits in Young's experiment is covered, what effect will be intensity of light at the centre of the screen?

Watch Video Solution

15. Write the relationship between the path difference and the wavelength of light used for constructive and destructive interference of light.

Watch Video Solution

16. What is the condition of obtaining bright interference fringes?

Watch Video Solution

17. If you move the source slit closer to the double slit in Young's experiment what will be effect on the fringes?

Watch Video Solution

18. Will there be an interference pattern on the screen if the slits in Young's experiment are illuminated by two different sodium lamps emitting light of same frequency and wavelength?

Watch Video Solution

19. Distinguish between interference and diffraction of light.

Watch Video Solution

20. Three lights of red, blue and green colour are used successively in Young's experiment. For which colour, the fringe width is maximum ?

Watch Video Solution

21. What wil be the effect on the fringes, if Young's double slit experiment set up is immersed in water ?

Watch Video Solution

22. What will be the ratio of slit widths if the amplitudes of the light waves emerging from them is $\sqrt{3} : 1$?

Watch Video Solution

23. What is the effect on the interference fringes in Young's double slit experiment when the monochromatic source is replaced by a source of white light?

Watch Video Solution

24. What are coherent sources ? Define interfernece of light. Obtain the condition for constructive and destructive interference of light .

Watch Video Solution

25. What are coherent sources of light ? Why nointerference pattern is observed when two coherent sources are (i) too close (ii) very far apart ?

Watch Video Solution

26. State the postulates of Huygens' wave theory.

Watch Video Solution

27. What is the condition for diffraction to take place ?

Watch Video Solution

28. Why diffraction is better experienced in sound waves than in light waves ?

Watch Video Solution

29. What will be the effect on the width of the central maxima if the slit it made narrower ?

Watch Video Solution

30. Why light waves cannot show diffracton around hills and tall buildings whereas sound waves can ?

Watch Video Solution

31. How does the angular separation between frings in single-slit diffraction experiment change when the distance of separation between the slit and screen is doubled ?

Watch Video Solution

32. State one defect of Huygens's wave theory.

Watch Video Solution

33. In case of diffraction from a singel slit, if red light is replaced by a blue light, what will be the effect on the fringe width?

Watch Video Solution

34. What is the condition for the nth secondary minima in case of diffraction from a single slit?

Watch Video Solution

35. Which quantity associated with light wave sets the limit of ability to distinguish very close objects?

Watch Video Solution

36. (a) Distinguish between unpolarized light and linearly polarized light. How does one get linearly polarised light with the help of a plaroid ?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1. The light transmitted by it is then incident on a second polaroid P_2 with its pass axis making angle of 60° relative to the pass axis of P_1. Find the intensity of the light transmitted by P_2.

Watch Video Solution

37. Define resolving power of an optical instrument.

Watch Video Solution

38. The intensity of scattered light I in Ray leigh scattering is proportional to ?

Watch Video Solution

39. What is the speed of light in a denser medium of polarising of polarising angle 30°?

Watch Video Solution

40. The resolving power of a microscope at 6000 Å is 10^4. What is its resolving power at 4000 Å

Watch Video Solution

41. Deduce Snell's Law of refraction for a plane wave using Huygen's principle.

Watch Video Solution

42. Why we use the objective lens of larger aperture to increase the resolving power of telescope ?

Watch Video Solution

43. Why can we not get diffraction pattern from a wide slit illuminated by monochromatic light ?

Watch Video Solution

44. What is polarisation ?

Watch Video Solution

45. Name two commonly used polarisers used to polarises light.

Watch Video Solution

46. Light waves can be polarised but sound waves cannot be. Why?

Watch Video Solution

47. Can two independent source of light be coherent? Why ?

Watch Video Solution

48. The headlights of a car polarised or unpolarised. Explain.

Watch Video Solution

49. Which of the following waves can be polarized (i) Heat (ii) Sound waves ? Give reason to support your answer.

Watch Video Solution

50. If the angle between the pass axes of a polariser and analyser is 45° . Write the ratio of the intensities of original light and the transmitted light after passing through the analyser.

Watch Video Solution

51. For which angle of incidence reflected ray is completely polarised?

Watch Video Solution

Revision Exercises Additional Questions

1. A: Light waves can be polarised.

R: Light waves are transverse in nature.

A. get reflected

B. get refracted

C. get polarised

D. do not get polarised

Answer: C

Watch Video Solution

2. The transverse nature of light is shown by

A. interference

B. diffraction

C. polarization

D. reflection

Answer: C

Watch Video Solution

3. The wavefront of a linear source of light is

A. spherical

B. plane

C. cylindrical

D. reflected type

Answer: C

Watch Video Solution

4. Which of the following cannot be polarised?

A. heat waves

B. light waves

C. sound waves

D. micro waves

Answer: C

Watch Video Solution

5. When light passes from a denser medium to a rarer medium

A. Velocity of light increases

B. Velocity of light decreases

C. Velocity of light remains unchanged

D. Velocity of light becomes infinity

Answer: A

Watch Video Solution

6. What is the Fresnel distance for an aperture of 3 mm and wavelength 400 nm?

A. 8.5 m

B. 22.5 m

C. 10 m

D. 15 m

Answer: B

Watch Video Solution

7. If the polarising angle for a medium is 45°, what is the refractive index of that medium?

A. 1

B. 1.3

C. 1.5

D. 0.9

Answer: A

Watch Video Solution

8. When the distance between the slit and screen in Young's experiment is doubled then

A. Fringe width becomes double

B. Fringe width becomes half

C. Fringe width remains unchanged

D. Fringe width becomes thrice

Answer: A

Watch Video Solution

9. At polarising angle, the angle between reflected and refracted rays is

A. 60°

B. 45°

C. 90°

D. 120°

Answer: C

Watch Video Solution

10. Sound waves do not exhibit-

A. interference

B. diffraction

C. polarisation

D. reflection

Answer: C

Watch Video Solution

11. The displacement of the interfering light waves are $y_1 = 4 \sin \omega t$ and $y_2 = 3 \sin\left(\omega t + \frac{\pi}{2}\right)$ What is the amplitude of the resultant wave?

A. 5

B. 7

C. 1

D. 0

Answer: A

Watch Video Solution

12. Soap bubble appears coloured due to the phenomenon of

A. scattering

B. diffraction

C. dispersion

D. interference

Answer: D

Watch Video Solution

Revision Exercises Fill In The Blanks

1. Bubbles of colourless soap solution appear coloured in sun light. Why ?

Watch Video Solution

2. What is the main condtion to produce interference of light ?

Watch Video Solution

3. For a path difference of λ, the corresponding phase difference is ....radians.

Watch Video Solution

4. On decreasing the distance between two slits, the fringe width will ....

Watch Video Solution

5. From a distance light source, the shape of the wavefront is.................. .

Watch Video Solution

6. When white light source is used for obtaining interference, the central fringe is ....

Watch Video Solution

7. A wavefront is..........of all the particales of a medium which are................. .

Watch Video Solution

8. When a wave undergoes reflection at a denser medium, what happens to its phase ?

Watch Video Solution

9. Which phenomena establish the wave nature of light ?

Watch Video Solution

10. Out of red and blue, fringe width will be maximum for ....colour.

Watch Video Solution

Revision Exercises Short Answer Questions

1. Draw the shape of wavefront when a plane wavefront in incident on (i) concave mirror and (ii) prism.

Watch Video Solution

2. Using Huygens' principle, establish the law of reflection.

Watch Video Solution

3. Using Huygens' principle for the wave theory of light, verify the law of refraction.

Watch Video Solution

4. In a Young's double slit interference experiment, the ratio of intensity at the maxima and minima in the interference pattern is $\frac{25}{9}$. What will be the ratio of amplitudes of light emitted by the two slits?

Watch Video Solution

5. What is the relation between phase difference and path difference ? The path difference at a point on the screen from two coherent sources is $5\lambda / 2$. Describe the possiblities of constructive and destructive interference at that point if the phase difference between the sources is either (i) π or (ii) 2π.

Watch Video Solution

6. The ratio of amplitude of two waves producing interference pattern is 1 : 4. Find $I_{\max}$

to $I_{\min}$ and fringe visiblity.

Watch Video Solution

7. Explain what is meant by diffraction of light. Describe a simple experiment to demonstrate diffraction at a single slit.

Watch Video Solution

8. (i) Write the condition under which light source can be said to be coherent.

(ii) Why it is said to have coherent sources to produce an interference pattern ?

Watch Video Solution

9. (a) If one of two identical slits producing interference in Young's experiment is covered with glass so that the light intensity passing through it is reduced to 50%, find the ratio of the maximu and minimum intensity of the fringe in the interference pattern.

(b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light ?

Watch Video Solution

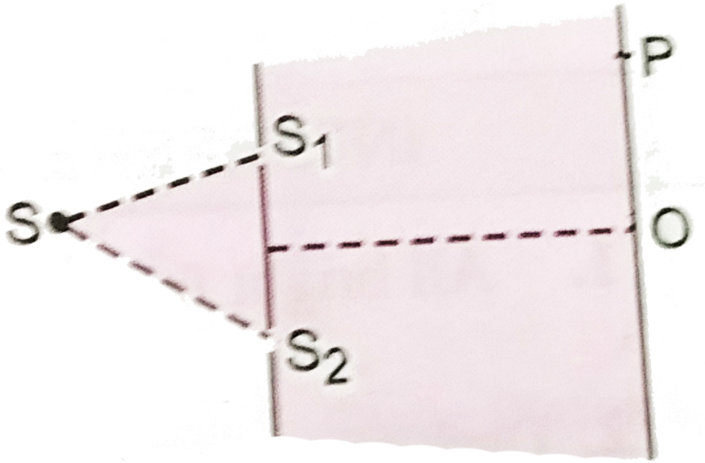
10. What is interference ? In Young's double-slit experiment, show that the fringe width β for interference fringes is $\beta = \dfrac{\lambda D}{d}$

Where D is the distance of the screen from the slit, d is the distance between two slits and λ is the wavelength of light used.

Watch Video Solution

11. Fig. shows an experimental set up simillar to Young's double slit experiment to observe interference of light. Here $SS_2 - SS_1 = \lambda/4$. Write down the conditions of (i) Contstructive interference

(ii) Destructive interference at any point P in terms of path diff. $(S_2P - S_1P)$. Does the central fringe observed in the above set up lie above or below O ? Give reason.



Watch Video Solution

12. (a) The ratio of the widths of two slits in Young's double-slit experiment is 4 : 1. Evaluate the ratio of intensities at maxima and minima in the interference pattern.

(b) Does the appearance of bright and dark fringes in the interference pattern violate, in any way, conservation of energy ? Explain.

Watch Video Solution

13. In Young's double slit experiment, what is the effect on the interfernece pattern if,

(i) the distance between the two slits is halved.

(ii) the distance between the screen and the plane of slits is doubled.

(iii) one of the slits is covered with translucent paper.

Watch Video Solution

14. For a single slit of width "a" the first minimum of the interference pattern of a monochromatic light of wavelength e occurs at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}$, we get a maximum for two narrow slits separated by distance "a". Explain.

Watch Video Solution

15. (a) Show using a proper diagram how unpolarised light can be linearly polarised by reflection from a transparent glass surface.

(b) The figure shows a ray of light falling normally on. the face AB of an equilateral glass prism having refractive index 3/2, placed A in water of refractive index 4/3. Will this ray suffer total internal reflection on striking the face AC? Justify your answer.

Watch Video Solution

16. What is meant by diffraction of light? Show graphically the relative intensity distribution for a single-slit diffraction pattern as a function of $\sin\theta$ and write the condition for the first secondary minimum of diffraction pattern in terms of path difference .

Watch Video Solution

17. (a) Write the factors by which the resolving power of a telescope can be increased.

(b) Estimate the angular separation between first-order maximum and third-order minimum of the diffraction pattern due to a single slit of width 1mm, when light of wavelength 600 nm is incident normal on it.

View Text Solution

18. Resolving power of a microscope is

Watch Video Solution

19. What will be the ratio of the resolving powers of two convex lenses used as objective lens in astronomical telescope, having same focal length and apertures as A_1 and $A_2 (A_1 > A_2)$? Which telescope will you prefer and why?

Watch Video Solution

20. State and explain Brewster's law of polarization.

Watch Video Solution

21. What is polarisation of light? Explain polarisation by scattering.

Watch Video Solution

22. What are polaroids? Give their applications.

Watch Video Solution

23. (a) Using the phenomenon of polarisation, show how transverse nature of light can be demonstrated.

(b) Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intesity I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its pass axis makes an angle of 30° with that of P_1. Determine the intensity of light transmitted through P_1, P_2 and P_3.

View Text Solution

Revision Exercises Long Answer Questions

1. Define a wavefront. Using Huygens' principle verify the laws of reflection at a plane surface.

Watch Video Solution

2. What are coherent sources? Why are coherent sources required to produce interference of light? Give an example of interference of light in everyday life.

In Young's double-slit experiment, the two slits are 0.03 cm apart and the screen is placed at a distance of 1.5 m away from the slits. The distance between the central bright fringe and fourth bright fringe is 1 cm. Calculate the wavelength of light used.

View Text Solution

3. (a) Light waves from two cohernet sources having intensities I and 2I cross each other at a point with a phase difference of 60°. What is the resultant intensity at the point ?

(b) With the help of a diagram obtain an expression for finding the distance between two consecutive bright or dark fringes in the interference pattern prodcued by double-slits.

View Text Solution

4. (a) In Young's double-slit experiments, deduce the conditions for obtaining constructive and desctructive interference fringes. Hence deduce the expression for the fringe width.

(b) Show that the fringe pattern on the screen is actually a superposition of single slit diffraction from each slit.

(c) What should be the width of each slit to obtain 10 maxima of the double-slit pattern within the central maximum of the single slit pattern, for green light of wavelength 500 nm, if the separation between two slits is 1 mm?

View Text Solution

5. State the importance of coherent sources in the phenomenon of interference. In Young's double slit expet-ment to produce interference pattern obtain the conditions for constructive and destructive interference. Hence deduce the expression for the fringe width. How does the firinge width get affected, if the entire experimental apparatus of Young's is immersed in water ?

Watch Video Solution

6. Explain what is meant by diffraction of light. Describe a simple experiment to demonstrate diffraction at a single slit.

Watch Video Solution

7. (a) Describe briefly how a dffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence obtain the conditions for the angular width of secondary maxima and secondary minima.

(b) Two wavelengths of sodium light of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture $2 \times 10^{-6} m$. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.

View Text Solution

8. State the condition under which the phenomenon of diffraction of light takes place. Derive an expression for the width of the central maximum due to diffraction of light at a single slit.

A slit of width 'a' is illuminated by a monochromatic light of wavelength 700 nm at normal incidence. Calculate the value of 'a' for position of

(i) first minimum at an angle of diffraction of 30.

(ii) first maximum at an angle of diffraction 30.

View Text Solution

9. (a) How does an unpolarised light incident on a polaroid get polarised ? Describe briefly, with the help of a necessary diagram, the polarisation of light by reflection from a transparent medium.

(b) Two polaroids 'A' and 'B' are kept in crossed position. How should a third polaroid 'C' be placed between them so that the intensity of polarised light transmitted by polaroid B reduces to 1/8 th of the intensity of unpolarised light incident on A?

View Text Solution

Revision Exercises Numerical Problems

1. Find the wavelength, frequency and speed of refracted light if it is incident from air to a glass surface. Wavelength of light is 590 nm and refractive index of glass is 1.5.

Watch Video Solution

2. The wavelength range of white light is 400 nm to 700 nm. What will be the wavelength range if light passes through water? Refractive index of water is 1.33.

Watch Video Solution

3. Two transparent media A and B have thickness ratio 1 : 2. The time taken by light in passing through A and B is same. Find the refractive index of B w.r.t A.

Watch Video Solution

4. Find the distance at which a ray of light having wavelength 600 nm can travel before broadening. The width of diffracting aperture is 4 mm.

Watch Video Solution

5. In Young's experiment if two straight narrow parallel slits 3 mm apart are illuminated with monochromatic light of wavelength 5900×10^{-8} cm (centimetre). Fringes are observed at a distance of 3m from slits. Find the width of fringes.

Watch Video Solution

6. Green light of wavelength 5100 A from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen 200 cm away is 2 cm find the separation between the slits.

Watch Video Solution

7. Two slits are made one millimetre apart and the screen is placed one metre away. What is the fringe separation when blue- green light of wavelength 500 nm is used ?

Watch Video Solution

8. The phase difference between two waves meeting at a point is $3\frac{\pi}{2}$. What is the corresponding path difference ?

Watch Video Solution

9. A beam of light consisting of two wavelength, 6500Å and 5200Å is used to obtain interference fringes in a Young's double slit experiment. Find the distance of the third fringe on the screen from the central maximum for the wavelength 6500Å. What is the least distance from the central maximum at whixh the bright fringes due to both wavelengths coincide? The distance between the slits is 2 mm and the distance between the plane of the slits and the screen is 120 cm.

Watch Video Solution

10. In YDSE, slits are separated by $0.24mm$ and the screen is kept $160cm$ away from slits. If fringe width is measured to be $0.4cm$, calculate the wavelength of light used.

Watch Video Solution

11. In Young's double slit experiment wave length of light used is 5000Å and distance between the slits is 2 mm, distance of screen from the slits is 1m. Find fringe width and also calculate the distance of 7^{th} dark fringe from central bright fringe.

Watch Video Solution

12. Answer the following questions :

(a) In a double-slit experiment using light of wavelength 600 nm, the angular width of the fringe formed on a distant screen is 0.1. Find the spacing between the two slits.

(b) Light of wavelength 5000Å propagating in air gets partly reflected from the surface of water. How will the wavelengths and frequencies of the refleceted and refracted light be affected?

View Text Solution

13. In Young's double-slit experiment, monochromatic light of wavelength 630 nm illuminates the pair of slits prodcues an interference pattern in which two consecutive bright fringes are separated by 8.1 mm. Another source of monochromatic light produces the interference pattern in which the two consecutive bright fringes are separated by 7.2 mm. Find the wavelength of light for the second source.

What is the effect on the interference fringes if the monochromatic source is replaced by a source of white light?

Watch Video Solution

14. In YDSE, slits are separated by $0.24mm$ and the screen is kept $160cm$ away from slits. If fringe width is measured to be $0.4cm$, calculate the wavelength of light used.

Watch Video Solution

15. A parallel beam of light of wavelength 500 nm falls on a narrow slit and the resulting diffraction pattern is observe on screen 1 m away. It is observed that the first minimum is at a distance of $2.5mm$ from the centre of the screen. Find the width of the slit.

Watch Video Solution

16. In Young's double-slit experiment, a screen is placed 1.5 m away from slits which are 0.03 cm apart. The distance between the central bright fringe and fourth bright fringe is 1 cm. Calculate the wavelength of light used.

Watch Video Solution

17. Find the ratio of intensity of maxima and minima in the interference pattern if the two slits used in Young's experiment have width ratio 4:9.

Watch Video Solution

18. Light of wavelength 6000Å is incident normally on single slit of width 0.23 mm. Find the angular spread between the central maxima and second-order maxima of diffraction pattern.

Watch Video Solution

19. Light of wavelength 6000Å is incident normally on a single slit of width 0.03 mm. Find the width of the central maxima on the screen which is at a distance 1.5 m away from the slit. What will be the width if the apparatus is immersed in water of refractive index 1.33?

Watch Video Solution

20. (a) Describe any two characteristic feature which distinguish interference and diffraction phenomena. Derive the expression for the

intensity at a point of the interference pattern in Young's double slit experiment.

(b) In the diffration due to single slit experiment, the aperture of the slit is 3 mm. If monochromatic light of wavelength 620 nm in incident normally on the slit, calculate the separation in between the first order minima and the 3^{rd} order maxima on one side of the screen. The distance between the slit and the screen is 1.5 m.

Watch Video Solution

21. If light of 6000Å is coming from a star, what will be resolving power of a telescope, if diameter of objective is 100 inch ?

Watch Video Solution

22. (a) Assume that the light of wavelength 6000Å is coming from a star. Find the limit of resolution of a telescope whose objective has a diameter of 250 cm.

(b) Two slits are made 1 mm apart and the screen is placed 1m away. What should be the width of each slit to obtain 10 maxima of the double-slit patterns within the central maximum of the single-slit pattern?

View Text Solution

23. For a given medium, the polarising angle is 60°. What will be the critical angle for the medium?

Watch Video Solution

24. Find the angle of refraction for a ray of light falling on a transparent medium of refractive index 1.6.

The reflected and refracted rays are perpendicular to each other.

Watch Video Solution

25. To reduce the intensity of incident unpolarised light to $1/4$, find the angle at which the axes of two polaroids should be placed.

Watch Video Solution

26. Two nicols are so oriented that the maximum amount of light is transmitted. To what fraction of its maximum value is the intensity of transmitted light reduced when the analyser is rotated through (i) 45° (ii) 90° (iii) 180°. ?

Watch Video Solution

27. Find the polarising angle and the angle of refraction in glass if the critical angle for a certain wavelength of light in glass is 40°.

Watch Video Solution

28. Find the angular divergence in which most of the light is diffracted if a parallel beam of monochromatic light of wavelength 500 nm passes through a long slit of width 0.3 mm.

Watch Video Solution

29. Calculate the angle of refraction and refractive index of water if reflected light is

plane polarised when incident at an angle of 55°.

Watch Video Solution

30. Light of wavelength 6000 $\overset{\circ}{A}$ is used to obtain interference fringe of width 6 mm in a young's double slit experiment. Calculate the wavelength of light required to obtain fringe of width 4 mm if the distance between the screen and slits is reduced to half of its initial value.

Watch Video Solution

31. (a) Explain two features to distinguish between the interference pattern in Young's double slit experiment with the difference pattern obtained due to a single slit.

(b) A monochromatic light of wavelength $500 nm$ is incident normally on a single slit of width 0.2 nm of produce a diffraction pattern. Find the angular width of the central maximum obtained on the screen.

Estimate the number of fringes obtained in Young's double slit experimental with fringe width $0.5 mm$, which can be accommodated within the region of total angular spread of the central maximum due to single slit.

Watch Video Solution

Objective Type Questions A Multiple Choice Questions

1. There is a Young's double-slit experiment set-up completely dipped in water. Assume that the refractive index of water is μ_1. One of the slits is covered with a thin film of thickness t and refractive index μ_2. What will be the optical path difference at the centre of screen ?

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

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

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

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

Answer: C

Watch Video Solution

2. Speed of light in a medium depends on

A. inertial properties of the medium

B. elastic properties of the medium

C. inertial as well as elastic properties of the medium

D. neither inertial nor elastic properties of the medium

Answer: D

Watch Video Solution

3. Two identical and coherent sources of light are used in Young's double-slit experiment and resulatant intensity at the centre of the screen is found to be I_1. When two identical sources of intensity same as before but incoherent are used for the experiment, then resultant intensity at the centre of the screen is found to be I_2. What is the value of $I_1 \,/\, I_2$?

A. 1

B. 2

C. 4

D. 0.5

Answer: B

View Text Solution

4. Contrast of the fringe pattern obtained in Young's double-slit experiment depends on

A. Wavelength

B. phase difference between sources

C. intensity ratio of the sources

D. distance between plane of slits and screen

Answer: C

Watch Video Solution

5. Which of the following properties show that light is a transverse wave?

A. Refraction

B. Dispersion

C. polarisation

D. Diffraction

Answer: C

Watch Video Solution

6. In Young's double-slit experiment, coordinate system is selected in such a manner that Y-coordinate of central maximum is 1cm and the same for 9^{th} maximum is 9 cm. If the entire set-up is immersed in a fluid with refractive index 4/3, then what will be new Y-coordinates of central maximum and 9^{th} maximum?

A. 1 cm , 9 cm

B. 3/4 cm, 27/4 cm

C. 4/3 cm , 7 cm

D. 1 cm , 7 cm

Answer: D

View Text Solution

7. In a standard Young's double-slit experiment set-up, two point P and Q are marked on the screen Path difference corresponding to point P is $\lambda/2$ and for point Q it is $\lambda/4$. Here λ is wavelength of light being used. If I_P and I_Q are the resultant intensities at points P and Q, then I_Q/I_P is

A. 2

B. $1/2$

C. 0

D. infinity

Answer: D

Watch Video Solution

8. A source emitting light of wavelengths λ_1 and λ_2 is used in Young's double-slit experiment. If fourth bright of λ_1 coincides with sixth bright of λ_2, then

A. $2\lambda_1 - 3\lambda_2$

B. $3\lambda_1 - 2\lambda_2$

C. $4\lambda_1 - 3\lambda_2$

D. $3\lambda_1 - 4\lambda_2$

Answer: A

Watch Video Solution

9. Select best monochromatic source of light.

A. Bulb

B. Candle

C. Tube light

D. Laser

Answer: D

Watch Video Solution

10. In Young's double-slit experiment , d is separation between the slits. Separation between plane of the slits and screen is D. Wavelength of light used is λ. Number of fringes per unit distance on the screen is

A. $\lambda D / d$

B. $d / \lambda D$

C. $\lambda d / D$

D. $D / \lambda d$

Answer: B

Watch Video Solution

11. When light is refracted which of the following does not change?

A. Amplitude

B. Velocity

C. Frequency

D. Wavelength

Answer: C

Watch Video Solution

12. Two sources are called coherent if they produce waves

A. of equal wavelength

B. of equal frequency

C. of equal velocity

D. of equal frequency and having constant phase difference between them.

Answer: D

Watch Video Solution

13. In standard Young's double-slit experiment, 9 fringes are found to be formed in a portion of screen. Wavelength of light used is 600 nm. How many fringes will be formed in the same portion of screen if wavelength of light is changed to 450 nm?

A. 12

B. 18

C. 14

D. 20

Answer: A

Watch Video Solution

14. Two light waves having the same wavelength λ in vacuum are in phase initially. Then the first ray travels a path of length L_1 through a medium of refractive index μ_1. Then second ray travels a path of length L_2 throug a medium of refractive index μ_2. The two waves are then combined to observed interference effects. The phase difference between the two, when they interfere, is

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

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

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

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

Answer: C

Watch Video Solution

15. When exposed to sunlight, thin films of oil on water often exhibit brilliant colours due to the phenomenon of

A. Polarisation

B. Scattering

C. Interference

D. reflection

Answer: C

Watch Video Solution

16. If entire Young's double-slit experiment set-up is immersed in water, then

A. fringe width will remain unaffected

B. fringe width will increase

C. fringe width will decrease

D. experiment cannot be performed in water.

Answer: C

Watch Video Solution

17. There is an equilateral triangle ABC. Two monochromatic and coherent sources of light are placed at points A and B. Intensity of light from both the sources reaching the point C is same and equal to $2W/m^2$. Resultant intensity of light at point C

A. is $8W/m^2$

B. is $4W/m^2$

C. is zero

D. cannot be determined with the given information

Answer: A

Watch Video Solution

18. What is the shape of wavefront from distant source of light?

A. Planar

B. Spherical

C. cylindrical

D. Depends on shape of the source

Answer: A

Watch Video Solution

19. What is the phase difference between any two points on a wave front ?

A. π

B. $\pi / 2$

C. $\pi / 4$

D. 0

Answer: D

Watch Video Solution

20. In YDSE, when a glass plate of refractive index 1.5 and thickness t is placed in the path of one of the intefering beams (wavelengthλ), intensity at the position where central maximum occurred previously remains unchanged. The minimum thickness of the glass plate is

A. $\lambda / 2$

B. λ

C. 2λ

D. 4λ

Answer: C

Watch Video Solution

21. It is observed that amplitude modulated (AM) radio wave shows appreciable diffraction when it encounters an opening of size 75 cm $\times$ 75 cm. In such a case, diffraction shown by frequency modulated (FM) wave is very negligible. If λ_A and λ_F represent average wavelengths of AM and FM waves, then

A. $\lambda_A < \lambda_F$

B. $\lambda_A > \lambda_F$

C. $\lambda_A \approx \lambda_F$

D. information is not sufficient to decide any relation between wavelengths

Answer: B

Watch Video Solution

22. A thin transparent sheet is placed in front of a slit in Young's double slit experiment. The fringe width will

A. remain unaffected

B. increase

C. decrease

D. change according to refractive index of material

Answer: A

Watch Video Solution

23. In Young's double-slit experiment, two cohernet sources of different intensites are used to make interference pattern. Ratio of the maximum to minimum intensity of pattern is found to be 25. What will be ratio of intensities of sources?

A. $625:1$

B. $9:4$

C. $25:1$

D. $5:1$

Answer: B

Watch Video Solution

24. There is a source emitting electromagnetic waves of wavelength 2m . One light ray reaches a point P in space direcly and the other ray reaches the same point P after travelling 1m extra distance and after getting reflected from a glass plate. Let I be the original intensity corresponding to both rays and glass plate reflects only 25% of incident energy. Resultant intensity at point P will be

A. $3I/2$

B. $9I/2$

C. $9I/4$

D. 0

Answer: C

Watch Video Solution

25. Two identical coherent sources are used to perform interference experiment. Intensity of light at the point of maxima is found to be I_0. If one of the slits is closed, then what will be intensity of light at the same point?

A. I_0

B. $4I_0$

C. $I_0 / 4$

D. $2I_0$

Answer: C

Watch Video Solution

Objective Type Questions B Multiple Choice Questions Aipmt Neet Other State Boards For Medical Entrance

1. In young's double slit experiment the separation d between the slits is $2mm$, the wavelength λ of the light used is $5896Å$ and distance D between the screen and slits is $100cm$. It is found that the angular width of the fringes is 0.20°. To increases the fringe angular width to 0.21°(with same λ and D) the separtion between the slits needs to be changed to

A. 2.1 mm

B. 1.9 mm

C. 1.8 mm

D. 1.7 mm

Answer: B

Watch Video Solution

2. Which colour of the light has the longest wavelength?

A. violet

B. red

C. blue

D. green

Answer: B

Watch Video Solution

3. In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2°, what will be the angular width of the first minima, if the entire experimental apparatus is immersed in water ? $(\mu_{\text{water}} = 4/3)$

A. 0.1°

B. 0.266°

C. 0.15°

D. 0.05°

Answer: C

Watch Video Solution

4. Unpolarized light is incident from air on a plane surface of a material of refractive index $'\mu'$. At a particular angle of incidence $'I'$, it is found that the reflected and refracted rays are perpendicular to each other.

Which of the following options is correct for this situation?

A. $i = \sin^{-1}\left(\frac{1}{\mu}\right)$

B. Reflected light is polarised with the electric vector perpendicular of the plane of incidence.

C. Reflected light is polaried with its electric vector parallel to the plane of incidence.

D. $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

Answer: B

Watch Video Solution

5. In a double slit experiment, the two slits are $1mm$ apart and the screen is placed $1m$ away. A monochromatic light of wavelength $500nm$ is used. What will be the width of each slit for obtaining ten maxima of double slit within the central maxima of single-slit pattern?

A. 0.02 mm

B. 0.2 mm

C. 0.1 mm

D. 0.5 mm

Answer: B

Watch Video Solution

6. For a parallel beam of monochromatic light of wavelength $'\lambda'$ differaction is produced by a single slit whose width $'a'$ is of the order as wavelength of the light. If $'D'$ is the distance of the screen from the slit, the width of the central maxima will be

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

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

C. $\frac{D\lambda}{a}$

D. $\frac{Da}{\lambda}$

Answer: B

Watch Video Solution

7. A beam of light of $\lambda = 600nm$ from a distance source falls on a single slit $1mm$ wide and the resulting diffraction pattern is observed on a screen $2m$ away. The distance between first dark fringes on either side of the central bright fringe is

A. 1.2 cm

B. 1.2 mm

C. 2.4 cm

D. 2.4 mm

Answer: B

Watch Video Solution

8. In a Young's double slit experiment , the intensity of light at a point on the screen where the path difference is λ is k units. Find the intensity at a point where the path difference is (a) $\frac{\lambda}{4}$ (b) $\frac{\lambda}{3}$ and (c) $\frac{\lambda}{2}$

A. K

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

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

D. zero

Answer: C

Watch Video Solution

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

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

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

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

D. I_0

Answer: C

Watch Video Solution

10. In a diffraction pattern due to a single slit of width 'a' the first minimum is observed at an angle 30 when light of wavelength 5000Å is incident on the slit. The first secodary maximum is observed at an angle of :

A. $\sin^{-1}\left(\frac{2}{3}\right)$

B. $\sin^{-1}\left(\frac{1}{2}\right)$

C. $\sin^{-1}\left(\frac{3}{4}\right)$

D. $\sin^{-1}\left(\frac{1}{4}\right)$

Answer: C

View Text Solution

Objective Type Questions Jee Main Other State Boards For Engineering Entrance

1. Unpolarized light of intensity I is incident on a system of two polarizers, A followed by B. The intensity of emergent light is $I/2$. If a third polarizer C is placed between A and B the intensity between the polarizers A and C is θ, then

A. $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{4}}$

B. $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{4}}$

C. $\cos\theta = \left(\frac{1}{3}\right)^{\frac{1}{2}}$

D. $\cos\theta = \left(\frac{2}{3}\right)^{\frac{1}{2}}$

Answer: A

Watch Video Solution

2. Lights of wavelength 550 nm falls normally on a slit of width $k22.0 \times 10^{-5} cm$. The angular position of the central maximum will be (in radian) :

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

B. $\frac{\pi}{8}$

C. $\frac{\pi}{12}$

D. $\frac{\pi}{6}$

Answer: B

Watch Video Solution

3. Unpolarised light of intensity I passes through an ideal polariser A. Another identical polariser B is placed behind A. The intensity of light beyond B is found to be $\frac{I}{2}$. Now another identical poariser C is placed between A and B. The intensity beyond B is now found to be $\frac{I}{8}$. The angle between polariser A and C is :

A. 45°

B. 60°

C. 0°

D. 30°

Answer: A

View Text Solution

4. In an interference experiment the ratio of amplitudes of coherent waves is $\frac{a_1}{a_2} = \frac{1}{3}$ The ratio of maximum and minimum intensities of fringes is ....

A. 9

B. 4

C. 18

D. 2

Answer: B

Watch Video Solution

5. 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:

A. $\frac{I_m}{9}\left(1+8\frac{\cos^2(\theta)}{2}\right)$

B. $\frac{I_m}{9}(4+5\cos^2\phi)$

C. $\frac{I_m}{3}\left(1+2\frac{\cos^2(\phi)}{2}\right)$

D. $\frac{I_m}{5}\left(1+3\frac{\cos^2(\phi)}{2}\right)$

Answer: A

View Text Solution

6. Calculate the limit of resolution of a telescope objective lens having a diameter of 200 cm, if it has to detect light of wavelength 500 nm coming from a star.

A. 457.5×10^{-9} radian

B. 610×10^{-9} radian

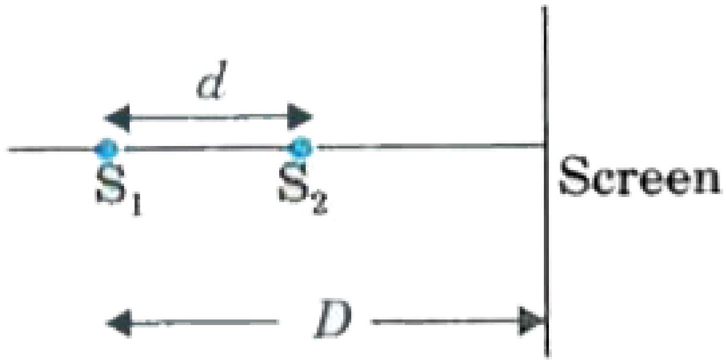
C. 305×10^{-9} radian

D. 152.5×10^{-9} radian

Answer: C

Watch Video Solution

7. Two coherent point sources S_1 and S_2 are separated by a small distance 'd' as shown. The fringes obtained on the screen will be :



A. straigth lines

B. semi-circle

C. concentric circles

D. points

Answer: C

View Text Solution

8. Two beams, A and B, of plane polarised light with mutually perpendicular planes of polarisation are seen through a polarised light with mutually perpendicular planes of polarisation are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity). a rotation of Polaroid through 30° makes the two beams appear equally bright. If the intiial intensities of the two beams are I_A and I_B respectively, then I_A / I_B equals :

A. $1/3$

B. 3

C. $3/2$

D. 1

Answer: A

View Text Solution

9. On a hot summer night, the refractive index of air is smallest near the ground and increases with height from the ground. When a light beam is directed horizontally, the Huygen's principle leads us to conclude that as it travels, the light beam

A. becomes narrower

B. goes horizontally without and deflection

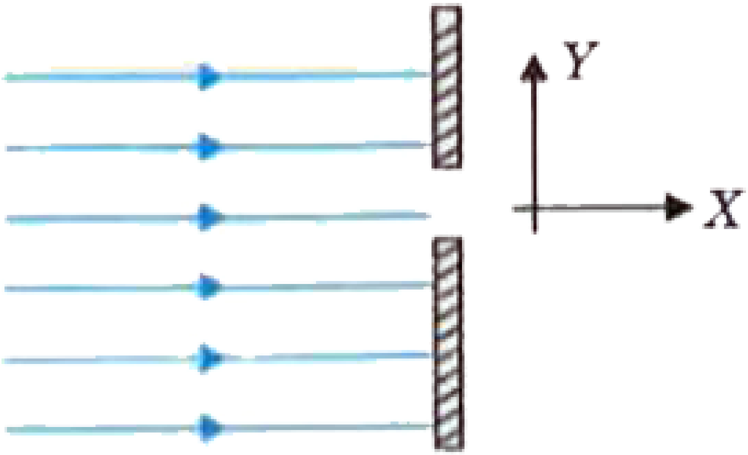
C. bends downwards

D. bends upwards

Answer: D

View Text Solution

10. A parallel beam of electrons travelling in X-direction falls on a slit of width d (see figure). If after passing the slit, an electron acquires momentum p_y in the Y-direction, then for a majority of electrons passing through the slit (h is Planck's constant):



A. $|p_y|d = h$

B. $|p_y|d > h$

C. $|p_y|d < h$

D. $|p_y|d > \; > h$

Answer: B

View Text Solution

11. An object is located in a fixed position in front of a screen. Sharp image is obtained on the screen for two positions of a thin lens separated by 10 cm. The size of the images in two situtation are in the ratio 3 : 2. What is the distance between the screen and the object?

A. 124.5 cm

B. 144.5 cm

C. 65.0 cm

D. 99.0 cm

Answer: D

View Text Solution

12. Two monochromatic light beams of intensity 16 and 9 units are interfering. The ratio of intensities of bright and dark parts of the resultant pattern is:

A. $\frac{16}{9}$

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

C. $\frac{7}{1}$

D. $\frac{49}{1}$

Answer: D

Watch Video Solution

13. In a Young's double-slit experiment with light of wavelength λ, the separation of slits is d and distance of screen is D such that $D > > d > > \lambda$. If the Fringe width is β, the distance from point of maximum intensity to the point where intensity falls to half of maximum intensity on either side is :

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

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

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

D. $\frac{\beta}{6}$

Answer: B

View Text Solution

14. Unpolarised light of intensity I_0 is incident on surface of a block of glass at Brewster's angle. In that case which one of the following startements is true?

A. Transmitted light is partially polarised with intensity $I_0 / 2$.

B. Transmitted light is completely polarised with intensity less than $I_0 / 2$.

C. Reflected light is completely polarised with intensity less than $I_0 / 2$.

D. Reflected light is partially polarised with intensity $I_0 / 2$.

Answer: C

View Text Solution

15. In an experiment of single slit diffraction pattern, first minimum for red light coincides with first maximum of some other wavelength. If wavelength of red light is 6600Å, then wavelength of first maximum will be:

A. 3300Å

B. 4400Å

C. 5500Å

D. 6600Å

Answer: B

Watch Video Solution

16. In a Young's double-slit experiment, the distance between the two identical slits is 6.1 times larger than the slit width. Then the number of intensity maxima observed within the central maximum of the single slit diffraction pattern is :

A. 3

B. 6

C. 12

D. 24

Answer: C

View Text Solution

17. In Young's double-slit experiment, the distance between slits and the screen is 1.0 m and monochromatic light of 600 nm is being used. A person standing near the slits is looking at fringe pattern. When the separation between the slits is varied, the interference pattern disappears for a particular distance d_0 between the slits. If the angular resolution of the eye is $\left(\frac{1}{60}\right)^{\circ}$, the value of d_0 is close to :

A. 1 mm

B. 2 mm

C. 4 mm

D. 3 mm

Answer: B

View Text Solution

18. Two stars are 10 light years away from the Earth. They are seen through a telescope of objective diameter 30 cm. The wavelength of light is 600 nm. To see the stars just resolved by the telescope, the minimum distance between them should be (1 light year = $9.46 \times 10^{15} m$) of the order of :

A. 10^{6} km

B. 10^{8} km

C. 10^{11} km

D. 10^{10} km

Answer: B

View Text Solution

19. The box of a pinhole camera, of length L, has a hole of radius a. It is assumed that when the hole is illuminated by a parallel beam of light of wavelength λ. The spread of the spot (obtained on the opposite wall of the camera) is the sum of its geometrical spread and the spread due to diffraction. The spot would then have its minimum size (say $b_{\min}$) when :

A. $a=\frac{\lambda^2}{L}$ and $b_{\min}=\left(\frac{2\lambda^2}{L}\right)$

B. $a=\sqrt{\lambda L}$ and $b_{\min}=\left(\frac{2\lambda^2}{L}\right)$

C. $a=\sqrt{\lambda L}$ and $b_{\min}=\sqrt{4\lambda L}$

D. $a = \frac{\lambda^2}{L}$ and $b_{\min} = \sqrt{4\lambda L}$

Answer: C

View Text Solution

20. A single slit of width b is illuminated by a coherent monochromatic light of wavelength λ. If the second and fourth minima in the diffraction pattern at a distance 1 m from the slit are at 3 cm and 6 cm respectively from the central maximum, what is the width of the central maximum? (i.e., distancebetween first minimum on either side of the central maximum)

A. $1.5cm$

B. $3.0cm$

C. $4.5cm$

D. $6.0cm$

Answer: B

View Text Solution

21. A single slit of width 0.1 mm is illuminated by a parallel beam of light of wavelength 6000Å and diffraction bands are observed on a screen 0.5 m from the slit. The distance of the third dark band from the central bright band is:

A. 3 mm

B. 9 mm

C. 4.5 mm

D. 1.5 mm

Answer: B

Watch Video Solution

22. In a Young's double slit experiment, slits are separated by $0.5mm$ and the screen is placed $150cm$ away. A beam of light consisting of two wavelengths, $650nm$ and $520nm$, is used to obtain interference fringes on the screen. The least distance from the commom central maximum to the point where the bright fringes fue to both the wavelengths coincide is

A. 1.56 mm

B. 7.8 mm

C. 9.75 mm

D. 15.6 mm

Answer: B

Watch Video Solution

Objective Type Questions Jee Advanced For Iit Entrance

1. 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

2. Yong's double-slit experiment is carried out by using green, red and blue light, one color at a time. The fringe widths recorded are β_G, β_R and β_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. $\beta_R > \beta_G > \beta_B$

Answer: D

Watch Video Solution

3. Two beams of light 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. $2I$

B. $4I$

C. $5I$

D. $7I$

Answer: B

Watch Video Solution

4. 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. $2\lambda/3$

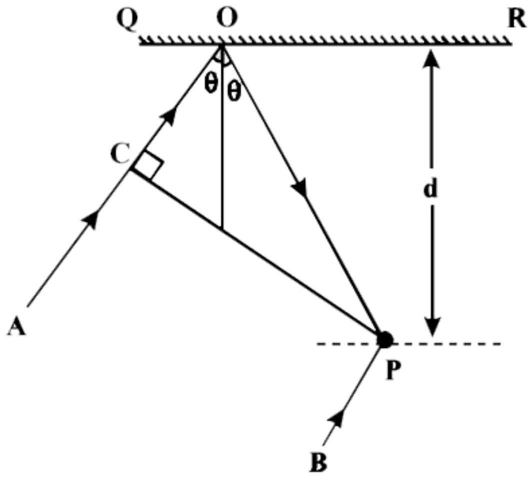
C. $\lambda/3$

D. λ

Answer: A

Watch Video Solution

5. In the adjacent diagram, CP represents a wavefront and AO & BP, the corresponding two rays. Find the condition on θ for constructive interference at P between the ray BP and reflected ray OP.



A. $\cos\theta = \frac{3}{2}(\lambda)d$

B. $\cos\theta = \frac{\lambda}{4d}$

C. $\sec\theta - \cos\theta = \frac{\lambda}{4d}$

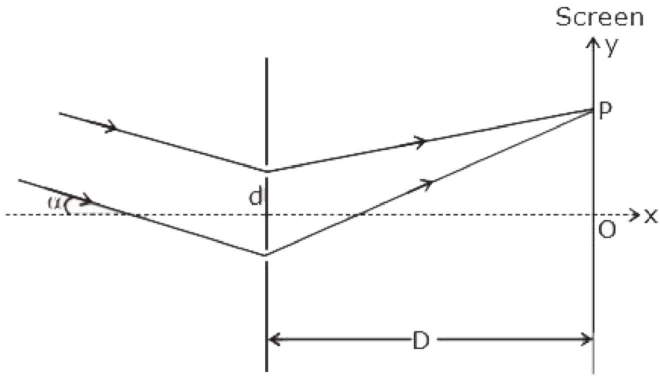
D. $\sec\theta - \cos\theta = \frac{4\lambda}{d}$

Answer: A

Watch Video Solution

Watch Video Solution

6. In a Young's double slit experiment, the slit separation d is 0.3 mm and the screen distance D is 1 m. A parallel beam of light of wavelength 600 nm is incident on the slits at angle as shown in figure. On the screen, the point O is equidistant from the slits and distance PO is 11.0 mm. Which of the following statement(s) is/are correct ?



A. For $\alpha = \frac{0.36}{\pi}$ degree, there will be destructive interference at point O.

B. Fringe spacing depends on α

C. For $\alpha = \frac{0.36}{\pi}$ degree, there will be destructive interference at point P.

D. For $\alpha = \theta$ there will be constructive interference at point P.

Answer: C

Watch Video Solution

Objective Type Questions C Multiple Choice Questions

1. If light wave is represented by the equation $y = A\sin(kx - \omega t)$. Here y may represent

A. electric field

B. magnetic field

C. pressure in medium

D. density of medium

Answer: A::B

Watch Video Solution

2. We know that electric and magnetic field are associated with electromagnetic wave travelling in vaccum or some medium. Electric and magnetic fields

A. remain constant

B. are mutually perpendicular

C. are perpendicular to the direction of travel of light

D. have same average value

Answer: B::C::D

View Text Solution

3. White source of light is used to perform Young's double-slit experiment.

A. there will not be any complete dark fringe

B. Central fringe will be white

C. Fringe adjacent to the centre will be violet

D. Fringe adjacent to the centre will be red

Answer: A::B::C

Watch Video Solution

4. One can use Huygen's principle to

A. explain law of reflection

B. explain Snell's law

C. find new location of wavefront

D. calculate speed of light in vacuum

Answer: A::B::C

Watch Video Solution

5. Four monochromatic light waves are represented as follows:

$P: E = E_0 \sin \omega t$

$Q: E = 2E_0 \sin(\omega t + \delta)$

$R: E = E_0 \sin 2\omega t$

$S: E = 2E_0 \sin(2\omega t + \delta)$

Sustained interference pattern is obtained due to superposition of

A. P and Q

B. R and S

C. P and S

D. Q and R

Answer: A::B

Watch Video Solution

6. In Young' s double-slit experiment, separation between the two slits is d and separation between plane of the slits and the screen is D. A small hole is made on the screen at a point directly in front of one of the slit. Some wavelengths are missing from the light coming out from hole on the other side. These wavelengths are

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

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

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

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

Answer: A::C

View Text Solution

7. If the source of light used in a Young's Double slit Experiment is changed from red to blue,then

A. there will be a dark fringe at the centre

B. fringe pattern will shrink

C. there will be bright at the centre

D. fringe width of pattern will increase

Answer: B::C

Watch Video Solution

8. Select the phenomena which are explained by wave theory of light

A. Speed of light in glass is less than that in vaccum

B. Light shows interference

C. Light shows diffractin

D. Photoelectric effect

Answer: A::B::C

Watch Video Solution

9. Light wave is travelling along X-axis in a medium. Which of the following can represent wavefront for this light wave ?

A. $x = 0$

B. $x = c$

C. $x^2 + y^2 + z^2 = c^2$

D. $z = c$

Answer: A::B

Watch Video Solution

10. Unpolarised light of intensity I_0 is passed through a polaroid A, and intensity of light after passing polaroid A becomes I_1. Light emerging from polaroid A is passed through another polaroid B, whose axis is inclined at an angle 60° with the axis of A. Intensity of light after emerging from B becomes I_2.

A. $I_1 = 0$

B. $I_1 = I_0 / 2$

C. $I_2 = I_0 / 4$

D. $I_2 = I_0 / 8$

Answer: B::D

Watch Video Solution

11. A light source, which emits two wavelength $\lambda_1 = 400nm$ and $\lambda_2 = 600nm$, is used in a Young's double slit experiment. If recorded fringe width for λ_1 and λ_2 are β_1 and β_2 and the number of fringes for them within a distance y on one side of the central maximum are m_1 and m_2 respectively, then

A. $\beta_2 > \beta_1$

B. $m_1 > m_2$

C. from the central maximum, 3^{rd} maximum of λ_2 overlaps with 5^{th} minimum of λ_1

D. the angular separation of fringes for λ_1 is greater than λ_2

Answer: A::B

Watch Video Solution

12. In a Young's double slit experiment, the separation between the two slits is d and the wavelength of the light is λ. The intensity of light falling 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 only one maximum.

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

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

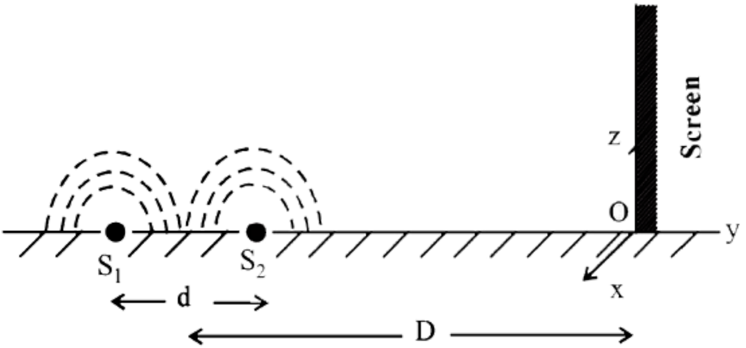
D. If the intensity of light falling on slit 2 is increased so that it becomes equal to that of silt 1, the intensitites of the observed dark and bright fringes will increases

Answer: A::B

Watch Video Solution

13. While conduction the Young's double slit experiment, a student replaced the two slits with a large opaque plate in the x-y plane containing two small holes that act as two coherent point sources (S_1, S_2) emitting light of wavelength 600nm. The student mistakenly placed the screen parallel to the x-z plane $(f \text{ or } z > 0)$ at a distance D=3 m from the mid-point of S_1,S_2, as shown schematically in the figure. The distance between the sources $d = 0.6003mm$. The origin O is at the intersection of the screen and the line joining

S_1S_2. Which of the following is (are) true of the intensity pattern of the screen?



A. Straight bright and dark bands parallel to the X-axis

B. The region very close to point O will be dark

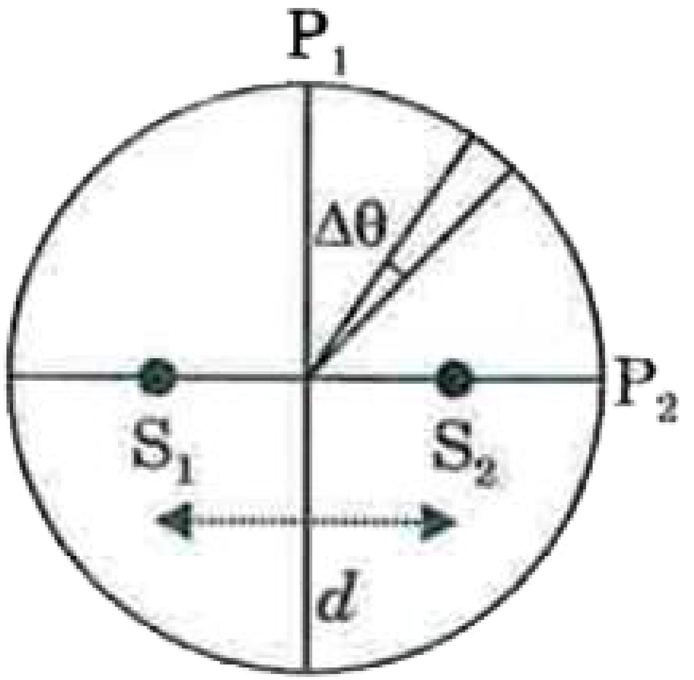
C. Hyperbolic bright and dark bands with foci symmetrically placed about O in the x-direction

D. Semi-circular bright and dark bands centred at point O.

Answer: B::D

Watch Video Solution

14. Two coherent monochromatic point sources S_1 and S_2 of wavelength $\lambda = 600nm$ are placed symmetrically on either side of the centre of the circle as shown. The sources are separated by a distance $d = 1.8mm$. This arrangement produces interference fringes visible as alternate bright and dark spots on the circumference of the circle. The angular separation between two consecutive bright spots is $\Delta\theta$. Which of the following options is/are correct ?



A. The total number of fringes produced between P_1 and P_2 in the first quadrant is close to 3000

B. A dark spot will be formed at point P_2

C. At P_2 the order of the fringe will be maximum

D. The angular separation between two consecutive brigth spots decreases as we move from P_1 to P_2 along the first quadrant.

Answer: A::C

View Text Solution

Objective Type Questions D Multiple Choice Questions

1. Let some unpolarised light is travelling along X-axis. Its electric field will be randomly oriented on Y-Z plane. We can represent this unpolarised light in terms of two components of electric field along Y-axis and Z-axis respectively and these two components are assumed to be at a phase difference. Thus

$E_y = E_1 \sin(\omega t - kx)$

$E_z = E_2 \sin(\omega t - kx + \delta)$

If value of δ changes randomly with time, then light is said to be unpolarised.

If value of δ is such that tip of the resultant electric field traces a straight line, then light is said to be linearly polarised. Similarly for circular path, light is said to be circularly polarised and for elliptical path, light is said to be elloptically polarised.

Light will be linearly polarised if

A. $\delta = 0$

B. $\delta = \pi$

C. $\delta = \pi / 2$

D. $\delta = \pi / 4$

Answer: A::B

View Text Solution

2. Let some unpolarised light is travelling along X-axis. Its electric field will be randomly oriented on Y-Z plane. We can represent this unpolarised light in terms of two components of electric field along Y-axis and Z-axis respectively and these two components are assumed to be at a phase difference. Thus

$$E_y = E_1 \sin(\omega t - kx)$$

$$E_z = E_2 \sin(\omega t - kx + \delta)$$

If value of δ changes randomly with time, then light is said to be unpolarised.

If value of δ is such that tip of the resultant electric field traces a straight line, then light is said to be linearly polarised. Similarly for circular path, light is said to be circularly polarised and for elliptical path, light is said to be elloptically polarised.

Light will be circularly polarised if

A. $\delta = 0$ and $E_1 \neq E_2$

B. $\delta = \pi / 2$ and $E_1 = E_2$

C. $\delta = \pi / 2$ and $E_1 \neq E_2$

D. $\delta = \pi$ and $E_1 = E_2$

Answer: B

View Text Solution

3. Let some unpolarised light is travelling along X-axis. Its electric field will be randomly oriented on Y-Z plane. We can represent this unpolarised light in terms of two components of electric field along Y-axis and Z-axis respectively and these two components are assumed to be at a phase difference. Thus

$$E_y = E_1 \sin(\omega t - kx)$$

$$E_z = E_2 \sin(\omega t - kx + \delta)$$

If value of δ changes randomly with time, then light is said to be unpolarised.

If value of δ is such that tip of the resultant electric field traces a straight line, then light is said to be linearly polarised. Similarly for circular path, light is said to be circularly polarised and for elliptical path, light is said to be elloptically polarised.

Light will be elliptically polarised if

A. $\delta = 0$ and $E_1 \neq E_2$

B. $\delta = \pi/2$ and $E_1 = E_2$

C. $\delta = \pi/2$ and $E_1 \neq E_2$

D. $\delta = \pi$ and $E_1 = E_2$

Answer: C

View Text Solution

4. We know that speed of light in vacuum is always constant and equal to $c = 3 \times 10^8 m/s$. There is a source of light and speed of light emitted from the source is to be measured.

Three different frames of refernce, namely P, Q and R, are used in the experiment. Frame of reference P is moving towards the source and R is moving away from the source with same speed. Frame of reference Q is fixed at its location. V_p, V_Q and V_R are the speeds of light as measured by the observers in corresponding reference frames.

Answer the following question :

Select correct option(s) if surrounding space is vacuum everywhere

A. $V_P > V_Q > V_R$

B. $V_P < V_Q < V_R$

C. $V_P = V_Q = V_R$

D. $V_Q = \dfrac{V_P + V_R}{2}$

Answer: C::D

View Text Solution

5. We know that speed of light in vacuum is always constant and equal to $c = 3 \times 10^8 m / s$. There is a source of light and speed of light emitted from the source is to be measured.

Three different frames of refernce, namely P, Q and R, are used in the experiment. Frame of reference P is moving towards the source and R is moving away from the source with same speed. Frame of reference Q is fixed at its location. V_p, V_Q and V_R are the speeds of light as measured by the observers in corresponding reference frames.

Answer the following question :

Select correct option(s) if surrounding space is water everywhere

A. $V_P > V_Q > V_R$

B. $V_P < V_Q < V_R$

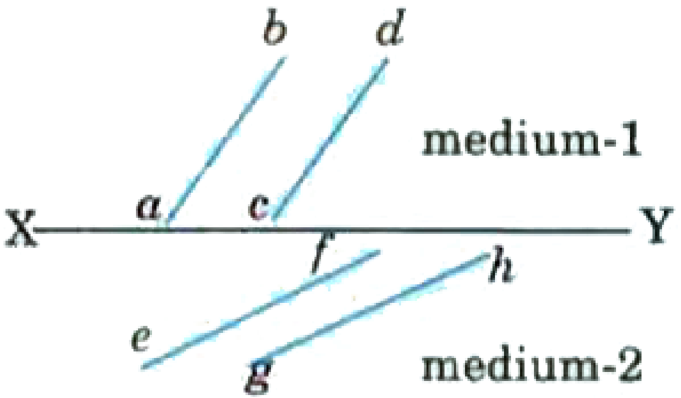
C. $V_P = V_Q = V_R$

D. $V_Q = \dfrac{V_P + V_R}{2}$

Answer: A::B

View Text Solution

6. The figure shows a surface XY separating two transparent media, medium - 1 and medium - 2. The lines ab and cd represent wavefronts of the light ab and cd represent wavefronts of the light wave travelling in medium-1 and incident on XY. The lines of ef and gh represent wavefronts of the light wave in medium - 2 after refraction.



Answer the following question :

Light travels as a :

A. parallel beam in each medium

B. convergent beam in each medium

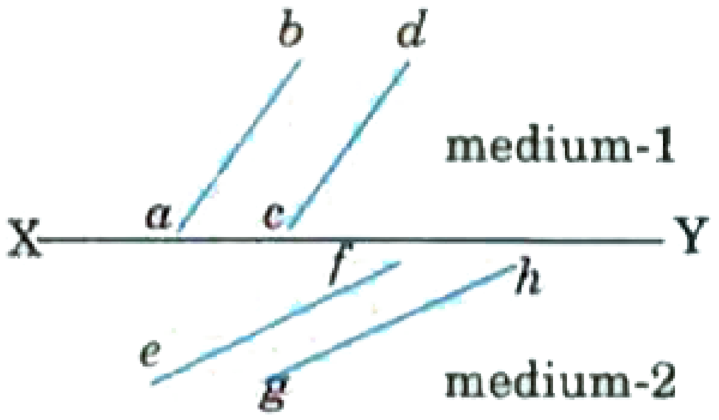
C. divergent beam in each medium

D. divergent beam in one medium and convergent beam in the other medium

Answer: A

View Text Solution

7. The figure shows a surface XY separating two transparent media, medium - 1 and medium - 2. The lines ab and cd represent wavefronts of the light ab and cd represent wavefronts of the light wave travelling in medium-1 and incident on XY. The lines of ef and gh represent wavefronts of the light wave in medium - 2 after refraction.



Answer the following question :

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

View Text Solution

Objective Type Questions Assertion Reason Type Questions

1. A: Light waves can be polarised.

R: Light waves are transverse in nature.

A. If both assertion and reason are correct and reason is a correct explanation of the

assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

Watch Video Solution

2. Assertion : When two light sources are placed near to each other, energy is distributed non-uniformly around them.

Reason : Light waves from two sources interfere each other and redistribution of energy takes place due to phenomenon of interfernece.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

View Text Solution

3. Assertion : Sound waves travelling in air cannot be polarised.

Reason : Polarisation is property of light waves only.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: C

Watch Video Solution

4. Assertion : Energy is created in constructive interference and energy is destroyed in destructive interference.

Reason : There is maximum intensity at the point of constructive interference.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: D

Watch Video Solution

5. Assertion : Light shows the phenomena of interference, diffrection and polarisation.

Reason : Because light behaves as corpuscles.

A. If both assertion and reason are correct and reason is a correct explanation of the

assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: B

Watch Video Solution

6. Assertion : Corpuscular theory of light cannot explain change in velocity of light when it changes medium.

Reason : According to corpuscular theory of light, speed of light is more in denser medium than in rarer medium.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

View Text Solution

7. Assertion : Phase difference between two points separated by a distance equal to $\lambda/2$ on same wavefront is π.

Reason : Path difference (Δx) and phase difference (δ) are related as $\delta = \frac{2\pi}{\lambda}\Delta x$.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: D

View Text Solution

8. Assertion : The sun is visible a few minutes before it is actually above horizon.

Reason : Light rays bend due to refraction.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: B

View Text Solution

9. Assertion : The frequencies of incident, reflected and refracted beam of monochromatic light are same.

Reason : The incident, reflected and refracted rays are coplanar.

A. If both assertion and reason are correct and reason is a correct explanation of the

assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: B

Watch Video Solution

10. Assertion : Two light sources with different frequecies cannot be coherent.

Reason : Phase difference between coherent sources remains constant with time.

A. If both assertion and reason are correct and reason is a correct explanation of the assertion.

B. If both assertion and reason and correct but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct.

Answer: A

View Text Solution

Objective Type Questions Matching Type Questions

1. Each question has matching list. The codes for the lists have choices (a), (b) , (c) and (d), out of which only one is correct.

	List-I		List-II
P	Law of Malus	1	$i_p = \tan^{-1}(\mu)$
Q	Brewster's Law	2	$I = I_0 \cos^2 \theta$
R	Snell's Law	3	$\sin^{-1}(1/\mu)$
S	Critical angle	4	$\mu \sin \theta = \text{constant}$

A. $\begin{matrix} P & Q & R & S \\ 2 & 1 & 4 & 3 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 1 & 3 & 2 & 4 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 3 & 4 & 1 & 2 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 4 & 1 & 2 & 3 \end{matrix}$

Answer: A

View Text Solution

2. Each question has matching list. The codes for the lists have choices (a), (b) , (c) and (d), out of which only one is correct.

	List-I		List-II
P	Coherent sources	1	Refractive index of material is different for different frequencies.
Q	Two sources of equal intensity	2	Sustained interference.
R	Monochromatic light	3	High contrast ratio for interference pattern.
S	Dispersion	4	Only a particular frequency is most dominant in beam.

A. $\begin{matrix} P & Q & R & S \\ 4 & 1 & 2 & 3 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 1 & 3 & 2 & 4 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 3 & 4 & 1 & 2 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 2 & 3 & 4 & 1 \end{matrix}$

Answer: D

View Text Solution

Objective Type Questions Matrix Match Type Questions

1. Each questions contains statements given in two columns, which have to be matched. Statements in column - I are labelled as A,B,C and D, whereas statements in column-II are labelled as p,q,r and s. Match the entries of column-I with appropriate entries of colomn-II . Each entry in column-I may have one or more than one correct option from column - II. The answers to these questions have to be appropriately bubbled as illustrated in the given example, if the correct matches are $A \rightarrow (q, r), B \rightarrow (p, s), C \rightarrow (r, s)$ and $D \rightarrow (q)$

.

Column I		Column II	
(A)	Wave nature of light	(p)	Interference
(B)	Particle nature of light	(q)	Diffraction
(C)	Colourful appearance of thin films	(r)	Photoelectric effect
(D)	Young's double-slit experiment	(s)	Compton effect

View Text Solution

Objective Type Questions Integer Type Questions

1. In stand Young's double - slit experiment , intensity of light at the centre of screen is found to be I_1. There is another point on the screen where difference beteen the waves is $\lambda/4$ and intensity of light at this point is I_2. Calculate I_1/I_2.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

2. In standard Young's double-slit experiment when sources of light are coherent, then intensity at the centre of the screen is found to be I_1 and when sources are incoherent, then intensity at the centre is found to be I_2.

Calculate I_1 / I_2.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

3. Separation between the slits in Young's double-slit experiment is 0.2 mm and separation between plane of the slits and screen is 2m. Wavelength of light used in the experiment is 5000Å. If first maximum is obtained at a distance x from the centre then what is x in mm?

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

Watch Video Solution

4. Two light beams of intensities I and 4I are used to make interference pattern on a screen. Two points P and Q are marked on the screen where resultant intensities are I_P and I_Q respectively. Phase difference between the waves at point P is $\pi/2$ and the same at Q is π. Calculate $\left(I_P - I_Q\right)/I$.

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

View Text Solution

5. Two light sources of intensities I and 4I are used to make interference pattern on a screen. What will be ratio of maximum to minimum intensity on the screen ?

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

View Text Solution

6. In Young's double slit experiment, the ratio of maximum and minimum intensities in the fringe system is $9:1$ the ratio of amplitudes of coherent sources is

Watch Video Solution

7. In Young's double-slit experiment, the separation between the slits is halved and the distance between the slits and the screen in doubled. The fringe width is

Watch Video Solution

8. In Young's experiment the wavelenght of red light is $7.8 \times 10^{-5} cm$ and that of blue light is 5.2×10^{-5} cm. The value of n for which

$(n+1)^{th}$ blue bright band coincides with n^{th} red band is

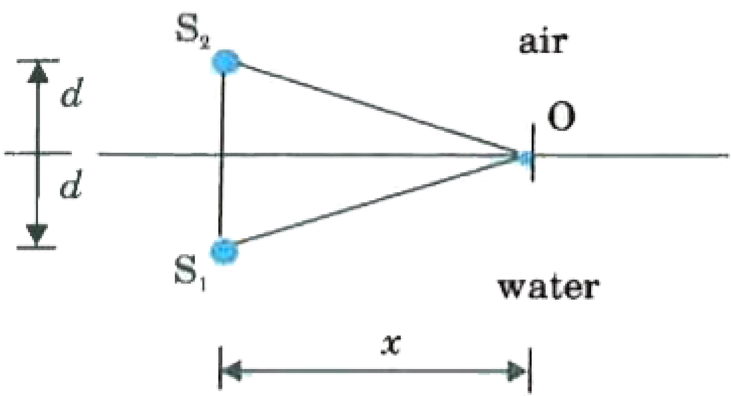
Watch Video Solution

9. Separation batween the slits in Young's double-slit experiment is 0.1 mm and distance of the screen from plane of slits is 1 m. Two wavelengths 400 nm and 560 nm are used in the experiment simultaneously. It is found that m^{th} dark from centre corresponding to 400 nm coincides with some dark of 560 nm. What is the minimum value of m?

0 1 2 3 4 5 6 7 8 9

Watch Video Solution

10. Two sources S_1 and S_2 are shown in the figure. Refractive index of water is $4/3$. Wavelength of light in air is λ.



Minimum value of x so that there is maximum intensity at Point O is given by following relation:

$$x^2 = k\lambda^2 - d^2$$

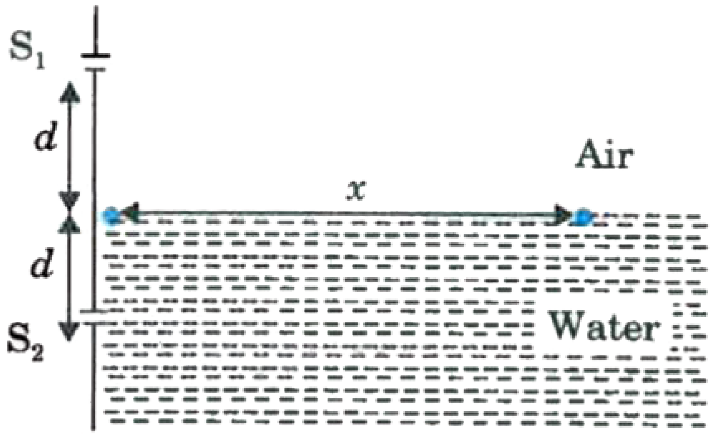
What is value of k ?

$0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9$

View Text Solution

11. A Young's double-slit interference arrangement with slits S_1 and S_2 is immersed in water (refractive index = 4/3) as shown in the figure. The positions of maxima on the surface of water are given by $x^2 = p^2m^2\lambda^2 - d^2$, where

λ is the wavelength of light in air (refractive index = 1), 2d is the separation between the slits and m is an interger. The value of p is



0 1 2 3 4 5 6 7 8 9

View Text Solution

Chapter Practice Test

1. How would the angular separation of interence fringes in Young's double slit experiment change when the distance between the slits and screen is halved ?

Watch Video Solution

2. What is the vlaue of refractive index of a medium of polarising angle 60° ?

Watch Video Solution

3. Unpolarised light of intensity I is incidnet of the polaroid. What will be the intensity of light transmitted by the polaroid?

Watch Video Solution

4. What will be the ratio of the resolving powers of two convex lenses used as objective lens in astronomical telescope, having same focal length and apertures as A_1 and $A_2(A_1 > A_2)$? Which telescope will you prefer and why?

Watch Video Solution

5. State Brewster's Law

The value of Brewster angle for a transparent medium is different for light of different colours

.

Give reason.

Watch Video Solution

6. The orientation between a polariser and an analyser is such that the intensity of transmitted light is maximum. On rotating the analyser through 60°, what fraction of maximum light will be transmitted?

Watch Video Solution

7. (a) Using the phenomenon of polarization, show, how, transverse nature of light can be demonstrated.

(b) Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity 10 is incident on P1. A third polaroid P3 is kept in between P_1 and P_2 such that its pass axis makes an angle of 30° with that of P_1. Determine the intensity transmitted through P_1, P_2 and P_3.

Watch Video Solution