PHYSICS

BOOKS - DC PANDEY PHYSICS (HINGLISH)

WAVE OPTICS

Example

1. A wave front is represented by the plane $y = 5 - x$ Find the direction of propagation of wave.

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2. A plane wavefront incident on a reflecting surface at an angle of 30° with horizontal. Find the angle of reflected wavefront with horizontal

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3. A plane wavefront incident on a reflecting surface at and angle of 30° with vertical. Find the angle (acute) of reflected wave with vertical.

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4. A plane wavefront is incident at an angle of 37° with horizontal a boundary of refractive medium from air $(\mu = 1)$ to a medium of refractive index $\mu = \frac{3}{2}$. Find the angle of refracted wavefront with horizontal

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5. A plane wavefront of yellow light with wavelength $0.5 \mu m$ in air suffers refraction in a medium in which velocity of light is $2 \times 10^8 ms^{-1}$ them, the wavelength of the light associated with a wavefront in the medium would be

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6. Two sources of intensity I and 4I are used in an interference experiment. Find the intensity at a point where the waves from two sources superimpose with a phase difference of (a) zero, (b) $\pi/2$, (c) π and (d) ratio of maximum and minimum intensity.

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7. Two sources with intensity I_0 and $4I_0$ respectively, interfere at a point in a medium. Find the ratio of

(i) maximum and minimum possible intensities,

(ii) ratio of amplitudes

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8. Two incoherent sources of light emitting light of intensity I_0 and $3I_0$ interfere in a medium. Calculate, the resultant intensity at any point.

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9. In a YDSE green light of wavelength 500 nm is used. Where will be the second bright fringe be formed for a set up in which separation between slits is 4 mm and the screen is placed 1 m from the slits?

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10. Bichromatic light is used in YDSE having wavelengths $\lambda_1 = 400nm$ and $\lambda_2 = 700nm$ Find minimum order of λ_1 which overlaps with λ_2

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11. Young's double slit experiment is carried out using microwaves of wavelength $\lambda = 3cm$. Distance between the slits is $d = 5cm$ and the distance

between the plane of slits and the screen is $D = 100cm$.

(a) Find total number of maxima and

(b) their positions on the screen.

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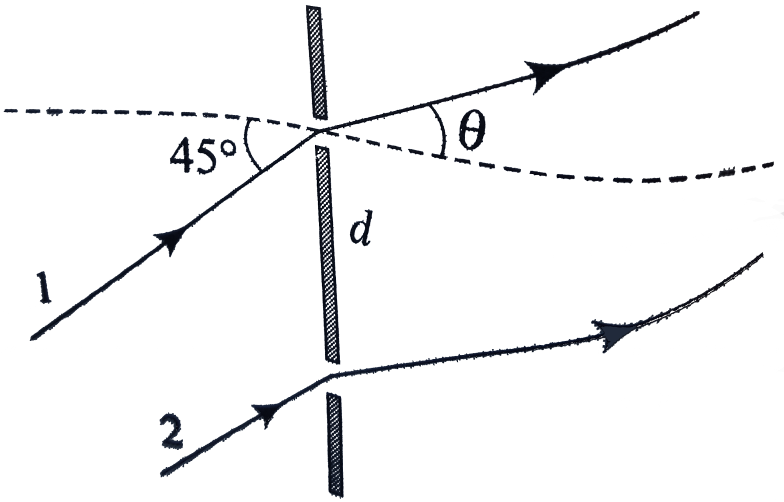
12. Distance between the slit shown in figure is $d = 20\lambda$, where λ is the wavelength of light used. Find the angle θ where

a. central maxima (where path difference is zero) is obtained, and

b. third-order maxima is obtained.



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13. In YDSE, the two slits are separated by 0.1 mm and they are

0.5 m from the screen. The wavelength of light used is 5000 Å. Find the

distance

between 7th maxima and 11 th mimima on the upper side of screen.

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14. In YDSE, the slits are seperated by 0.28 mm and the screen is placed 1.4 m away. The distance between the first dark fringe and fourth bright fringe is obtained to be 0.6 cm Determine the wavelength of the light used in the experiment.

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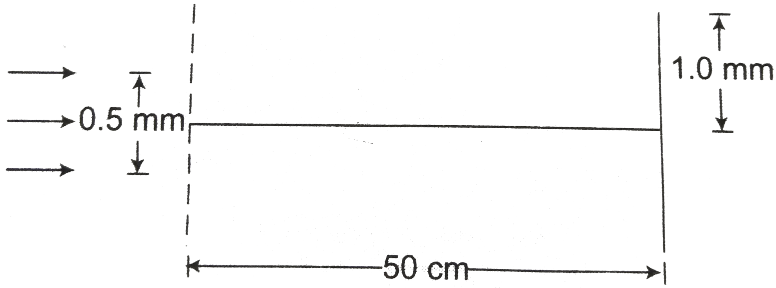
15. White coherent light $(400nm - 700nm)$ is sent through the slits of a YDSE. $D = 0.5mm$, D=50 cm. There is a hole in the screen at a point $1.0mm$ away (along the width of the fringes) from the central line.

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

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



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16. Two slits in YDSE are placed 2 millimetre from each other. Interference pattern is observedon a screen placed 2 m from the plane of slits. What is the fringe width for a light of wavelength 400 nm?

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17. In young's double slit experiment with monochromic light, fringes are obtained on a screen placed at some distance from the plane of slits. If the screen is moved by 5 cm towards the slits, then the change in fringe width is $30\mu m$ if the distance between the slits is 1mm, then calculate wavelength of the light used.

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18. Fringe width in a particular YDSE is measured to be β What will be the fringe width, if wavelength of the light is doubled, separation between the slits is halved and separation between the screen and slits is tripled ?

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19. Whose fringe width will be larger, the one for red light or the one for yellow light, all other things be the same?

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20. Two slits in YDSE are placed 1 mm from each other. Interference pattern is observed on a screen placed 1m from the plane of slits. What is the angular fringe width for a light of wavelength 400 nm

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

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22. In Young's double slit experiment separation between slits is 1mm, distance of screen from slits is 2m. If wavelength of incident light is 500 nm. Determine

(i) fringe width

(ii) angular fringe width

(iii) distance between 4 th bright fringe and 3rd dark fringe

(iii) If whole arrangement is immersed in water $(\mu_w = 4/3)$, new angular fringe width.

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23. Two coherent sources each emitting light of intensity I_0 Interfere, in a medium at a point, where phase different between them is $\frac{2\pi}{3}$. Then, the resultant intensity at that point would be.

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24. In a Young's double slit set up using monochromatic light of wavelength λ the intensity of light at a point, where path difference is 2λ is found to be I_0 What will be the intensity at a point when path different is $\lambda/3$?

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25. Maximum intensity in YDSE is I_0. Find the intensity at a point on the screen where

(a) The phase difference between the two interfering beams is $\frac{\pi}{3}$.

(b) the path difference between them is $\frac{\lambda}{4}$.

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26. In a Young's double slits set up, the wavelength of light used is 546nm. The distance of screen from slits is 1m. The slits separation is 0.3 mm.

(a) Compare the intensity at a point P distant 10mm from the central fringe where the intensity is I_0.

(b) Find the number of bright fringes between P and the central fringe.

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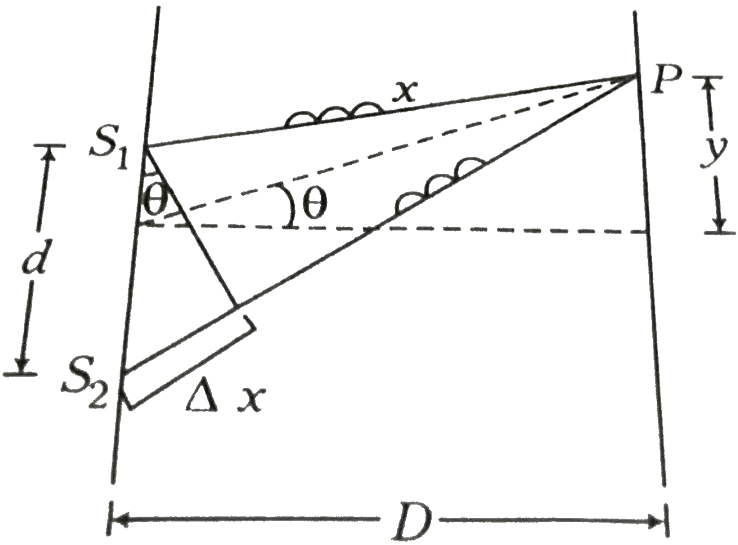
27. Consider an interference arrangement similar to YDSE. Slits S_1 and S_2 are illuminated with coherent microwave sources each of frequency 2 MHz. The sources are synchronised to have zero phase difference. The slits are separated by distance d= 75m. The intensity $I_{(\theta)}$ is measured as a function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



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28. Light travels in a mica sheet of refractive index 1.4 and length 10 cm.Find the optical path equivalent to length of the sheet.

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29. Interference fringes are produced by a double slit arrangement

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

one of

the interfering beam. If the fringes are displaced through 30 fringe

widths for

light of wavelength $6 \times 10^{-5} cm$, find the thickness of the plate.

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30. In YDSE using monochromatic light, the fringe pattern shifts by a certain distance on the screen when a mica sheet of refractive index 1.5 and thickness 2 microns is introduced in the path of one of the interfering waves. The mica sheet is then removed and the distance between the plane of slits and the screen is doubled. It is found that the distance between successive maxima (or minima) now is the same as the observed fringe shift upon the introduction of the mica sheet. Calculate the wavelength of the light.

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31. In YDSE, find the thickness of a glass slab $(\mu = 1.5)$ which should be placed in front of the upper slit S_1 so that the central maximum now

lies at a point where 5th bright fringe was lying earlier (before inserting the

slab). Wavelength of light used is $5000Å$.

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32. In a double slit pattern $(\lambda = 6000Å)$, the first order and tenth order maxima fall at 12.50 mm and 14.55mm from a particular reference point. If λ is changed to 5500Å, find the position of zero order and tenth order fringes, other arrangements remaining the same.

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

(i) Calculate the fringe width.

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

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

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35. In a double slit pattern $(\lambda = 6000\text{Å})$, the first order and tenth order maxima fall at 12.50 mm and 14.55mm from a particular reference point. If λ is changed to 5500Å, find the position of zero order and tenth order fringes, other arrangements remaining the same.

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36. Calculate the minimum thickness of a soap bubble film $(\mu = 1.33)$ that results in constructive interference in the reflected light if the film is illuminated with light whose wavelength in free space is $\lambda = 600nm$.

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37. In solar cells, a silicon solar cell $(\mu = 3.5)$ is coated with a thin film of silicon monoxide $SiO(\mu = 1.45)$ to minimize reflective losses from the surface.

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

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38. A parallel beam of white light falls on a thin film whose refractive index is equal to $4/3$. The angle of incidence $i = 53^\circ$ What must be the minimum film thickness, if the reflected light is to be coloured yellow $(\lambda \text{of yellow} = 0.6 \mu m)$ most intensity ? $(\tan 53^\circ = 4/3)$

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39. Light source of wavelength 400 nm used in a Lloyd's mirror, lies 1 mm above the plane mirror. Find the distance of first minima above the mirror. Distance of the screen from the plane of the sources is 2 m.

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40. A screen is placed $50cm$ from a single slit, which is illuminated with 6000Å light. If the distance between the first and third minima in the diffraction pattern is $3.00mm$, what is the width of the slit ?

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41. A beam of light of wavelength 400 nm falls on a narrow slit and the resulting diffraction pattern is observed on a screen 2 m away from the slit. It is observed that 2nd order minima occurs at a distance of 2 mm from the position of central maxima. Find the width of hte slit.

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42. A beam of light of wavelength 600 nm from a distance source falls on a single slit 2 mm wide and the resulting diffraction pattern is observed on a screen 2m away. What is the distance between the first dark fringes on either side of central bright fringe ?

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43. A slit of width d is illuminated by red light of wavelength 6500Å For what value of d will the first maximum fall atangle of diffractive of 30°

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44. A beam of light of wavelength 600 nm from a distant source falls on a single slit 1.0 mm wide and the resulting diffraction pattern is observed on a screen 2 m away What is the distance between the second bright fringe on either side of the central bright fringe ?

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45. A screen is placed 50cm from a single slit, which is illuminated with 6000Å light. If distance between the first and third minima in the diffraction pattern is 3.0 mm, what is the width of the slit?

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46. A beam of light of wavelength 600 nm from a distance source falls on a single slit 1 mm wide and resulting diffraction pattern is observed on a screen 2m away. What is the distance between the first bright fringes on either side of the central bright fringe ?

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47. In a single slit diffraction experiment first minima for $\lambda_1 = 660nm$ coincides with first maxima for wavelength λ_2. Calculate the value of λ_2.

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48. A lens of focal length $1m$ forms Fraunhofer diffraction pattern of a single slit of width $0.04cm$ in its focal plane. The incident light contains two wavvlength λ_1 and λ_2. It is found that the fourth minimum crresponding to λ_1 and the fifth minimum corresponding to λ_2 occur at the same point $0.5cm$ from the central maximum. Compute λ_1 and λ_2

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49. Light of wavelength 580 nm is incident on a slit having a width of 0.300 nm The viewing screen is 2.00 m from the slit. Find the positions of the first dark fringe and the width of the central bright fringe.

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50. A parallel beam of monochromatic light of wavelength 450 m passes through a long slit of width 0.2 mm. find the angular divergence in which most of the light is diffracted.

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51. Angular width of central maximum in the Fraunhoffer diffraction pattern of a slit is measured. The slit is illuminated by light of wavelength 6000Å. When the slit is illuminated by light of another wavelength, the angular width decreases by 30%. Calculate the wavelength of this light.

The same decrease in the angular width of central maximum is obtained when the original apparatus is immersed in a liquid. Find the refractive index of the liquid.

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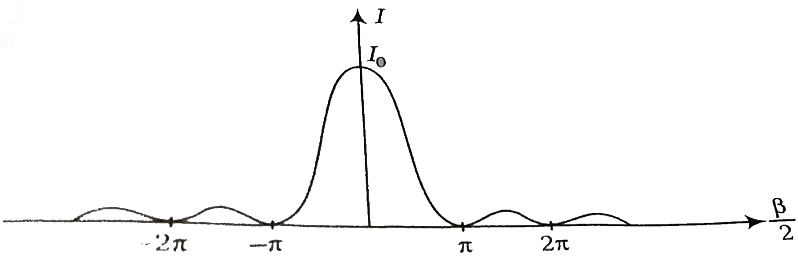
52. Find the ratio of the intensities of the secondary maxima to the intensity of the central maximum for the single slit Fraunhofer diffraction pattern.



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53. For what distance is ray optics a good approximation when the aperture is $2mm$ wide and wavelength is $600nm$?

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54. Estimate how large can be the aperture opening to work with laws of ray optics using a monochromatic light of wavelength 450 nm, to a distance of around 20 m.

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55. A diffraction grating has 1.26×10^4 rulings uniformly spaced over width w=25.4 mm. It is illuminated at normal incidence by blue light of wavelength 450 nm At what angles to the central axis do the second order maxima occur

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56. Two polaroids are oriented with their planes perpendicular to incident light and transmission axis making an angle of 30° with each other. What fraction of incident unpolarised light transmitted?

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57. When light of particular wavelength falls on a plane surface at an angle of incidence 60° then the reflected light becomes completely plane polarised Find the refractive index of surface material and the angle of refraction through it.

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Check Point

1. By corpuscular theory of light, the phenomenon which cannot be explained is

A. refraction

B. interference

C. diffraction

D. polarisation

Answer: A

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2. According to corpuscular theory of light, the different colours of light are due to

A. different electromagnetic waves

B. different force of attraction among the corpuscles

C. different size of the corpuscles

D. None of the above

Answer: C

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3. Interference

A. transverse nature of light

B. longitudinal nature of light

C. wave nature of light

D. particle nature of light

Answer: C

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4. Two identical light sources S_1 and S_2 emit light of same wavelength λ. These light rays will exhibit interference if

A. their phase difference remain constant

B. their phases are distributed randomly

C. their light intensities remain constant

D. their light intensities change randomly

Answer: A

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5. Which of the following is conserved when light waves interfere

A. Intensity

B. Energy

C. Amplitude

D. Momentum

Answer: B

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6. When interference of light takes place

A. energy is created in the region of maximum intensity

B. energy is destroyed in the region of maximum intensity

C. conservation of energy holds good and energy is radistributed

D. conservation of energy does not hold good

Answer: C

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7. If two waves represented by $y_1 = 4\sin\omega t$ and $y_2 = 3\sin\left(\omega t + \frac{\pi}{3}\right)$ interfere at a point find out the amplitude of the resulting wave

A. 7

B. 6

C. 5

D. 3.5

Answer: B

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8. it the two waves represented dy $y_1 = 4\cos\omega t$ and $y_2 = 3\cos(\omega t + \pi / 3)$ interfere at a point, then the amplitude of the resulting wave will be about

A. 7

B. 5

C. 6

D. 3.5

Answer: C

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9. Two coherent sources of intensities I_1 and I_2 produce an interference pattern. The maximum intensity in the interference pattern will be

A. $l_1 + l_2$

B. $l_1^2 + l_2^2$

C. $(l_1 + l_2)^2$

D. $\left(\sqrt{l_1} + \sqrt{l_2}\right)^2$

Answer: D

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10. What is the path difference of destructive interference

A. $n\lambda$

B. $n(\lambda + 1)$

C. $\frac{(n+1)\lambda}{2}$

D. $\frac{(2n+a)\lambda}{2}$

Answer: D

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11. If the amplitude ratio of two sources producing interference is 3 : 5, the ratio of intensities at maxima and minima is

A. $25:16$

B. $5:3$

C. $16:1$

D. $25:9$

Answer: C

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12. Two sources of sound of the same frequency produce sound intensities I and $4I$ at a point P when used individually. If they are used together such that the sounds from them reach P with a phase differenceof $2\pi/3$, the intensity at P will be

A. 2l

B. 3I

C. 4I

D. 5I

Answer: B

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13. Two incoherent sources of intensities I and 4I superpose then the resultant intensity is

A. 5I

B. 9I

C. 3I

D. I

Answer: A

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14. For the sustained interference of light, the necessary condition is that the two sources should

A. have constant phase difference

B. be narrow

C. be close to each other

D. of same amplitude

Answer: A

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15. Which of the following is not an essential condition for interference?

A. The two interfering waves must propagation in almost the same direction

B. The waves must propagation in almost the same direction

C. The amplitudes of the two waves must be equal

D. The two interfering beams of light must originate from the same source

Answer: C

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16. In Young's double slit experiment, an interference pattern is obtained on a screen by a light of wavelength 6000Å, coming from the coherent sources S_1 and S_2. At certain point P on the screen third dark fringe is formed. Then the path difference $S_1P - S_2P$ in microns is

A. 0.75

B. 1.5

C. 3.0

D. 4.5

Answer: B

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17. In Young's double slit experiment, when two light waves form third minimum, they have

A. phase difference of 3π

B. phase difference of $\frac{5\pi}{2}$

C. path difference of 3λ

D. path difference of $\frac{5\lambda}{2}$

Answer: D

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18. Two slits are separated by a distance of $0.5mm$ and illuminated with light of $\lambda = 6000\text{Å}$. If the screen is placed $2.5m$ from the slits. The distance of the third bright image from the centre will be

A. $1.5mm$

B. 3 mm

C. 6 mm

D. 9mm

Answer: D

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19. Fringe width decrease with increase in

A. λ

B. D

C. d

D. None of these

Answer: C

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20. In a Young's double slit experiment, the fringe width will remain same, if (D = distance between screen and plane of slits, d = separation between two slits and λ = wavelength of light used)

A. Both λ and D are doubled

B. Both d and D are doubled

C. D is doubled but d is halved

D. $lamba$ is doubled but d is halved

Answer: B

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21. Interference was observed in interference chamber when air was present, now the chamber is evacuated and if the same light is used, a careful observer will see

A. no interference pattern will be obtained

B. exactly same interference pattern will be obtained with better contrast

C. the fringe width is slightly decreased

D. the fringe width is slightly increased

Answer: D

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22. Monochromatic green light of wavelength $5 \times 10^{-7} m$ illuminates a pair of slits 1 mm apart. The separation of bright lines on the interference pattern formed on a screen 2 m away is

A. 0.25 mm

B. $0.1 mm$

C. $1.0 mm$

D. $0.01 mm$

Answer: C

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23. In double slits experiment, for light of which colour the fringe width will be minimum

A. violet

B. red

C. green

D. yellow

Answer: A

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24. The Young's double slit experiment is performed with blue light and green light of wavelength 4360Å and 5460Å respectively. If y is the distance of $4th$ maxima from the central one, then

A. $x(\text{blue}) = x(\text{green})$

B. $x(\text{blue}) > x(\text{green})$

C. $x(\text{blue}) < x(\text{green})$

D. $\frac{x(\text{blue})}{x(\text{blue})} = \frac{5460}{4360}$

Answer: C

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25. In Young's double slit experiment, green light $(\lambda = 5461\text{Å})$ is used and 60 fringes were seen in the field view. Now sodium light is used $(\lambda = 5890\text{Å})$, then number of fringes observed are

A. 40

B. 60

C. 50

D. 55

Answer: D

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26. In Young's double-slit experiment, if the monochromatic source of light is replaced by white light, then one sees

A. no interference fringe pattern

B. coloured fringes

C. black and white fringes

D. white central fringe surrounded by few coloured fringes on either side

Answer: D

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27. In the Young's double slit experiment, the interference pattern is found to have as intensity ratio between the bright and dark fringes as 9. This implies that

A. the intensities of individual sources are 5 and 4 units respectively

B. the intensities of individual sources are 4 and 1 units

C. the ratio of their amplitude is 3

D. the ratio of their amplitudes is 4

Answer: B

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28. What happens to the fringe pattern if in the path of one of the slits a glass plate which absorbs 50% energy is interposed?

A. The bright fringes become bright and dark fringes become darker

B. No fringes are observed

C. The fringe width decreases

D. None of the above

Answer: D

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29. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other then in the interference pattern.

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

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

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

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

Answer: A

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30. In a Young's double-slit expriment using identical slits, the intensity at a bright fringe is I_(0). If one of the slits is now covered, the intensity at any point on the screen will be

A. l_0

B. $2l_0$

C. $l_0/4$

D. $l_0/2$

Answer: C

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31. When a transparent parallel plate of uniform thickness t and refractive index μ is interposed normally in the path of a beam of light, the optical path is

A. $(\mu+1)t$

B. $(\mu-1)t$

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

D. μt

Answer: B

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32. A thin mica sheet of thickness $2\times10^{-6}m$ and refractive index $(\mu=1.5)$ is introduced in the path of the first wave. The wavelength of the wave used is 5000Å. The central bright maximum will shift

A. two fringes upward

B. two fringes downward

C. ten fringes upward

D. None of these

Answer: A

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33. In Young's double slit experiment, the aperture screen distance is $2m$. The fringe width is $1mm$. Light of $600nm$ is used. If a thin plate of glass $(\mu = 1.5)$ of thickness $0.06mm$ is placed over one of the slits, then there will be a lateral displacement of the fringes by

A. 0 cm

B. 5 cm

C. 10 cm

D. 15 cm

Answer: B

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34. Interference fringes were produced in Young's double-slit experiment using light of wavelength 5000Å. When a film of thickness $2.5 \times 10^{-3} cm$ was placed in front of one of the slits, the fringe pattern shifted by a distance equal to 20 fringe-widths. The refractive index of the material of the film is

A. 1.25

B. 1.35

C. 1.4

D. 1.5

Answer: C

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35. What is the minimum thickness of a thin film $(\mu = 1.2)$ that results in constructive interference in the reflected light? If the film is illuminated with light whose wavelength in free space is $\lambda = 500 nm$?

A. 104 nm

B. 200 nm

C. 300 nm

D. 400 nm

Answer: A

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36. The phenomenon of diffraction of light was discovered by-

A. Young

B. Hertz

C. Girmaldi

D. Malus

Answer: C

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37. In Young's double slit experiment the type of diffractive is

A. Fresnel

B. Fraunhofer

C. Both (a) and (b)

D. None of these

Answer: A

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38. The bending of light about corners of an obstacle is called

A. reflection

B. diffraction

C. refraction

D. interference

Answer: B

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39. To observe diffraction, the size of the obstacle

A. should be of the same order as wavelength

B. should be much larger then the wavelength

C. has no relation to wavelength

D. should be exactly $(\lambda / 2)$

Answer: A

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40. Yellow light is used in a single slit diffraction experiment with slit width of 0.6 mm. If yellow light is replaced by X-rays, then the observed pattern will reveal,

A. that the central maximum is narrower

B. more number of fringes

C. less number of fringes

D. no diffraction pattern

Answer: D

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41. In Fresnel's class of diffraction the

A. obstacle screen distance is finite

B. the diffracted wavefront is considered as spherical

C. no convex lens is used to focus the diffraction fringes on the screen

D. All of the above

Answer: D

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42. A slit of width is illuminated by white light. For red light $(\lambda = 6500\text{Å})$, the first minima is obtained at $\theta = 30^\circ$. Then the value of will be

A. 3250Å

B. $6.5 \times 10^{-4} mm$

C. 1.24 microns

D. $2.6 \times 10^{-4} cm$

Answer: B

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43. Light of wavelength 6328Å is incident normally on a slit of width 0.2 mm. Angular width of the central maximum on the screen will be :

A. 0.36°

B. 0.18°

C. 0.72°

D. 0.09°

Answer: B

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44. A diffraction pattern is obtained using a beam of redlight. What happens if the red light is replaced by blue light

A. No change

B. Diffraction bands become narrower and crowded together

C. Diffraction bands become broader and farther apart

D. Bands disappear

Answer: B

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45. Direction of the first secondary maximum in the Fraunhofer diffraction pattern at a single slit is given by (a is the width of the slit)

A. $a\sin\theta = \frac{\lambda}{2}$

B. $a\cos\theta = \frac{3\lambda}{2}$

C. $a\sin\theta = \lambda$

D. $a\sin\theta = \frac{3\lambda}{2}$

Answer: D

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46. A light wave is incident normally over a slit of width $24 \times 10^{-5} cm$. The angular position of second dark fringe from the central maxima is 30°. What is the wavelength of light?

A. $6000Å$

B. $5000Å$

C. $3000Å$

D. $1500Å$

Answer: A

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47. The first diffraction minima due to a single slit diffraction is at $\theta = 30^{\circ}$ for a light of wavelength $5000Å$ The width of the slit is

A. $5 \times 10^{-5} cm$

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

C. $2.5 \times 10^{-5} cm$

D. $1.25 \times 10^{5} cm$

Answer: B

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48. Light of wavelength 6328Å is incident normally on a slit of width 0.2 mm. Angular width of the central maximum on the screen will be :

A. 0.36°

B. 0.18°

C. 0.72°

D. 0.09°

Answer: A

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49. Write two points of difference between interference and diffraction pattern of light.

A. diffraction is due to interaction of light from the same wavefront, whereas the interference is the interaction of waves from two isolated sources

B. diffraction is due to interaction of light from the same wavefront, whereas the interference is the interaction of two waves derived from the same source

C. diffraction is due to interaction of waves derived from the same source, whereas the interference is the bending of light from the same wavefront

D. diffraction is caused by the reflected waves from a source, whereas interference is caused due to refraction of waves from a source

Answer: B

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50. The X-ray cannot be diffracted by means of an ordinary grating due to

A. large wavelength

B. high speed

C. short wavelength

D. All of the above

Answer: C

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51. A polariser in used to

A. reduce intensity of light

B. produce polarised light

C. increase intensity of light

D. produce unpolarised light

Answer: B

Watch Video Solution

52. Which of the following cannot be polarised?

A. Radio waves

B. Ultraviolet rays

C. Infrared rays

D. sound wave in air

Answer: D

Watch Video Solution

53. Light waves can be polarised as they are

A. transverse

B. of high frequency

C. longitudinal

D. reflected

Answer: A

Watch Video Solution

54. The transverse nature of light is shown by

A. interference of light

B. refraction of light

C. polarisation of light

D. dispersion of light

Answer: C

Watch Video Solution

55. Through which character we can distinguish the light waves from sound waves

A. interferece

B. refraction

C. polarisation

D. reflection

Answer: C

Watch Video Solution

56. Which of the following is incorrect?

A. it the wave is longitudinal then it must be a mechanical wave

B. if the wave is mechanical then it may or not be transverse wave

C. Mechanical waves cannot propagate in vacuum

D. Diffractor helps us to distinguish between sound wave and light wave

Answer: D

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57. An optically active compound

A. rotates the plane polarised light

B. changes the direction of polarised light

C. does not allow plane polarised light to pass through

D. None of the above

Answer: A

Watch Video Solution

58. A polaroid is placed at 45° to an incoming light of intensity l_0 Now, the intensity of light passing through polaroid after polarisation would be

A. l_0

B. $l_0/2$

C. $l_0/4$

D. zero

Answer: B

Watch Video Solution

59. When the angle of incidence on a material is 60°, the reflected light is completely polarized. The velocity of the refracted ray inside the material is (in ms^{-1})

A. 3×10^8

B. $\left(\frac{3}{\sqrt{2}}\right) \times 10^8$

C. $\sqrt{3} \times 10^8$

D. 0.5×10^8

Answer: C

Watch Video Solution

60. The angle of polarisation for any medium is 60° , what will be critical angle for this

A. $\sin^{-1}\sqrt{3}$

B. $\tan^{-1}\sqrt{3}$

C. $\cos^{-1}\sqrt{3}$

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

Answer: D

Watch Video Solution

61. The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refractive index n),

A. $\sin^{-1}(n)$

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

C. $\tan^{-1}\left(\frac{1}{n}\right)$

D. $\tan^{-1}(n)$

Answer: D

Watch Video Solution

62. A light has amplitude A and angle between analyser and polariser is 60°. Light is reflected by analyser has amplitude

A. $A\sqrt{2}$

B. $A/\sqrt{2}$

C. $\sqrt{3}A/2$

D. $A/2$

Answer: D

Watch Video Solution

63. Light is incident on a glass surface at polarising angle of 57.5° Then the angle between the incident ray and the refracted ray is

A. 57.5°

B. 115°

C. 65°

D. 205°

Answer: D

Watch Video Solution

64. When unpolarised light beam is incident from air onto glass ($n = 1.5$) at the polarising angle

A. reflected beam is polarised 100 percent

B. reflected and refracted beams are partially polarised

C. the reason for (a) is that almost all the light is reflected

D. All of the above

Answer: A

Watch Video Solution

65. The Brewster angle for the glass air interface is 54.74° if a ray of light going from air to glass strikes at an angle of incidence 45° then the angle of refraction is

A. 60°

B. 30°

C. 25°

D. 54.74°

Answer: B

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Taking It Together

1. 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

2. In a Young's double-slit experment, the fringe width is β. If the entire arrangement is now placed inside a liquid of refractive index μ, the fringe width will become

A. $\dfrac{\beta}{n+1}$

B. $n\beta$

C. $\dfrac{\beta}{n}$

D. $\dfrac{\beta}{n-1}$

Answer: C

Watch Video Solution

3. Consider sunlight incident on a slit of width $10^4 Å$. 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 a diffused slit white in colour

Answer: A

Watch Video Solution

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

A. $6 \times 10^{-7} m$

B. $6.8 \times 10^{-5} m$

C. $3.4 \times 10^{-5} m$

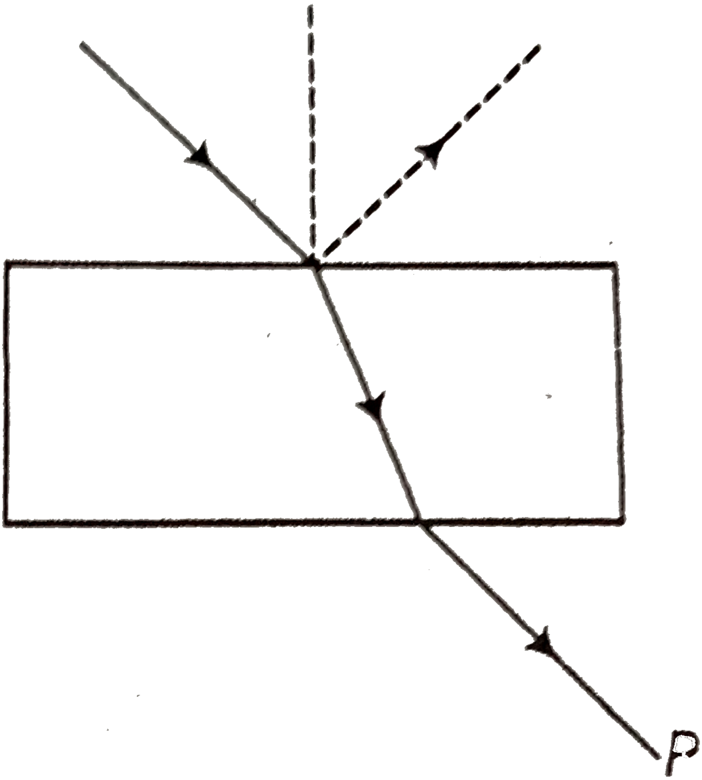
D. $3.4 \times 10^{-4} m$

Answer: C

Watch Video Solution

5. 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 through the polaroid

B. The intensity of light as seen through the polaroid shall be independent of the rotation

C. The intensity of light as seen through the polaroid shall go through a minimum byt 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

6. Two waves of same frequency and same amplitude from two monochromatic sources are allowed to superpose at a certain point. If in one case the phase difference is 0 and in other case it is $\pi/2$ then the ratio of the intensities in the two cases will be

A. $1:1$

B. $2:1$

C. $4:1$

D. None of the above

Answer: B

Watch Video Solution

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7. What is the minimum thickness of a soap bubble needed for constructive interference in reflected light, if the light incident on the film is 750 nm? Assume that the refractive index for the film is $n = 1.33$

A. 282 nm

B. $70.5nm$

C. 141nm

D. 387 nm

Answer: C

Watch Video Solution

8. Monochromatic light from a narrow slit illuminates two parallel slits producing an interference pattern on a screen. The separation between the two slits is now doubled and the distance between the screen and the slits is reduced to half. The fringe width

A. is doubled

B. becomes four times

C. becomes one - fourth

D. remains the same

Answer: C

Watch Video Solution

9. Lights of wavelengths $\lambda_1 = 4500\text{Å}, \lambda_2 = 6000\text{Å}$ are sent through a double slit arrangement simultaneously. Then

A. no interference pattern will be formed

B. the third order bright fringe of λ_1 will coincide with the fourth order bright fringe of λ_2

C. the third order bright fringe of λ_2 will coincide with the fourth order bright fringe of λ_1

D. the fringes of wavelength λ_1 will be wider than the fringes of wavelength λ_2

Answer: C

Watch Video Solution

10. Estimate how large can be the aperture opening to work with laws of ray optics using a monochromatic light of wavelength 450 nm, to a distance of around 20 m.

A. 6 mm

B. 3 mm

C. 2 mm

D. 8 mm

Answer: B

Watch Video Solution

11. Two slits at a distance of $1mm$ are illuminated by a light of wavelength $6.5 \times 10^{-7}m$. The interference fringes are observed on a screen placed at a distance of $1m$. The distance between third dark fringe and fifth bright fringe will be

A. $0.65mm$

B. $1.63mm$

C. $3.25mm$

D. $4.88mm$

Answer: B

Watch Video Solution

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

A. 12

B. 18

C. 24

D. 30

Answer: B

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13. A parallel beam of monochromatic light of wavelength 5000Å is incident normally on a single narrow slit of width $0.001mm$. The light is focused by a convex lens on a screen placed on the focal plane. The first minimum will be formed for the angle of diffraction equal to

A. 0°

B. 15°

C. 30°

D. 60°

Answer: C

Watch Video Solution

14. In Young's double slit experiment, the 10th maximum of wavelength λ_1 is at distance of y_1 from the central maximum. When the wavelength of the source is changed to λ_2 , 5th maximum is at a distance of y_2 from its central masximum. Then $\frac{y_1}{y_2}$ is

A. $\frac{2\lambda_1}{\lambda_2}$

B. $\frac{2\lambda_2}{\lambda_1}$

C. $\frac{\lambda_1}{2\lambda_2}$

D. $\frac{\lambda_2}{2\lambda_1}$

Answer: A

Watch Video Solution

15. It is found that what waves of same intensity from two coherent sources superpose at a certain point, then the resultant intensity is equal to the intensity of one wave only. This means that the phase difference between the two waves at that point is

A. zero

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

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

D. π

Answer: C

Watch Video Solution

16. The two slits are 1 mm apart from each other and illuminated with a light of wavelength 5×10^{-7} m. If the distance of the screen is 1 m from the slits, then the distance between third dark fringe and fifth bright fringe is

A. $1.5mm$

B. $0.75mm$

C. $1.25mm$

D. $0.625mm$

Answer: C

Watch Video Solution

17. What is the minimum thickness of a soap bubble needed for constructive interference in reflected light, if the light incident on the film is 750 nm? Assume that the refractive index for the film is $n = 1.33$

A. 282 nm

B. $70.5nm$

C. 141 nm

D. 387 nm

Answer: C

Watch Video Solution

18. A thin mica sheet of thickness 4×10^{-6} m and refractive index $(\mu = 1.5)$ is introduced in the path of the light from upper slit. The wavelength of the wave used is 5000Å The central bright maximum will shift

A. 4 fringes upward

B. 2 fringes downward

C. 10 fringes upward

D. None of these

Answer: A

Watch Video Solution

19. Light of wavelength $589.3 nm$ is incident normally on the slit of width $0.1 mm$. What will be the angular width of the central diffraction maximum at a distance of $1 m$ from the slit?

A. 0.68°

B. 0.34°

C. 2.05°

D. None of these

Answer: B

Watch Video Solution

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

A. 1.8

B. 1.54

C. 1.67

D. 1.2

Answer: A

Watch Video Solution

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

A. $2I$

B. $4I$

C. $5I$

D. $9I$

Answer: B

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22. In a Young's double slit experiment using red and blue lights of wavelengths 600 nm and 480 nm respectively, the value of n for which the nth red fringe coincides with $(n+1)$ th blue fringe is

A. 5

B. 4

C. 3

D. 2

Answer: A

Watch Video Solution

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

A. $2I$

B. $4I$

C. $5I$

D. $7I$

Answer: B

Watch Video Solution

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

A. 12

B. 7

C. 18

D. 4

Answer: B

Watch Video Solution

25. A beam of light parallel to central line AB is incident on the plane of slits. The number of minima obtained on the large screen is n_1. Now if the beam is tilted by some angle $(\neq 90^\circ)$ as shown in figure, then the number of minima obtained is n_2. Then,

- $n_1 = n_2$
- $n_1 > n_2$

- $n_2 > n_1$
- n_2 will be zero

Answer: A

Watch Video Solution

26. Unpolarized light of intensity 32 Wm^{-3} passes through three polarizers such that the transmission axis of the last polarizer is crossed with the first. If the intensity of the emerging light is $3Wm^{-2}$, what is the angle between the transmission axces of the first two polarizers ? At what angle will the transmitted intensity be maximum ?

A. 60°

B. 45°

C. 90°

D. 120°

Answer: A

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27. In a Young's experiment, one of the slits is covered with a transparent sheet of thickness $3.6 \times 10^{-3} cm$ due to which position of central fringe shifts to a position originally occupied by 30th fringe. If $\lambda = 6000 \text{Å}$, then find the refractive index of the sheet.

A. 1.5

B. 1.2

C. 1.4

D. 1.6

Answer: A

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

A. $2cm, 7.5cm$

B. $3cm, 6cm$

C. $2cm, 4cm$

D. $4/3cm, 10/3cm$

Answer: C

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29. In Young's double slit experiment, wavelength $\lambda = 5000\text{Å}$ the distance between, the slits is $0.2mm$ and the screen is at 200cm from the slits. The central maximum is at $x = 0$ The third maximum (Taking the central maximum as zeroth maximum) will be at x equal to

A. $1.67cm$

B. $1.5cm$

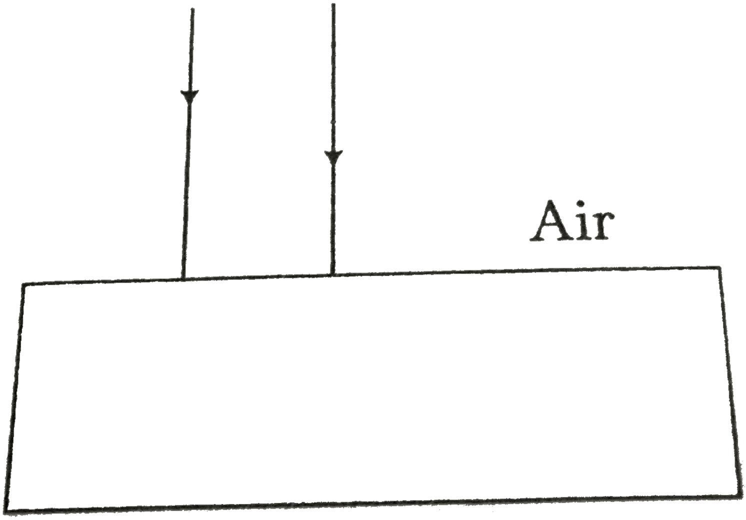
C. $0.5cm$

D. $5.0cm$

Answer: B

Watch Video Solution

30. A parallel beam of light of intensity I is incident on a glass plate. 25% of light is reflected in any reflection by upper surface and 50% of light is reflected by any reflection from lower surface. Rest is refracted The ratio of maximum to minimum intensity in interference region of reflected rays is



A. $\left(\dfrac{\frac{1}{2}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$

B. $\left(\dfrac{\frac{1}{4}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$

C. $\dfrac{5}{8}$

D. None of these

Answer: D

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31. In the Young's double slit experiment, the intensities at two points P_1 and P_2 on the screen are respectively I_1 and I_2 If P_1 is located at the centre of a bright fringe and P_2 is located at a distance equal to a quarter of fringe width from P_1 then $\frac{I_1}{I_2}$ is

A. 2

B. 3

C. 4

D. None of these

Answer: A

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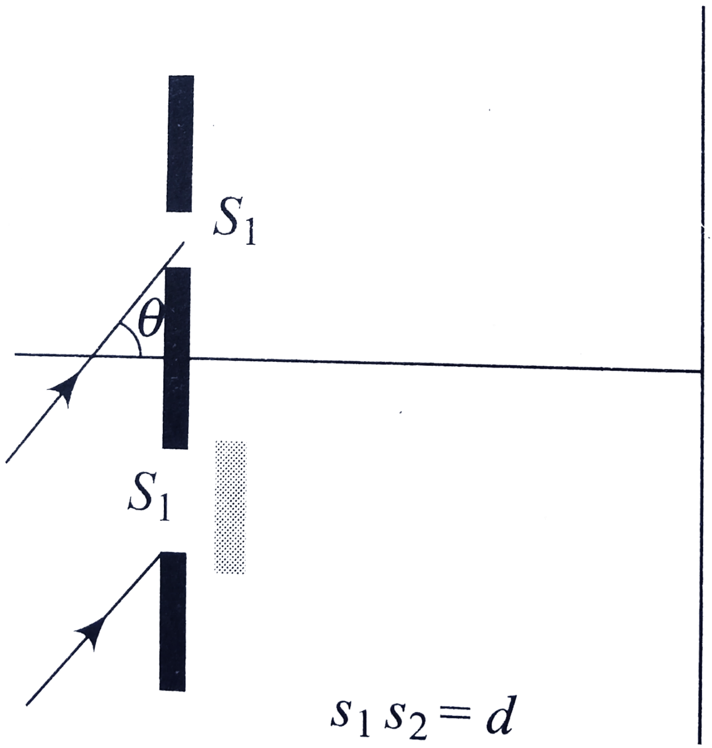
32. A monochromatic beam of light fall on YDSE apparatus at some angle (say θ) as shown in figure. A thin sheet of glass is inserted in front of the lower slit s_2. The central bright fringe (path difference $= 0$) will be obtained



A. at O

B. above O

C. below O

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

Answer: A

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33. 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 interference 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

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

A. $4:1$

B. $1:1$

C. $2:1$

D. $1:4$

Answer: C

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

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

D. λ

Answer: A

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36. In the standard Young's double slit experiment, the intensity on the screen at a point distant 1.25 fringe widths from the central maximum is (assuming slits to be identical)

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

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

C. $\frac{1}{3}I_{\max}$

D. $I_{\max}$

Answer: A

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37. In a Young's double slit experiment, D equals the distance of screen and d is the separation between the slits. The distance of the nearest point to the central maximum where the intensity is same as that due to a single slit is equla to

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

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

C. $\frac{D\lambda}{3d}$

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

Answer: C

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38. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and theh screen is at a distance $d(> \; > b)$ from the slits At a point on the screen directly in front of one of the slits, certain wavelengths are missing some of these missing wavelengths are

A. $\lambda = \frac{b^2}{2d}$

B. $\lambda = \frac{2b^2}{d}$

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

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

Answer: C

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39. The intensity of each of the two slits in Young's double slit experiment is I_0 Calculate the minimum separation between the two points on the screen where intensities are $2I_0$ and I_0 Given the fringe width equal to α

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

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

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

D. None of these

Answer: C

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40. In a double-slit experiment, fringes are produced using light of wavelength $4800A^{\circ}$. One slit is covered by a thin plate of glass of refractive index 1.4 and the other slit by another plate of glass of double thickness and of refractive index 1.7. On doing so, the central bright fringe shifts to a position originally occupied by the fifth bright fringe from the centre. find the thickness of the glass plates.

A. $2.4\mu m$

B. $4.8\mu m$

C. $8\mu m$

D. $16\mu m$

Answer: C

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41. An interference is observed due to two coherent sources separated by a distance 5λ along Y-axis, where λ is the wavelength of light A detector D is moved along the positive X -axis The number of point on the X-axis excluding the points x=0 and $x=\infty$ at which resultant intensity will be maximum are

A. 4

B. 5

C. ∞

D. zero

Answer: A

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42. In a Young's double slit experiment, using unequal slit widths, the intensity at a point midway between a bright and dark fringes is 4I. If one slit is covered by an opaque film, intensity at that point becomes 2I. If the other is covered instead, then the intensity at that point is

A. $2I$

B. $5I$

C. $(5+2\sqrt{2})I$

D. $(5+4\sqrt{2})I$

Answer: A

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43. Two coherent light sources A and B are at a distance 3λ from each other (λ=wavelength)The distances from A on the X-axis at which the interference is constructive are

A. 3λ

B. 8λ

C. $5\lambda/4$

D. 8.75λ

Answer: C

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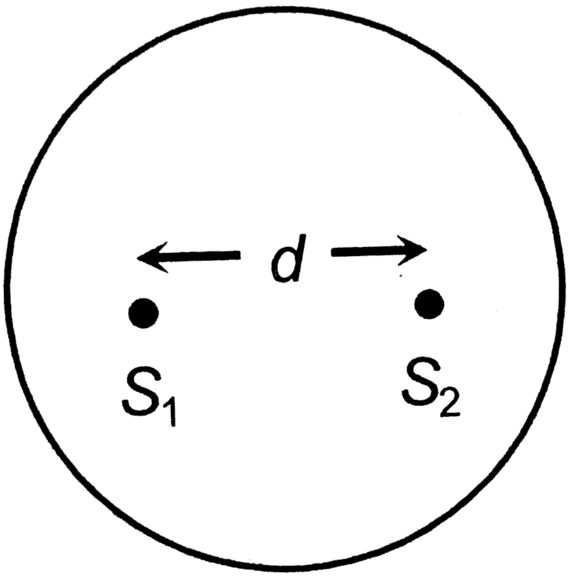
44. Two coherent sources separated by distance d are radiating in phase having wavelength λ. A detector moves in a big circle around the two sources in the plane of the two sources. The angular position of $n = 4$ interference maxima is given as



A. $\sin^{-1}\frac{n\lambda}{d}$

B. $\cos^{-1}\frac{4\lambda}{d}$

C. $\tan^{-1}\frac{d}{4\lambda}$

D. $\cos^{-1}\frac{\lambda}{4d}$

Answer: B

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45. 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

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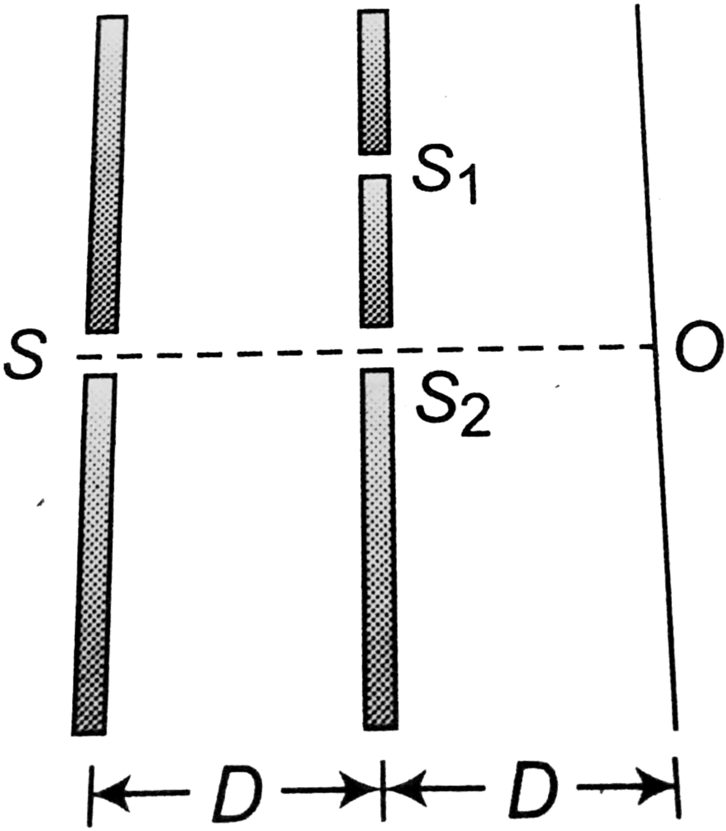
46. Two ideal slits S_1 and S_2 are at a distance d apart, and illuninated by light of wavelength λ passing through an ideal source slit S placed on the line through S_2 as shown. The distance between the planes of slits and the source slit is D. A screen is held at a distance D from the plane of the slits. The minimum value of d for which there is darkness at O is $(d < \; < D)$



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

B. $\sqrt{\lambda D}$

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

D. $\sqrt{3\lambda D}$

Answer: C

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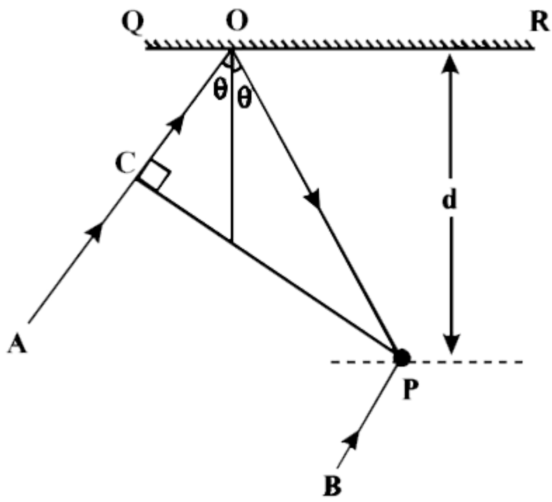
47. In the adjacent diagram, CP represents a wavefront and AO & BP, the corresponding two rays. Find the condition on θ for constructive interference at P between the ray BP and reflected ray OP.



A. $\cos\theta = 3\lambda / 2d$

B. $\cos\theta = \lambda / 4d$

C. $\sec\theta - \cos\theta = \lambda / d$

D. $\sec\theta - \cos\theta = 4\lambda / d$

Answer: B

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Assertion Reason

1. Assertion interference shows wave nature of light

Reason Photoelectric effect proves particle nature of light.

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2. Assertion if wavelength is of the order of distance between the slits, then figure size is large.

Reason Fringe width is given by $\beta = \lambda D / d$

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3. Assertion Two coherent sources transmit waves of equal intensity I_0 Resultant intensity at a point where path difference is $\frac{\lambda}{3}$ is also I_0.

Reason In interference resultant intensity at any point is the average intensity of two individual intensities.

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4. Assertion In Young's double slit experiment, ratio $\frac{I_{\max}}{I_{\min}}$ is infinite

Reason If width of any one of the slits is slightly increased, then this ratio will decrease.

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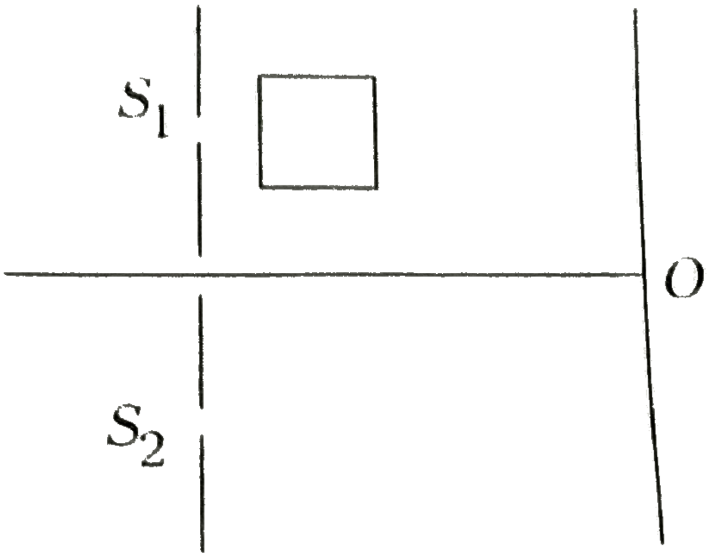
5. Assertion If a glass slab is placed in front of one of the slits, then fringe width will decrease

Reason Glass slab will produce an additional path difference.

View Text Solution

6. Assertion In the YDSE set up shown in figure a glass slab is inserted in front of the slit S_1 as shown in figure Then zero order maxima (where path difference =0) will lie above point O.

Reason Glass slab will produce an extra path difference in the path of the ray passing through S_1



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7. Assertion Fraunhofer diffraction occurs when all the rays passing through a narrow slit are approximately parallel to one another

Reason Fraunhofer diffraction pattern can be achieved by placing the screen far from the slit.

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8. Assertion In Young's double slit experiment, often both the phenomena interference and diffraction are present

Reason Diffraction results due to superposition of wavelets from different points of the some wavefront

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9. Assertion In diffraction phernomenon different maximas have different intensities

Reason In interference different maximas have same intensities

View Text Solution

10. Assertion (A) : The unpolarised light and polarized light can be distinguished from each other by using Polaroid.

Reason (R) : A Polaroid is capable of producing plane polarized beams of light.

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Match Column

1. In Young's double slit experiment, match the following two coloums.

	Column I	Column II
A	When width of one slit is slightly increased	p. maximum
B	When one slit is closed	q. maximum
C	When both the sources are made incoherent	r. maximum
D	When a glass slab is inserted in front of one of the slits	s. fringe patt

Note Assume absorption from glass slab to be negligible

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2. In normal YDSE experiment maximum intensity is $4I_0$ in Column I, y-coordinate is given corresponding to centre line In Coloum II resultant intensities are given Match the two columns.

	Column I	Column II
A	$y = \frac{\lambda D}{d}$	$p. I = I_0$
B	$y = \frac{\lambda D}{2d}$	$q. I = 2I_0$
C	$y = \frac{\lambda D}{3d}$	$r. I = 4I_0$
D	$y = \frac{\lambda D}{4d}$	$s. I = zero$

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3. In normal YDSE experiment, match the following two coloums.

	Column I	Column II
A	In YDSE apparatus is immersed in a liquid	p. fringe wi
B	When wavelength of light used in increased	q. fringe wi
C	When distance between slits and screen (D) is increased	r. fringe wi
D	When distance between two slits (d) is increased	s. fringe pa

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4. Match the following two coloums

	Column I	Column II
A	The phenomenon of resitribution of light energy an account of superimposition	p. Coherent
B	Emit continous light waves of same wavelength having constant phase difference	q. Interferen
C	The phenomenon of bending of light around corners	r. Polarizati
D	The phenomenon of restricting the vibration of ordinary light	s. Diffractio

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1. The interference pattern is obtained with two coherent light sources of intensity ration n. In the interference pattern, the ratio

$\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$ will be

A. $\frac{\sqrt{n}}{n+1}$

B. $\frac{2\sqrt{n}}{n+1}$

C. $\frac{\sqrt{n}}{(n+1)^2}$

D. $\frac{2\sqrt{n}}{(n+1)^2}$

Answer: B

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2. A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focal length 60cm. The aperture is illuminated normally by a parallel beam of wavelength 5×10^{-5} cm. The distance of the first dark band of the diffraction pattern from the centre of the screen is

A. $0.10cm$

B. $0.25cm$

C. $0.20cm$

D. $0.15cm$

Answer: D

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3. 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 experiment. What will be the intensity in front of one of the slits on the screen placed at a distance $D = 10d$?

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

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

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

D. I_0

Answer: C

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4. In a diffraction pattern due to single slit of width $'a'$, the first minimum is observed at an angle 30° when light of wavelength 5000Å is inclined on the slit. The first secondary 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

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5. Light of wavelength λ is incident on a slit of width d and distance between screen and slit is D. Then width of maxima and width of slit will be equal if D is --

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

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

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

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

Answer: B

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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 $120cm$.

A. $0.16cm$

B. $0.32cm$

C. $0.48cm$

D. $1.92cm$

Answer: A

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7. Find the right condition(s) for Fraunhofer diffraction due to a single slit

A. Source is at infinite distance and the incident beam has coverged at the slit

B. Source is near to the slit and the incident beam is parallel

C. Source is at infinity and the incident beam is parallel

D. Source is near to the slit and the incident beam has coverged at the slit

Answer: C

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8. The parallel beams of monochromatic light of wavelength 4.5×10^{-7} m passes through a long slit with width 0.2×10^{-3} m. The angular divergence in which most of the light is

A. 4.5×10^{-3} rad

B. $4.5\pi \text{rad}$

C. $2.25 \times 10^{-3} \text{rad}$

D. 9×10^{-3} rad

Answer: A

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9. The condition for obtaining secondary maxima in the diffraction pattern due to single slit is

A. $a \sin \theta = \frac{n\lambda}{2}$

B. $a \sin \theta = (2n - 1)\lambda / 2$

C. $a \sin \theta = n\lambda$

D. $a \sin \theta = (2n - 1)\lambda$

Answer: B

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10. In Young's double slit experiement when wavelength used is 6000Å and the screen is $40 cm$ from the slits, the fringes are $0.012 cm$ wide. What is the distance between the slits?

A. $0.24cm$

B. $0.2cm$

C. $2.4cm$

D. $0.024cm$

Answer: B

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11. The polarising angle of glass is 57° . A ray of light which is incident at this light which is incident at this angle will have an angle of refraction as

A. 43°

B. 25°

C. 38°

D. 33°

Answer: D

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12. Diffraction of light is observed only, when the obstacle size is-

A. should be much larger than the wavlength

B. has no relation to wavelength

C. should be of the order of wavelength

D. should be $\lambda / 2$ where λ is the wavelength

Answer: C

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13. A plane wave of wavelength 6250Å is incident normally on a slit of width 2×10^{-2} cm The width of the principal maximum of diffraction pattern on a screen at a distance of 50 cm will be

A. $312.5 \times 10^{-3} cm$

B. $312.5 \times 10^{-4} cm$

C. $312 cm$

D. $312.5 \times 10^{-5} cm$

Answer: A

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

A. $(2D\lambda)a$

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

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

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

Answer: A

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15. A beam of light of wavelength 590 nm is focussed by a converging lens of diameter 10.0 cm at a distnce of 20 cm from it. find the diameter of he disc image formed.

A. $5.76 \times 10^{-4} cm$

B. $7.51 \times 10^{-4} cm$

C. $8.72 \times 10^{-4} cm$

D. $9.80 \times 10^{-4} cm$

Answer: A

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16. A plane polarized light is incident normally on a tourmaline plate. Its E vector make an angle of 60° with the optic axis of the plate. Find the percentage difference between initial and final intensities

A. 50%

B. 25%

C. 75%

D. 90%

Answer: C

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17. 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. $0.2mm$

B. $0.1mm$

C. $0.5mm$

D. $0.02mm$

Answer: A

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18. In Young's double slit experiment, The locus of the point P lying in a plane with a constant path difference between two interfering waves is

A. a hyperbola

B. a straight line

C. an ellipse

D. a parabola

Answer: A

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19. Wavefront is the locus of all points, where the particles of the medium vibrate with the same

A. phse

B. amplitude

C. frequency

D. period

Answer: A

Watch Video Solution

20. In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wavelength of light used). The intensity at a point where the path difference is $\lambda/4$ will be

A. K

B. $K/4$

C. $K/2$

D. Zero

Answer: C

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21. Two doherent sources of intensity ratio α interfere in interference pattern $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$ is equal to

A. $\frac{2\alpha}{1+\alpha}$

B. $\frac{2\sqrt{\alpha}}{1+\alpha}$

C. $\frac{2\alpha}{1+\sqrt{\alpha}}$

D. $\frac{1+\alpha}{2\alpha}$

Answer: B

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22. Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are

A. 5I and 3I

B. 9I and 3I

C. 4I and I

D. 9I and I

Answer: D

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23. Colours of thin soap bubbles are due to

A. interference

B. scattering

C. diffraction

D. dispersion

Answer: A

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24. 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

A. $9:1$

B. $3:1$

C. $2:1$

D. $1:1$

Answer: C

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25. In Young's double slit interference experiment, using two coherent waves of different amplitudes, the intensities ratio between bright and dark fringes is 3 Then, the value of the wave amplitudes ratio that arrive there is

A. $\left(\frac{\sqrt{3}+1}{\sqrt{3}-1}\right)$

B. $\left(\frac{\sqrt{3}-1}{\sqrt{3}+1}\right)$

C. $\sqrt{3}:1$

D. $1:\sqrt{3}$

Answer: A

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26. The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refractive index n),

A. $\sin^{-1}\mu$

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

C. $\tan^{-1}\left(\frac{1}{\mu}\right)$

D. $\tan^{-1}(\mu)$

Answer: D

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27. A polarised light intensity I_0 is passed through another polariser whose pass axis makes an angle of 60° with the pass axis of the former, What is the intensity of emergent polarised light from second polarised?

A. $I = I_0$

B. $I = I_0 / 6$

C. $I = I_0 / 5$

D. $I_0 / 4$

Answer: D

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28. A fringe width of a certain interference pattern is $\beta = 0.002$ cm What is the distance of 5th dark fringe centre?

A. $1 \times 10^{-2} cm$

B. $11 \times 10^{-2} cm$

C. $1.1 \times 10^{-2} cm$

D. $3.28 \times 10^{6} cm$

Answer: C

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29. In Young's double-slit experiment, the slits are $2mm$ apart and are illuminated by photons of two wavelengths $\lambda_1 = 12000\text{Å}$ and

$\lambda_2 = 10000\text{Å}$. At what minimum distance from the common central bright fringe on the screen $2m$ from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

A. 8 mm

B. 6 mm

C. 4 mm

D. 3 mm

Answer: B

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30. If two slits is Young's experiment are 0.4 mm apart and fringe width on a screen 200 cm away is 2 mm the wavelength of light illuminating the slits is

A. 500 mm

B. 600 mm

C. 400 mm

D. 300 mm

Answer: C

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31. Light of wavelength λ from a point source falls on a small circular rings around a central bright spot are formed on a screen beyond the obstacle The distance beetween the screen and obstacle is D. Then, the condition for the formation of rings, is

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

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

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

D. $\lambda \approx \frac{D}{4}$

Answer: B

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32. Which of the following phenomena support the wave theory of light?

1. Scattering

2.Interference

3. Diffraction

4. Velocity of light in a denser medium is less than the velocity of light in the rare medium

A. 1, 2 and 3

B. 1, 2 and 4

C. 2, 3 and 4

D. 1, 3 and 4

Answer: C

33. λ_1 and λ_2 are used to illuminated the slits. β_1 and β_2 are the corresponding fringe widths. The wavelength λ_1 can produce photoelectric effect when incident on a metal But the wavelength λ_2 cannot produce photoelectric effect. The correct relation between β_1 and β_2 is

A. $\beta_1 < \beta_2$

B. $\beta_1 = \beta_2$

C. $\beta_1 > \beta_2$

D. $\beta_1 \neq \beta_2$

Answer: A

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34. When we close one slit in the Young's double slit experiment then

A. the bandwidth increased

B. the bandwidth is decreased

C. the bandwidth remains unchanged

D. the diffraction pattern is observed

Answer: D

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35. A beam of light is incident on a glass slab $(\mu = 1.54)$ in a direction as shown in the figure. The reflected light is analysed by a polaroid prism. On rotating the polaroid, $(\tan 57^\circ = 1.54)$

` (##DPP_PHY_CP24_E01_002_Q01.png" width="80%">

A. the intensity remains unchanged

B. the intensity is reduced to zero and remains at zero

C. the intensity gradually reduced to zero and then again increases

D. the intensity increases continuously

Answer: C

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36. In Young's double slit experiment, the phase difference between the two waves reaching at the location of the third dark fringe is

A. π

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

C. 5π

D. 3π

Answer: B

Watch Video Solution

37. A parallel beam of fast moving electrons is incident normally on a narrow slit. A fluorescent screen is placed at a large distance from the slit.

If the speed of the electrons is increased, which of the following statements is correct?

A. Diffraction pattern is not observed on the screen in the case of electrons

B. The angular widht of the central maximum of the diffraction pattern will increase

C. The angular widht of the central maximum will decrease

D. The angular width of the central maximum will be unaffected

Answer: B

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38. White light reflected from a soap film (Refractive index $= 1.5$) has a maxima at 600 mm and a minima at 450 nm at with no minimum in between. Then, the thickness of the film is

A. 1

B. 2

C. 3

D. 4

Answer: C

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39. In Young's double slit experiment, the fringe width is $1 \times 10^{-4} m$ if the distance between the slit and screen is doubled and the distance between the two slit is reduced to half and wavelength is changed from $6.4 \times 10^{7} m$ to $4.0 \times 10^{-7} m$, the value of new fringe width will be

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

B. $2.0 \times 10^{-4} m$

C. $1 \times 10^{-4} m$

D. $0.5 \times 10^{-4} m$

Answer: A

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40. Assertion: To observe diffraction of light the size of obstacle/aperture should be of the order of $10^{-7}m$.

Reason: $10^{-7}m$ is the order of wavelength of visible light.

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41. Assertion: The pattern and position of fringes always remain same even after the introduction of transparent medium in a path of one of the slit.

Reason: The central fringe is bright or dark is depend upon the initial phase difference between the two coherence sources.

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42. Assertion : Corpuscular theory fails to explain the velocities of light in air and water.

Reason : According to corpuscular theory, light should travel faster in denser media than in rarer media.

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For Jee Main Only One Option Is Correct

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

A. 2 cm only

B. 4 cm only

C. $2cm, \frac{2}{3}cm, \frac{2}{5}cm$

D. $4cm, \frac{4}{3}cm, \frac{4}{5}cm$

Answer: A

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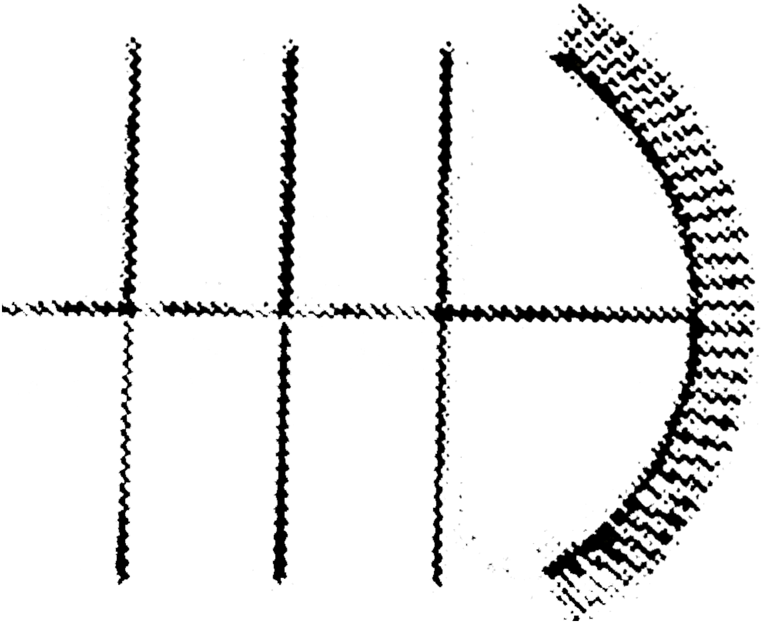
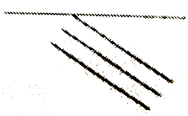
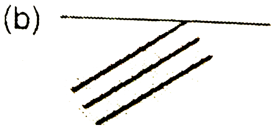
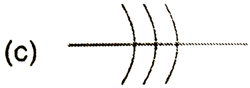
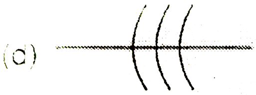
2. Plane wavefronts are incident on a spherical mirror as shown, the reflected wavefronts will be



A. (a) 

B. 

C. 

D. 

Answer: A

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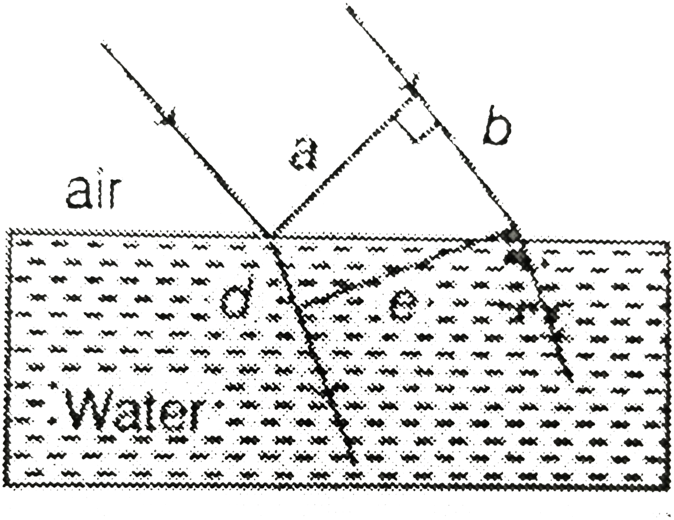
3. Figure shows plane waves refracted for air to water. What is the refractive index of water with respect to air ?



A. a/e

B. b/e

C. b/d

D. d/b

Answer: C

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4. In Young's double slit experiment, the wavelength of red light is $5200Å$.

The value of n for which nth bright band due to red light coincides with

$(n+1)th$ bright band due to blue light$(\lambda = 7800 Angstrom)$, is

A. 1

B. 2

C. 3

D. 4

Answer: B

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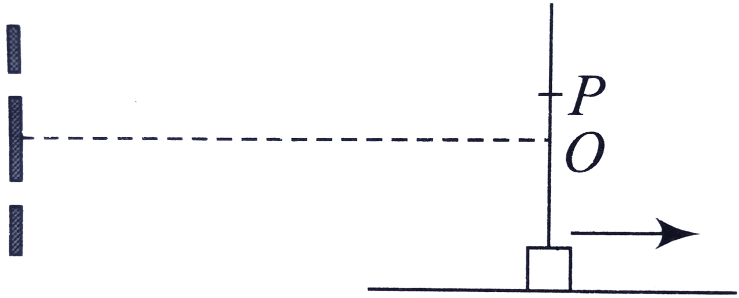
5. In Young's double-slit experment, the frist maxima is observed at a fixed point P on the screen. Now, the screen is continously moved away from the plane of slits. The ratio of intensity at point P to the intensity at point

O (center of the screen)



A. remains constant

B. keeps on decreasing

C. first decreases and then increases

D. first increases and then decreases

Answer: C

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6. In a YDSE with two identical slits, when the upper slit is covered with a thin, perfectly tranparent sheet of mica, the intensity at the centre of screen reduces ro 75% of the initial value. The second minima is observed to above this point and third maxima below it. which of the following can not be a possible value of phase difference caused by the mica sheet

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

B. $\frac{7\pi}{2}$

C. $\frac{10\pi}{3}$

D. $\frac{11\pi}{3}$

Answer: A

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7. In a double slit experiment ,the separation between the slits is $d = 0.25cm$ and the distance of the screen $D = 100$cm from the slits .if the wavelength of light used in $\lambda = 6000\text{Å}$and $I_0$is the intensity of the central bright fringe.the intensity at a distance $x = 4 \times 10^{-5}$in form the central maximum is-

A. I_0

B. $I_0 / 2$

C. $3I_0 / 4$

D. $I_0 / 3$

Answer: C

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8. A thin film of thickness t and index of refractive 1.33 coats a glass with index of refraction 1.50.What is the least thickness t that will strong reflect light with wavelength $600nm$ incident normally?

A. 200 nm

B. 100 nm

C. 400 nm

D. 300 nm

Answer: B

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9. Two parallel rays are travelling in a medium of refractive index $\mu_1 = 4/3$. One of the rays passes through a parallel glass slab of thickness t and refractive index $\mu_2 = 3/2$. The path difference between the two rays due to the glass slab will be

A. 4t/3

B. 3t/2

C. t/8

D. t/6

Answer: C

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10. Light waves travel in vacuum along the y-axis. Which of the following may represent the wavefront?

A. x=constant

B. y=constant

C. z=constant

D. x+y+z=constant

Answer: B

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

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

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

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

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

Answer: C

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

A. 1.8

B. 1.5

C. 1.67

D. 1.2

Answer: A

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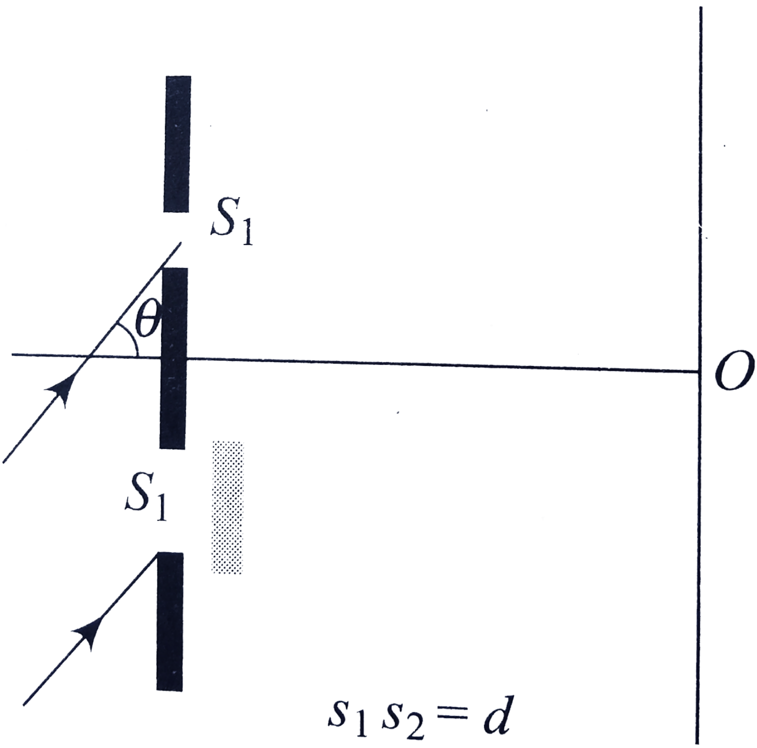
13. A monochromatic beam of light fall on YDSE apparatus at some angle (say θ) as shown in figure. A thin sheet of glass is inserted in front of the lower slit s_2. The central bright fringe (path difference $= 0$) will be obtained



A. at O

B. above O

C. below O

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

Answer: D

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14. 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

A. unchanged

B. halved

C. doubled

D. four times

Answer: D

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15. Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are

A. 5I and I

B. 5I and 3I

C. 9I and I

D. 9I and 3I

Answer: C

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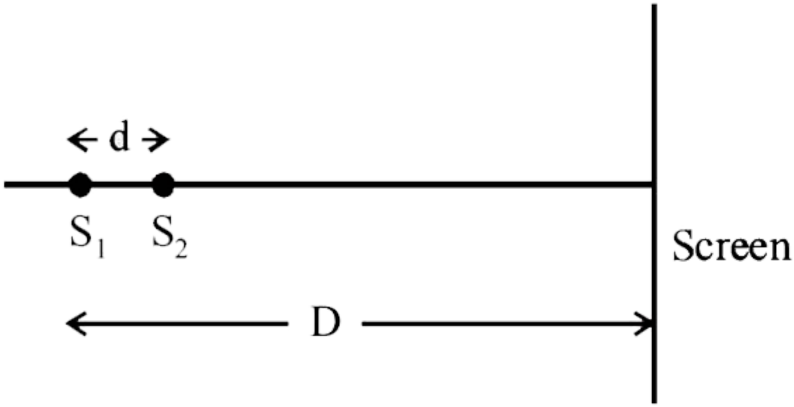
16. Two coherent point sources S_1 and S_2 are separated by a small distance d as shown. The fringes obtained on the screen will be



A. ellipse

B. straight lines

C. hyperbolas

D. concentric circles

Answer: D

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

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

D. λ

Answer: A

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18. In Young's double slit expriment, assume intensity of light on screen due to each source alone is I_0 and K_1 is equal to difference of maximum and minimum intensity. Now intensity of one source is made $\frac{I_0}{4}$ and K_2 is again difference of maximum and minimum intensity . Then $\frac{K_1}{K_2} =$

A. 4

B. 3

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

D. 2

Answer: D

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19. 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 $4/3$.

A. 0.2°

B. 0.27°

C. 0.3°

D. 0.15°

Answer: D

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20. In Young's double slit experiment with light of wavelength $\lambda = 600 nm$, intensity of central fringe is I_0. Now one of the slit is covered by glass plate of refractive index 1.4 and thickness t=$5\mu m$. The new intensity at the same point on screen will be :

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

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

C. I_0

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

Answer: C

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21. Find the maximum intensity in case of interfarence of infinite identical coherent sources having intensities $I_0, \frac{I_0}{4}, \frac{I_0}{16}, \frac{I_0}{64}, \frac{I_0}{256}$ .... (upto infinite).

A. I_0

B. $2I_0$

C. $4I_0$

D. $8I_0$

Answer: C

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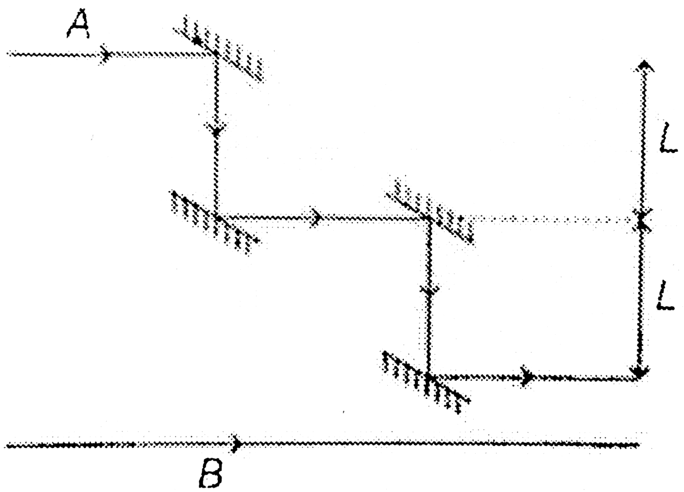
22. In the figure shown, light waves A and B both of wavelength λ are initially in phase and travelling rightward as incident by the two rays. Wave A is reflected from four parallel surfaces but ends up travelling in original direction. The possible value(s) of distance L in terms of wavelength λ in figure which put A and B exactly out of phase with each other after all the reflected is/are



A. $\lambda/2$

B. $3\lambda/2$

C. $3\lambda/4$

D. λ

Answer: C

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For Jee Advanced Only One Option Is Correct

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

A. 12

B. 7

C. 18

D. 4

Answer: B

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2. In Young's double-slit experiment $d/D = 10^{-4}$ (d = distance between slits, D = distance of screen from the slits) At point P on the screen, resulting intensity is equal to the intensity due to the individual slit I_0.

Then, the distance of point P from the central maximum is $(\lambda = 6000\text{Å})$

A. 2 nm

B. 1 mm

C. 0.5 mm

D. 4 mm

Answer: A

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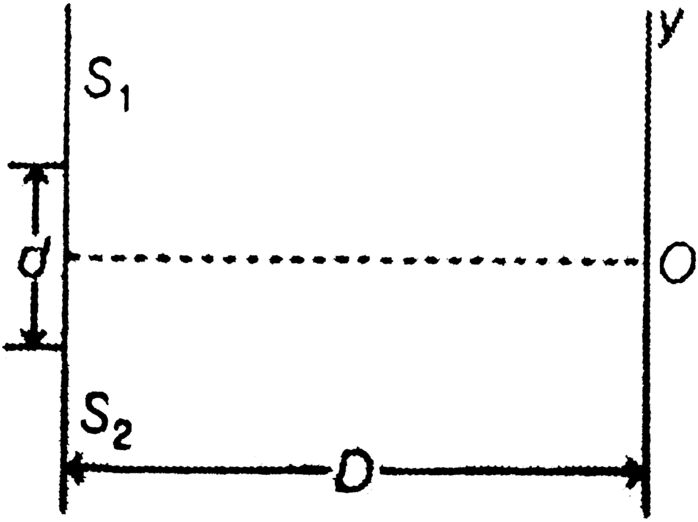
3. Consider a usual set-up of Young's double slit experiment with slits of equal slits of equal intensity as shown in the figure. Take O as origin and the y axis as indicated. If average intensity between $y_1 = -\frac{\lambda D}{4d}$ and $y_2 = +\frac{\lambda D}{4d}$ equals n times the intensity of maxima, then n equals (take average over phase difference)



A. $\frac{1}{2}\left(1+\frac{2}{\pi}\right)$

B. $2\left(1+\frac{2}{\pi}\right)$

C. $\left(1+\frac{2}{\pi}\right)$

D. $\frac{1}{2}\left(1-\frac{2}{\pi}\right)$

Answer: A

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4. In Young's double slit experiment, the fringes are displaced index 1.5 is introduced in the path of one of the beams. When this plate in replaced by another plate of the same thickness, the shift of fringes is $(3/2)x$. The refractive index of the second plate is

A. 1.75

B. 1.40

C. 1.25

D. 1.67

Answer: A

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

A. 2 cm, 7.5 cm

B. 3 cm, 6 cm

C. 2 cm, 4 cm

D. 4/3 cm, 10/3 cm

Answer: C

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6. The maximum intensity in Young's double slit experiment is I_0 . What will be the intensity of light in front of one the slits on a screen where path difference is $\frac{\lambda}{4}$?

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

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

C. I_0

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

Answer: A

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7. The coherent point sources S_1 and S_2 vibrating in same phase emit light of wavelength λ. The separation between the sources is 2λ. Consider a line passingh through S_2 and perpendicular to the line S_1S_2. What is the smallest distance from S_2 where a minimum of intensity occurs due to interference of waves from the two sources?

A. $\frac{7\lambda}{12}$

B. $\frac{15\lambda}{4}$

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

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

Answer: A

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8. Two identical coherent sources are placed on a diameter of a circle of radius R at a separation $d(< < R)(d = n\lambda)$ symmetrically about the centre of the circle. The sources emit identical wavelength λ each. What will be the number of points on the circle with constructive interference?

A. 20

B. 22

C. 24

D. 26

Answer: A

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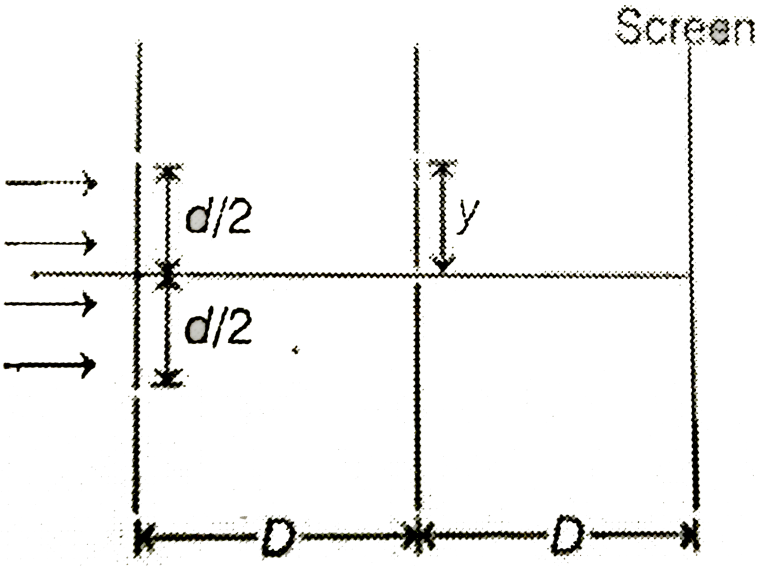
9. In the Young's double slit experiment apparatus shown in figure, the ratio of maximum to minimum intensity on the screen is 9. The wavelength of light used is λ, then the value of y is



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

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

C. $\frac{\lambda D}{3d}$

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

Answer: C

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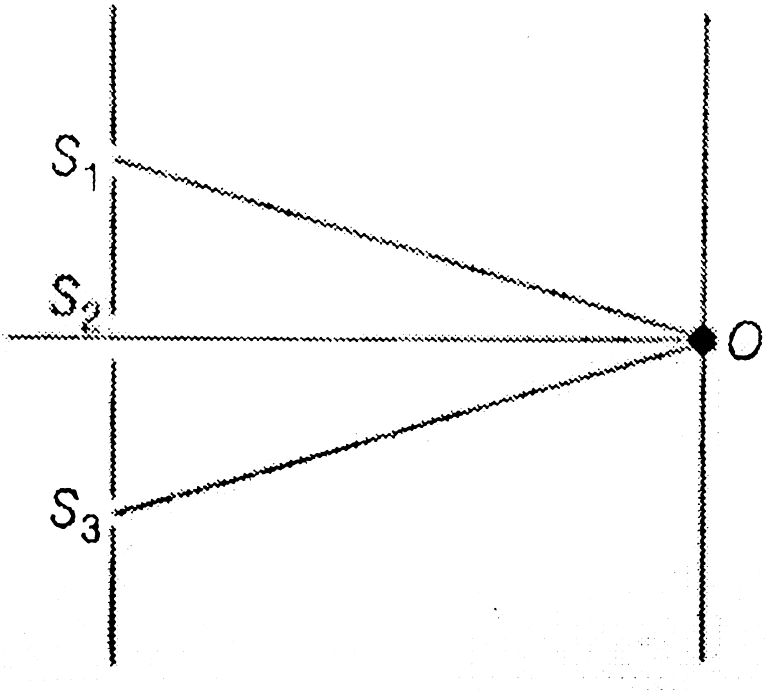
10. In the figure shown $S_1O - S_2O = S_3O - S_2O = \frac{\lambda}{4}$, Intensity at O due to any one of the slits is I_0. What is the intensity due to all the three coherent sources S_1, S_2 and S_3 ?



A. $3I_0$

B. I_0

C. $5I_0$

D. $9I_0$

Answer: C

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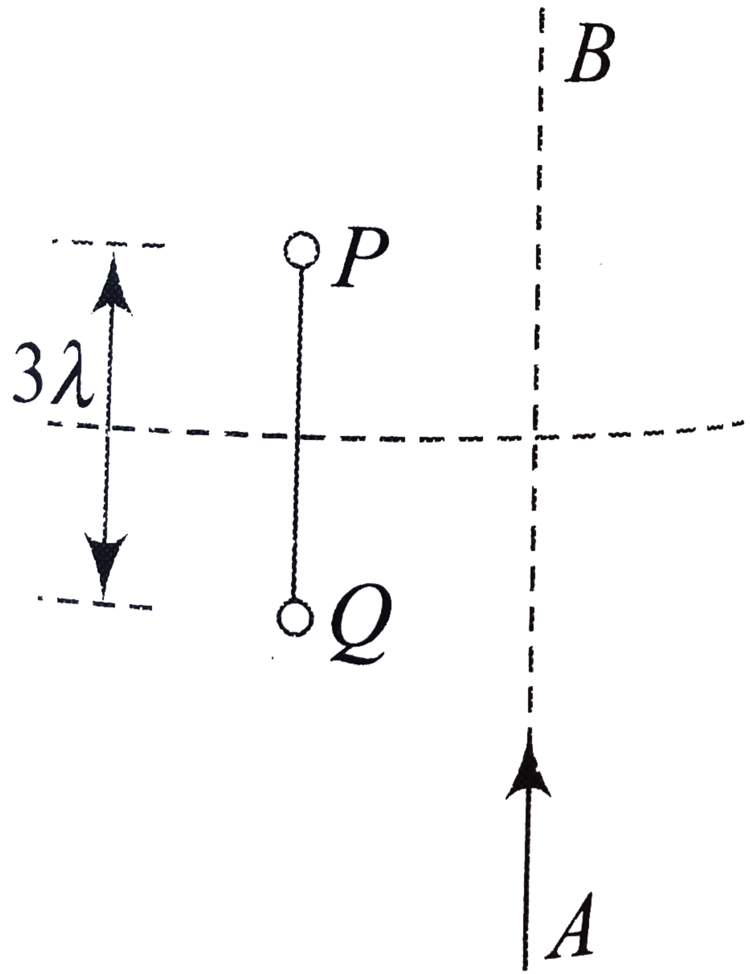
11. Two coherent light sources, each of wavelength λ, are separated by a distance 3λ, The maximum number of minima formed on line AB, which funs from $-\infty$ to $+\infty$, is



A. 2

B. 4

C. 6

D. 8

Answer: C

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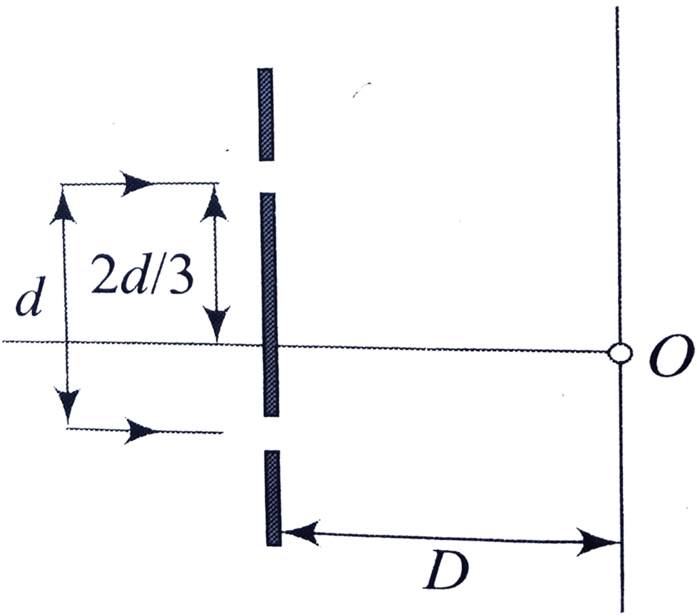
12. In figure, if a parallel beam of white light is incident on the plane of the slit, then the distance of the nearest white spot on the screen form O is [assume $d < < D, \lambda < < D$]



A. d/4

B. d/2

C. d/3

D. d/6

Answer: D

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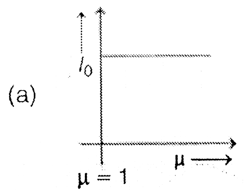
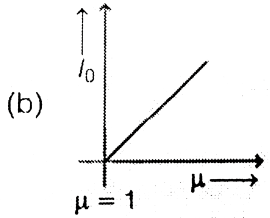
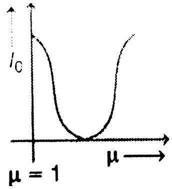
13. In YDSE if a slab whose refractive index can be varied is placed in front of one of the slits. Then, the variation of resultant intensity at mid-point of screen with μ will be best represented by `(mu is greater than or equal to 1)

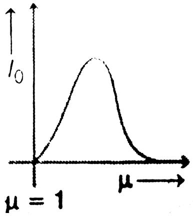
A. 

B. 

(c)

C. 

(d)

D. 

Answer: C

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14. Two identical narrow slits S_1 and S_2 are illuminated by light of wavelength λ from a point source P. If, as shown in the diagtam above the light is then allowed to fall on a scree, and if n is a positive integer, the condition for destructive interference at Q is that

A. $(I_1 - I_2) = (2n+1)\lambda/2$

B. $(I_3 - I_4) = (2n+1)\lambda/2$

C. $(I_1 + I_2) - (I_3 + I_4) = n\lambda$

D. $(I_1 + I_3) - (I_2 + I_4) = (2n + 1)\lambda/2$

Answer: D

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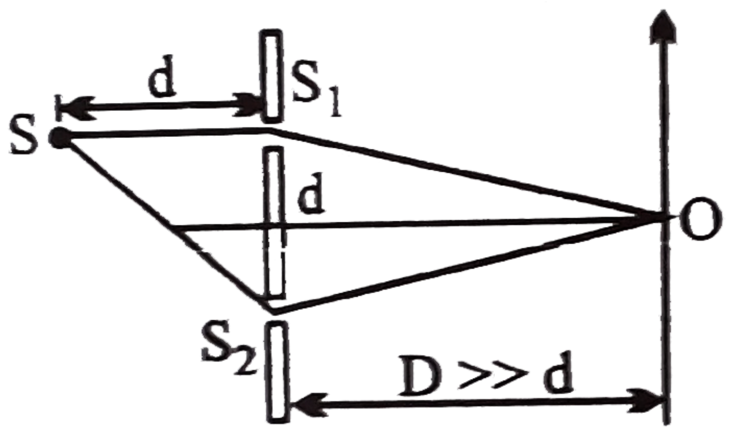
15. To make the central fringe at the center O , mica sheet of refractive index 1.5 is introduced Choose the corect statement.



A. The thickness of sheet is $\frac{d^2}{D}$ in front of S_1

B. The thickness of sheet is $\frac{d^2}{D}$ in front of S_2

C. The thickness of sheet is $\frac{d^2}{2D}$ in front of S_1

D. The thickness of sheet is $\frac{d^2}{2D}$ in front of S_1

Answer: A

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16. A thin oil film of refractive index 1.2 floats on the surface of water $\left(\mu = \frac{4}{3}\right)$. When a light of wavelength $\lambda = 9.6 \times 10^{-7} m$ falls normally on the film from air, then it appears dark when seen normally. The minimum change in its thickness for which it will appear bright in normally reflected light by the same light is:

A. $10^{-7} m$

B. $2 \times 10^{-7} m$

C. $3 \times 10^{-7} m$

D. $5 \times 10^{-7} m$

Answer: B

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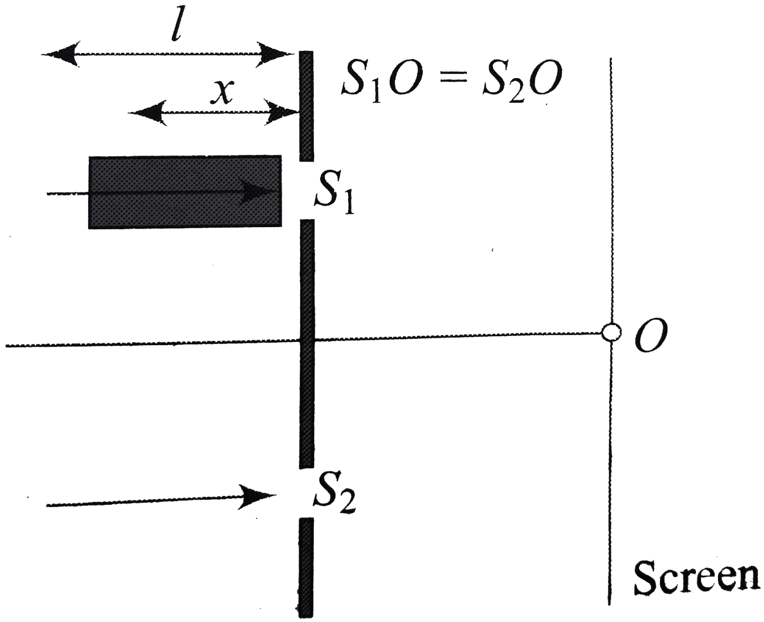
17. In figure, parallel beam of light is incident on the plane of the slits of a Young's double-slit experiment. Light incident on the slit S_1 passes through a medium of variable refractive index $\mu = 1 + ax$ (where 'x' is the distance from the plane of slits as shown), up to distance 'l' before falling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



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

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

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

D. None of these

Answer: B

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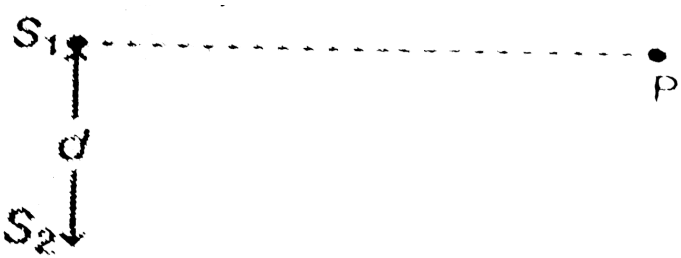
18. Consider two coherent monochromatic (wavelength λ) sources S_1 and S_2 separated by a distance d. The ratio of intensity of S_1 and that of S_2 at point P is 4. The distance of P from S_1 if the resultant intensity at point P is equal to $\frac{9}{4}$, times the intensity due to S_1 is : (n is a positive integer)



A. $\frac{d^2 - n^2\lambda^2}{2n\lambda}$

B. $\frac{d^2 + n^2\lambda^2}{2n\lambda}$

C. $\frac{n\lambda d}{\sqrt{d^2 - n^2\lambda^2}}$

D. $\frac{2n\lambda d}{\sqrt{d^2 - n^2\lambda^2}}$

Answer: A

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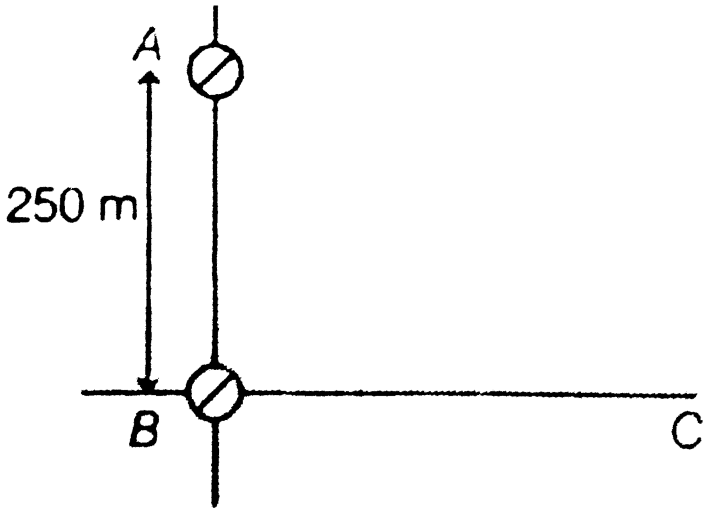
19. Two radio transmitters radiating in phase are located at point A and B, 250 m apart. The ratio wave have frequency of 3MHz. A radio receiver is moved out from point B along a line BC (perpendicular to AB). The distance from B beyond which the detector does not detect any minima si

:



A. 200 m

B. 400 m

C. 600 m

D. 500 m

Answer: C

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20. A parallel beam of light of all wavelength greater than 3000Å falls on a double slit in a Young's double slit experiment. It is observed that the wavelength 3600Å and 6000Å are absent at a distance of 31.5 mm from the position of the centre maximum and the orders of the interference at this point for the two wavelength differ by 7. If the distance between the slit and the screen in 1m, the sepration between the two slits is

A. 0.08 mm

B. 0.13 mm

C. 0.2 mm

D. 0.1 mm

Answer: C

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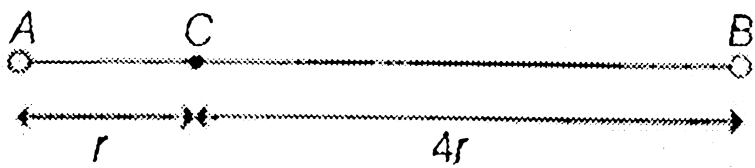
21. Two point coherent sources of power $P_0 nad 4P_0$ emmitting sound of frequency 150 Hz are kept at point A and B respectively. Both sources are in same phase. A detector is kept at point C as showin in figure. The distance of point A and B is r and 4r form detectro respectively. The speed of sound in medium is 300 m/s . Given $P_0 = 64\pi$ Watt and r=1m. The intensity observed by detector is



A. $25W/m^2$

B. $4W/m^2$

C. $9W/m^2$

D. zero

Answer: B

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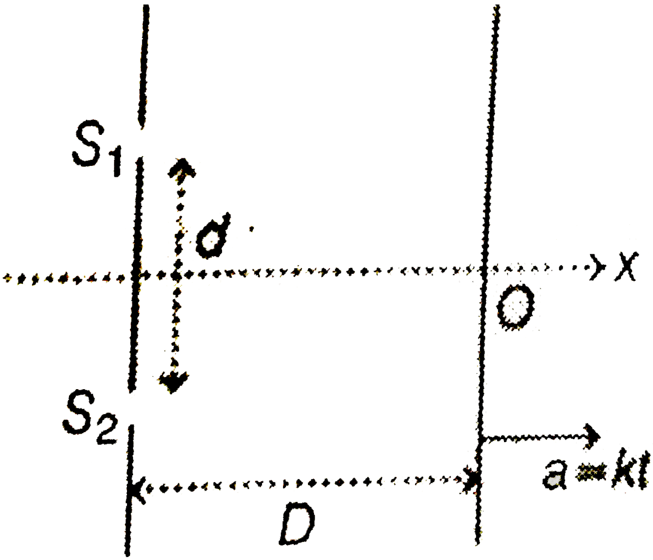
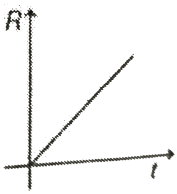
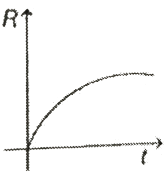
22. Consider the YDSE (Young's double slit experiment) arrangement shown in figure . The screen in the arrangement starts accelerating from rest in positive x-direction, with acceleration a=kt, (here k is a constant), then rate of change of fringe width (R) varies with time t as

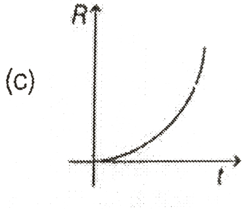


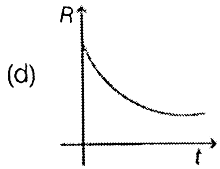
A. (a)



B. (b)



C. 

D. 

Answer: B

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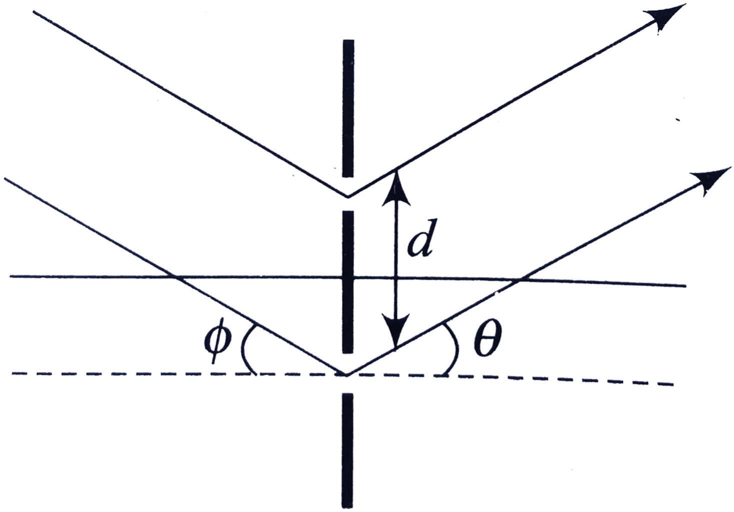
23. Light is incident at an angle ϕ with the normal to a plane containing two slits of separation d. Select the expression that correctly describes the positions of the interference maxima in terms of the incoming angle

ϕ and outgoing angle θ.



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For Jee Advanced B More Than One Option Is Correct

1. In the Young's double slit experiment, the interference pattern is found to have as intensity ratio between the bright and dark fringes as 9. This implies that

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

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

C. the amplitude ratio is 3.

D. the amplitude ratio is 2.

Answer: B::D

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2. White light is used to illuminate the two slits in a Young's double slit experiment. The separation between the slits is b and theh screen is at a distance $d(> > b)$ from the slits At a point on the screen directly in front of one of the slits, certain wavelengths are missing some of these missing wavelengths are

A. $\lambda = b^2 = b^2 / d$

B. $\lambda = b^2 = 2b^2 / d$

C. $\lambda = b^2 = b^2 / 3d$

D. $\lambda = 2b^2 = b^2 / 3d$

Answer: A::C

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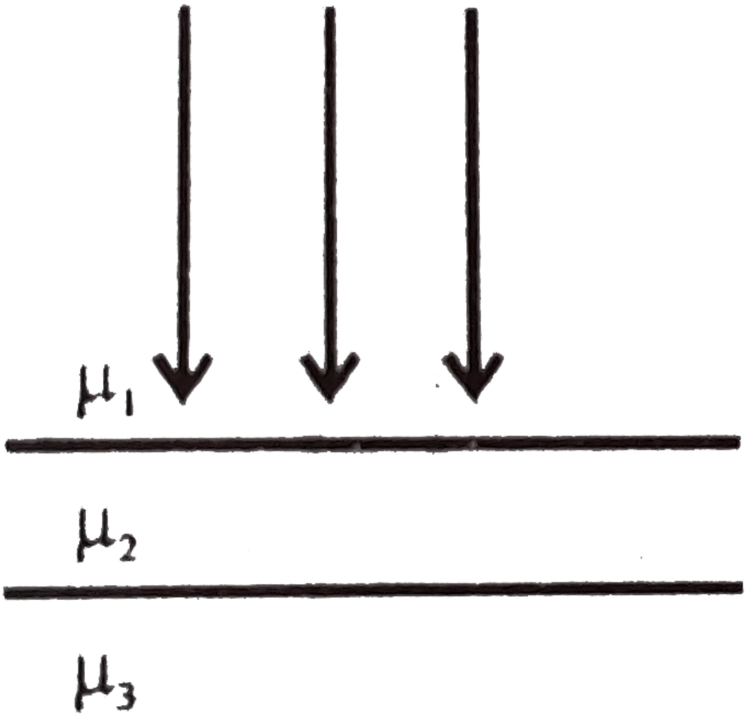
3. Consider a case of thin film interference as shown.Thickness of film is equal to wavelength of light in μ_2



A. Reflected light will be maxima if $\mu_1 < \mu_2 < u_3$

B. Reflected light will be maxima if $\mu_1 < \mu_2 > u_3$

C. Transmitted light will be maxima if $\mu_1 < \mu_2 > u_3$

D. Transmitted light will be maxima if $\mu_1 > \mu_2 > u_3$

Answer: A::C

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4. In a Young's double slit experiment minimum intensity is found to be non-zero. If one of the slits is covered by a transparent film which absorbs 10% of light energy passing through it, then

A. Intensity at maxima must decrease

B. Intensity at maxima may decrease

C. Intensity at maxima may increase

D. Intensity at maxima may decrease

Answer: A::C::D

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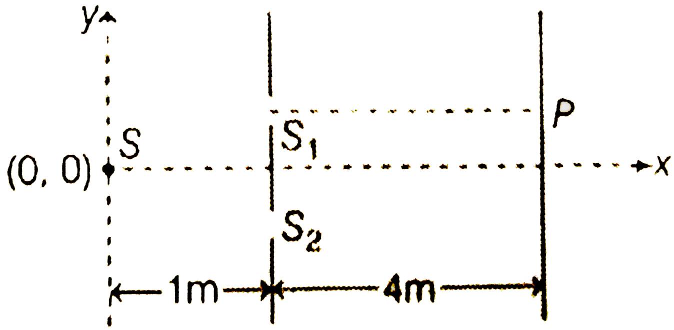
5. Figure shows a Young's double slit experiment set-up. The source S of wavelength 4000Å oscillates along y-axis according to the equation $y - \sin \pi t$, where y is in millimeters and t is in seconds. The distance two slits S_1 and S_2 is 0.5 mm.



A. The position of central maxima as a function of time is $4 \sin \pi t$

B. The position of central maxima as a function of time is $-4 \sin \pi t$

C. The instant at which maximum intensity occurs at P for the first time is $\frac{1}{\pi} \sin^{-1}\left(\frac{59}{80}\right)$

D. The instant at which minimum intensity occurs at P for the first time is $\frac{1}{\pi} \sin^{-1}\left(\frac{27}{80}\right)$

Answer: B::C::D

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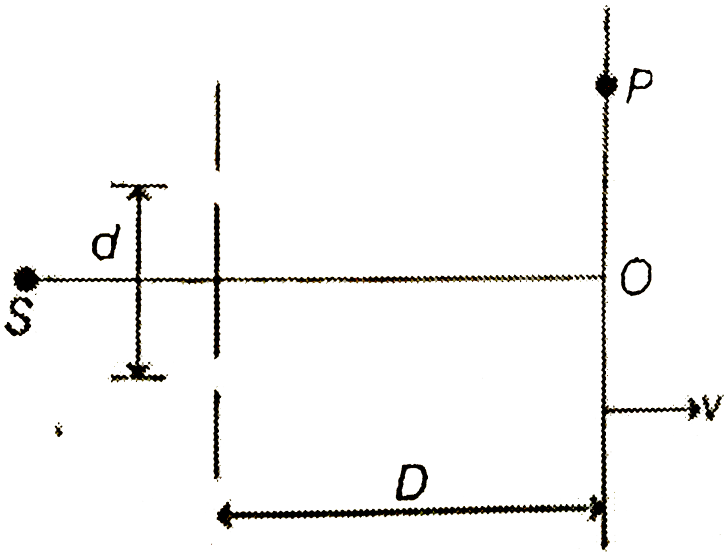
For Jee Advanced C Comprehension Type Questions Passage I

1. In YDSE apparatus shown in figure wavlength of light used is λ. The screen is moved away form the source with a constant speed v. Initial distance between screen and plane of slits was D.



At a point P on the screen the order of fringe will

A. increase

B. decrease

C. remain constant

D. first increases and then decreases

Answer: B

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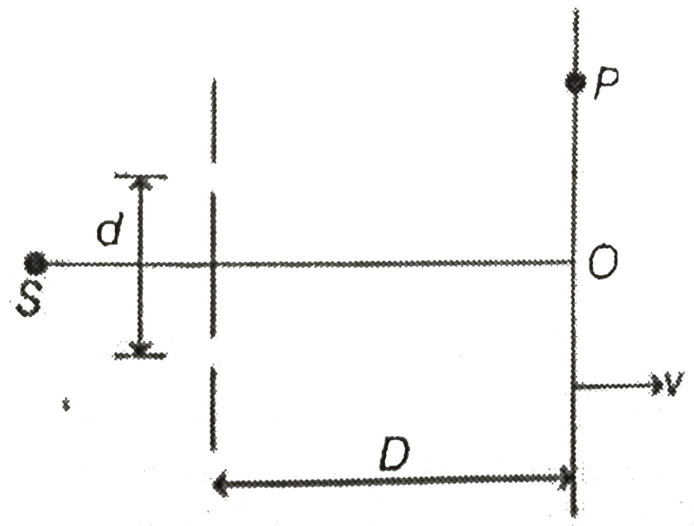
2. In YDSE apparatus shown in figure wavlength of light used is λ. The screen is moved away form the source with a constant speed v. Initial distance between screen and plane of slits was D.



At a point P on the screen the order of fringe will

A. $\frac{2D}{v}$

B. $\frac{D}{v}$

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

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

Answer: B

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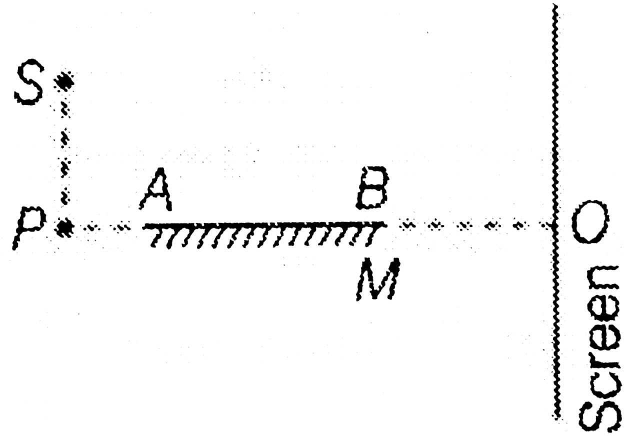
For Jee Advanced C Comprehension Type Questions Passage Ii

1. In a Lloyds's mirror experiment as narraow slit S iransmitting a light of wavelength λ is placed 3 mm above a small plane mirror (as shown). The light coming directly from the the slit and that coming after the reflection interfere on a screen placed at a distance of 90 cm from the slit. Length of mirror is 2 mm and the middle point of mirror is 2 mm from point P.



If fringe width is 0.1 mm then what is the wavelength of light used ?

A. $3.33 \times 10^{-7} m$

B. $6.67 \times 10^{-7} m$

C. $1.0 \times 10^{-7} m$

D. $4 \times 10 s$

Answer: B

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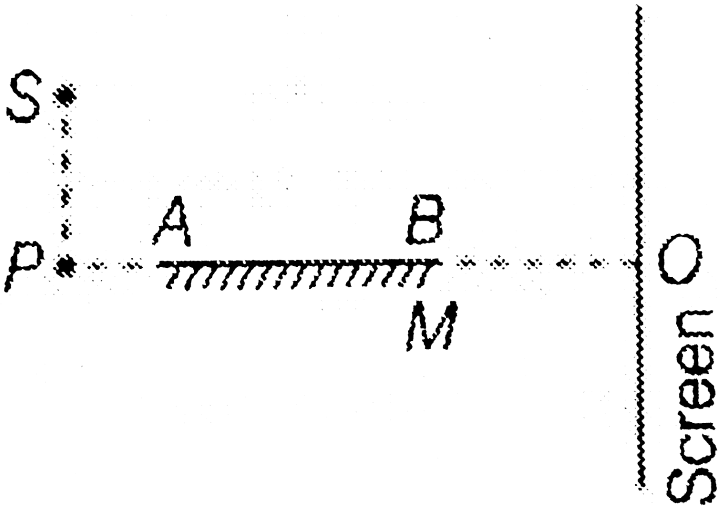
2. In a Lloyds's mirror experiment as narraow slit S iransmitting a light of wavelength λ is placed 3 mm above a small plane mirror (as shown). The light coming directly from the the slit and that coming after the reflection interfere on a screen placed at a distance of 90 cm from the slit. Length of mirror is 2 mm and the middle point of mirror is 2 mm from point P.



If the mirror is shifted towards left then how does the fringe pattern on screen changes ?

A. fringe width decreases and the region in which interference is formed shifts downwards

B. fringe width decreases and the region in which interference is formed shifts upwards

C. fringe width does not change and the region in which interference is formed shifts upwards

D. fringe width does not change and the region in which interference is formed shifts downwards

Answer: C

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For Jee Advanced C Comprehension Type Questions Passage Iii

1. A perons with a normal near point (25cm) uses a compound microscope consisting of an objective lens of focal length 8.0 mm and an eye-lense of focal length 2.5 cm. A small objective placed at a distance of 9.0 mm in front of the objective lens produces an image, which is then magnified by the eye-lens to produce a virtual image at the near point. Assume that the eye is placed close to the eye-piece.

The distance between the objective and the eye-lens is

A. 7.20 cm

B. 9.47 cm

C. 2.27 cm

D. 4.93 cm

Answer: B

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2. A perons with a normal near point (25cm) uses a compound microscope consisting of an objective lens of focal length 8.0 mm and an eye-lense of focal length 2.5 cm. A small objective placed at a distance of 9.0 mm in front of the objective lens produces an image, which is then magnified by the eye-lens to produce a virtual image at the near point.

Assume that the eye is placed close to the eye-piece.

The magnifying power of the microscope is

A. 34

B. 8

C. 11

D. 88

Answer: D

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For Jee Advanced D Matrix Matching Type Questions

1. In the YDSE apparatus shown in figure Δx is the path difference between S_2P and S_1P. Now a glass slab is introduced in front of S_2, then match the following.

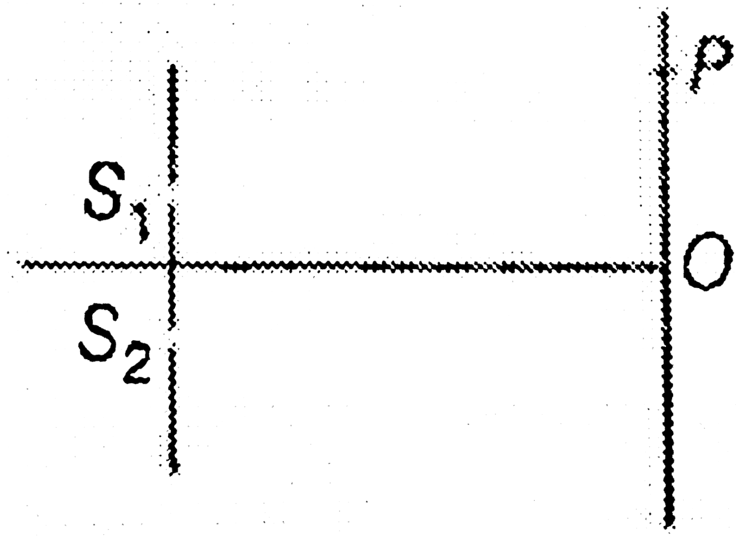

Table-1	Table-2
(A) Δx at P will	(P) increase
(B) Fringe width will	(Q) decrease
(C) Fringe pattern will	(R) remain same
(D) Number of fringes between O and P will	(S) shift upward
	(T) shift downward

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For Jee Advanced E Integer Type Questions

1. In the Young's double slit experiment, the intensities at two points P_1 and P_2 on the screen are respectively I_1 and I_2 If P_1 is located at the centre of a bright fringe and P_2 is located at a distance equal to a quarter of fringe width from P_1 then $\frac{I_1}{I_2}$ is

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

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3. Two waves of same frequency and same amplitude from two monochromatic sources are allowed to superpose at a certain point. If in one case the phase difference is 0 and in other case it is $\pi/2$ then the ratio of the intensities in the two cases will be

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4. An interference is observed due to two coherent sources separated by a distance 5λ along Y-axis, where λ is the wavelength of light A detector D is moved along the positive X -axis The number of point on the X-axis excluding the points x=0 and $x = \infty$ at which resultant intensity will be maximum are

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5. Two beam of light having intensities I and 4I interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\frac{\pi}{2}$ at point A and π at point B. Then the difference between resultant intensities at A and B is : $(2001, 2M)$

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6. In a Young's experiment, one of the slits is covered with a transparent sheet of thickness $3.6 \times 10^{-3} cm$ due to which position of central fringe shifts to a position originally occupied by 30th fringe. If $\lambda = 6000 \text{Å}$, then find the refractive index of the sheet.

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7. One slit of a double slits experiment is covered by a thin glass plate of refractive index$1.4$and the other by a thin glass plate of refractive index 1.7 .The point on the screen ,where central bright fringe was formed before the introduction of the glass sheets,is now occupied by the $15th$ bright fringe.Assuming that both the glass plates have same thickness and wavelength of light used in 4800Å ,find the their thickness.

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8. Phase difference at the central point changes by $\pi / 3$ when as thick film having a refractive index 1.5 and thickness $0.4 \mu m$ is placed in front of upper slit of a YDSE set up. If the wavelength (in nm) of the light used is 600 k, find k.

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9. A monchromatic beam of electrons accelerated by a potential difference V falls normally on the plate containing two narrow slits seperated by a distance d. The interference pattern is observed on a screen parallel to the plane of the slit and at a distance of D from slits. Fringe width is found to be ω_1. When electron beam is accelerated by the potential differene of 4V, the finge width becomes ω_2. Find the ratio $\frac{\omega_1}{\omega_2}$.

(Given $d < < D$)

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10. The outer surface of a transparent glass slab of refractive index $\mu_S = 1.5$ is coated by a thin layer of transparent medium of refractive index $\mu_C = 1.6$. Orange light of wavelength 6400Å falls normally on the coating. The reflected light at the upper surface and at the lower surface of teh coat interfere destructively. If thickness of the coat is $5K \times 10^{-8}$ m, calculate the minimum value of K.

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11. In a Young's double slit experiment, slits are seperated by a distance d and screen is at distance D, $(D > > d)$ from slit plane. If light source of wavelength $\lambda(\lambda < < d)$ is used. The minimum distance from central point on the screen where intensity is one fourth of the maximum is $\frac{D\lambda}{nd}$. Find the value of n.

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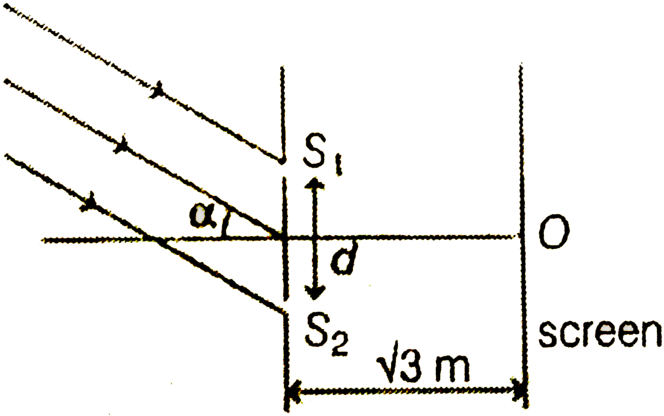
12. A parrallel beam of light $(\lambda = 5000\text{Å})$ is incident at an angle $\alpha = 30^\circ$ as shown in YDSE experiment. Intensity due to each slit at any point on screen in I_0. The distance between slits is 1mm. The intensity at central point O on the screen is KI_0. Find the value of K.



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13. In a Young's double slit experiment, one of the slits is covered by a thin film of thickness t=0.04 mm, and refractive index $\mu = 1.2 + \frac{9 \times 10^{-14} m^2}{\lambda^2}$, where λ is the wavelength in meter. A beam of light consisting of two wavelength $\lambda_1 = 400 nm$ and $\lambda_2 = 600 nm$ falls normally on the plane of the slits. Find the distance between two central maxima in milimeter. Distance of screen from slits is 400 times the the separation between the slits.

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