PHYSICS

BOOKS - DHANPAT RAI & CO PHYSICS (HINGLISH)

WAVE OPTICS

Example

1. The velocity of light in vacuum is $3 \times 10^8 ms^{-1}$. What is the velcoity of light in glass if the index of refraction of glass if 1.5?

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2. Monochromatic light of wvalength $589nm$ is incident from air on a water surface. What are the wavelength, frequency and speed of (a)

reflected and (b) refracted light ? μ of water is 1.33`.

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

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4. The refractive index of diamond is 2.47 and that of glass is 1.51. How much faster does light travel in glass than in diamond ?

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5. Calculate the time which light will take to travel normally through a glass plate of thickness $1mm$. Refractive index of glass is 1.5.

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6. White light is a mixture of light of wavelengths between 400 nm and 700 nm. If this light goes through water $(\mu = 1.33)$` what are the limits of the wavelength there ?

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7. The optical path of a monochromatic light is the same if it goes through 2.00 cm of glass or 2.25 cm of water. If the refractive index of water is 1.33, what is the refractive index of glass?

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8. For the same angle of incidence, the angles of refraction in media P, Q and R are $35^\circ, 25^\circ, 15^\circ$ resp. In which medium will the velocity of light be minimum ?

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9. If ε_0 and μ_0 are respectively, the electric permittivity and the magnetic permeability of free space, ε and μ the corresponding quantities in a medium, the refractive index of the medium is

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10. A glass slab of thickness $4cm$ contains the same number of waves as $5cm$ of water, when both are traversed by the same monochromatic light. If the refractive index of water is $4/3$, then refractive index of glass is

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11. Refractive index of air is 1.0003. The correct thickness of air column which will have one more wavelength of yellow light (6000Å)

than in the same thickness in vacuum is

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

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13. In Young's double slit experiment the slits are separated by 0.24 mm. The screen is 2 m away from the slits . The fringe width is 0.3 cm. Calculate the wavelength of the light used in the experiment.

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14. In Young's double slit experiment, while using a source of light of wavelength 4500 $\mathring{A}$, the fringe width obtained is 0.4 cm. If the distance between the slits and the screen is reduced to half , calculate the new fringe width.

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15. In Young's double slit experiment , the light has a frequency of $6 \times 10^{14} Hz$ and the distance between the centres of adjacent fringes is $0.75mm$. If the screen is $1.5m$ away, what is the distance between the slits ?

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16. In Young's double slit experiment the fringe width obtained is 0.6cm , when light of wavelength 4800 $\mathring{A}$ is used. If the disatance

between the screen and the slit is reduced to half, what should be the wavelength of light used to obtain fringes 0.0045 m wide ?

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

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18. The two slits in Young's double slit experiment are separated by a distance of 0.03 mm. An interference pattern is produced on a screen 1.5 m away. The 4th bright fringe is at a distance of 1 cm from the central maximum. Calculate the wavelength of light used.

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19. Two slits $0, 125mm$ apart are illuminated by light of wavelength $4500Å$. The screen is $1m$ away, from the plane of the slits. Find the separation between the 2nd bright fringe on both sides of the central maximum.

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20. In Young's double slit experiment, the slits are $0.2mm$ apart and the screen is $1.5m$ away. It is observed that the distance between the central bright fringe and fourth dark fringe is $1.8cm$. Calculate wavelength of light used.

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21. A double slit is illuminated by light of wave length 6000 Å. The slit are 0.1 cm apart and the screen is placed one metre away. Calculate.

(i). The angular position of the 10^{th} maximum in radian and

(ii). Separation of the two adjacent minimal.

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22. In Young's double slit experiment the slits are 0.5 mm apart and interference is observed on a screen placed at a distance of 100 cm from the slits. It is found that the 9^{th} bright fringe is at a distance of 8.835 mm from the second dark fringe from the centre of the fringe pattern. Find the wavelength of light used.

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23. In a Young's double experiment , the slits are 1.5 mm apart. When the slits are illuminated by a nonochromatic light source and the screen is kept 1 m apart from the slits ,width of 10 fringes is measured as 3.93 mm . Calculated the wavelength of light used. What

will be the width of 10 fringes when the distance between the slits and the screen is increased by 0.5 m . The source of light used remains the same.

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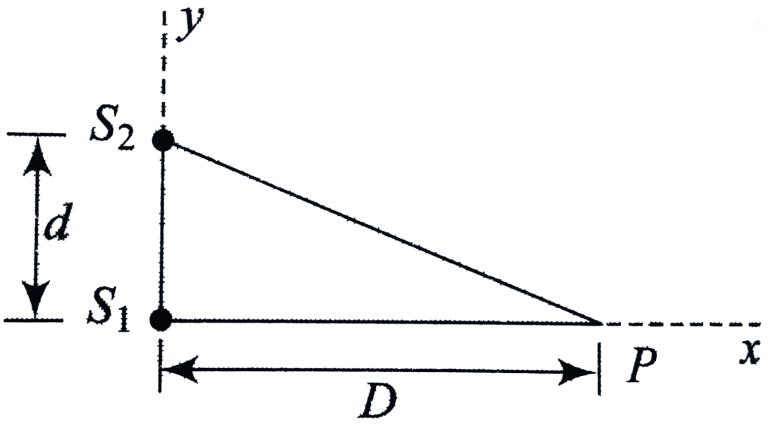
24. Two sources S_1 and S_2 emiting light of wavelenght 600 nm placed a distance 1.0×10^{-2} cm apart.

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

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

(b) Locate the psoition of the farthest minima detected



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25. In Lloyd's single mirror interference experiment, the source slit is at a distance of 2 mm from the plane mirror . The screen is kept at a distance of 1.5m from the source . If light of wavelength 5890 Å is used, calculate the fringe width.

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26. In Lloyd's interference experiment, 10 fringes occupy a space of 1.5 mm. The distance between the source and the screen is 1.25 m. If light of wavelength 6000 Å is used, find the distance of the source from the plane minor.

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27. In Lloyd's experiment , the slit and its image have a separation of 4.32 mm and the obsevations made at a plane 2.0 m away fringes of separation 0.26 mm. Find the wavelength of light used.

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28. In Lloyd's interference experiment, the path difference between direct and reflected beams of light for the 10th bright fringe was observed to be 0.63 mm. Find the wavelength of light used.

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29. In a Fresnel's biprism experiment, sodium light of wavelength 5832Å is used. Calculated the fringe width, given the distance between the screen and the biprism =120 cm and the distance the two sources=0.04 cm.

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30. In a biprism experiment , the slit is illuminated with light of wavelength 4800Å . The distance the slit and birprism is 20cm and that between biprism and eyepiece is 80cm . If two virtual source are 0.3 cm apart, determine the distance between the 5th bright band on one side of the central bright band and the 5th dark bank on the other side.

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31. In a biprism experiment, the distance between 4th an 13th bright fringes is measured when light of wavelength 6×10^{-7} m is used. On replaceing the source by another of different wavelength without disturbing the adjustment of the apparatus , it is found that the distance between 5th and 15th bright fringes is the same as measured before, what is the wavelength of light used?

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32. In a biprism experiment , fringe width is measured as 0.4 mm . When the eyepiece is moved away from the biprism through 30 cm, the fringe width increase by 50% if the two virtual soruces are 0.6 mm apart, find the wavelength of light used.

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33. In a biprism experiment , the distance between the coherent source is 0.5 mm and that between the slit and the eyepiece is 1.2 m, the slit is illuminated by red light of wavelength 6500Å . If the red light is repluced by a green light of movelength6550Å , it is found that the nth red band coincides with (n+1)th green bright band. Calculate the distance of these from the central bright band.

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34. Interference fringers are produced by a Fresnel's biprism in the focal plane of reading microscope which is 100 cm from the slit. A lens interposed between the biprism and the microscope gives two images of the slit in two positions.If the images of the slits are 4.05 mm apart in one case, 2.90 mmin the other and the wavelength of light used is 5893 Å, find the distance between two consecutive bands.

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35. Two slits in Young's double slit experiment have widths in the ratio 81:1. What is the the ratio of amplitudes of light waves coming from them ?

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36. What is the ratio of slit widths when amplitudes of light waves from them have ratio $1:\sqrt{2}$?

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37. The phase difference between two waves reaching a point is $\pi/2$. What is the resultant amplitude, if the individual amplitudes are $3mm$ and $4mm$?

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38. Consider interference between waves form two sources of intensities $I\&4I$.Find intensities at point where the phase difference is π

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39. In Young's double slit experiment, if I_0 is intensity of light from each sources, what is the intensity at a point on screen where two waves arrive having a phase diff. of 60° and 120°.

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40. Find the ratio of intensities at the two points X and Y on a screen in Young's double slit experiment, where waves from the two source S_1 and S_2 have path difference of zero, and $\lambda/4$ respectively.

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41. Two coherent sources whose intensity ratio is 81:1 produce interference fringes. Calculate the ratio of intensity of maxima and minima in the fringe systen.

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42. The ratio of intensity at maxima and minima in the interference pattern is 25:9. What will be the widths of the two slits in Young's interference experiment ?

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43. Two coherent sources of light of intensity ratio β interfere. Prove that the interference pattern, $\frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}} = \frac{2\sqrt{\beta}}{1+\beta}$.

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44. The ratio of the intensity at the centre of a bright fringe to the intensity at a point one-quarter of the distance between two fringe from the centre is

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45. Fringes are produced with monochromatic light of wave-length 5.45×10^{-5} cm. A thin glass plate of refractive index 1.5 is then placed normally in the path of one of the interference beams and the central bright band of the fringe system is found to move into the position previously occupied by the third bright band from the system. Find the thickness of the glass plate.

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46. When a thin sheet of a transparent material of thinkness 7.2×10^{-4}cm is introduced in the path one of the interfering beams, the central fringe shift to a position occupied by the sixth bright fringe. If $\lambda = 6 \times 10^{-5}$ cm, find the refractive index of the sheet.

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47. Interference fringes were produced by Young's double slit method, the wavelength of light used being 6000Å. The separation between the two slits is 2 mm.The distance between the slits and screen is 10 cm. When a transparent plate of thickness 0.5 mm is placed over one of the slits. the fringe pattern is displaced by 5 min. Find the refractive index of the material of the plate.

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48. A soap film is illuminated by while light incient at an angle of 30°. The reflected light is examined by a spectroscope in which a dark band corresponding to wavelength 6000Å is found . Calculate the minimum thickness of the film. Given refractive index of film $= \frac{4}{3}$

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49. White light reflected at perpendicular incidence from a soap film has, in the visible specturm, an interference amximum at 6000Å and a minimum at 4500Å with no minimum in between. If $\mu = 4/3$ for film, what is the film thickness ?

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50. A soap film of $\mu = \frac{4}{3}$ is illuminated by white light incident at an angle of 45°. The transmitted light is examined by spectrospe and bright fringe is found to be for wavelength of 6000Å. Find the minimum thickness of the film.

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51. White light is incident on a soap film of $\mu = 4/3$ at an angle of 30°. On examining the transmitted light with a spectrometer a dark

band of wavelength 5.5×10^{-7} m is found. Find the minimum thickness of the film.

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52. A slit 4.0 cm wide is irradiated with microwaves of 2.0 cm. Find the angular spread of central maximum assuming incidence normal to the plane of the slit.

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53. 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

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54. A screen is placed $2m$ away from the single narrow slit. Calculate the slit width if the first minimum lies $5mm$ on either side of the central maximum. Incident plane waves have a wavelength of 5000Å.

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55. Light of wavelength 5500 Å falls on a slit on a slit of width 0.13 cm at normal incidence. Calculate the width of the central maximum on a screen kept 2.5 m away from slit.

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

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57. Red light of wavelength 6500Å from a distant source falls on a slit $0.50mm$ wide. Calculate the distance between first two dark bands on each side of central bright band in the diffraction pattern observed on a screen placed $1.8m$ from the slit.

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58. Parallel light of wavelength 5000 Å falls normally on a single slit. The central maximum spreads out to 30° on either side of the incident light.Find the width of the slit.For what width of the slit the central maximum would spread out to 90° from the direction of the incident light ?

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59. A slit of width 0.025 mis placed in front of a lens of focal length 50 cm. The slit is illuminated with light of wavelength 5900 Å.

Calculate the distance between the centre and first dark band of diffraction pattern obtained on a screen placed at the focal plane of the lens.

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60. Two spectral lines of sodium D_1 and D_2 have wavelengths of approximately 5890 Å and 5896 Å. A sodium lamp sends incident plane wave onto a slit of width 2 micrometre. A screen is located 2 m from the slit. Find the spacing between the first maxima of two sodium lines as measured on the screen.

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61. What should be the width of each slit to obtain 10 maxima of the double slit interference pattern within the central maximum of single slit diffraction pattern ? (NCERT Solved example)

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62. A laser operates at a frequency of 3×10^{14} Hz and has an aperture of 10^{-2} m. What will be the angular spread ?

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63. A laser beam has a wavelength of $7 \times 10^{-7} m$ and aperure $10^{-2} m$. The beam is sent to moon at a distance of $4 \times 10^{5} km$ from earth. Find the angular spread and areal spread of the beam on reaching the moon.

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64. Estimate the distance for which ray optics is good approximation for an aperture of $4mm$ and wavelength $400nm$.

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

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66. Light of wavelength 5000Å is diffrated by an aperture of width $2mm$. For what distance by the diffracted beam does the spreading due to diffraction become greater than the width of the aperture ?

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67. Light of wavelength $600nm$ is incident on an aperture of size $2mm$. Calculate the distance light can travel before its spread is more than the size of aperture.

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

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69. A diffracting grating 1 cm wide has 1200 lines and is used in second order. What is the diffraction angle for light of wavelength 550 nm?

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70. A diffraction garating has 5,000 rulings per centimetre. What is the second order diffraction angle for violent light (λ = 500 nm).

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71. A planetransmissiongratinghaveing 8000 lines per cm is hevingused at normal incidence. Find the longest wavelength which canbe obscraved in the first order.

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72. A diffraction grating having 600 lines per mm is illuminated normally by light of wovelength 600 $\mathring{A}$What is the heghest order of diffraction image that can be seen ?

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73. A plane transmissio grating when illuminated with normal light produces a second order diffraction at 30° for wavelength λ=500 $\mathring{A}$. Calculate the number of lines per cm on the grating.

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74. Aparallel beam of sodium lignt falls normally of a plane grating having 4240 lines per cm. A second order line is obseved at 30° to the normal. Find the wavelength. What is the highest order that can be observed with this grating? Will this line appear to be of the same colour in each order ?

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75. A. diffraction grating has 800 lines per mm and is illuminated normally by parallel monochromatic light of wavelengths 560 nm and 590 nm. Calculate the difference in the angular positions of the first order spectra of the two lights on th same suide of the normal.

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76. A diffraction grating used at normal incidence gives a line $\lambda_1 = 600\text{Å}$ in a certain order supermposed on another line $\lambda_2 = 450\text{Å}$ of the next higher order. If the angle of diffraction is 30° how many lines are there in 1 cm of the grating.

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

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

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79. Earth is moving towards a fixed star with a velocity of $30kms^{-1}$. An observer on earth observes a shift of $0.58Å$ in wavelength of light coming from star. What is the actual wavelength of light emitted by star ?

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80. A plane electromagnetic wave of frequency w_0 falls normally on the surface of a mirror approaching with a relativisitic velocity v. Then frequency of the reflected wave will be (given $\beta = \frac{v}{c}$):

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81. The red shift of radiation froma distance nebula consits of light known to hace a wavelength of 434 nm. In the laboratory, this wavelength appears to be 6562 Å. What is the speed of the nebulal

in the line of sight relative to the earth ? Is it approching or receding ?

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82. Given $v' = (1 - v/c)v$ and $v' = \frac{(1 - v/c)v}{\sqrt{1 - v_2/c_2}}$ For what value v/c, these question differ by 10%

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83. An e.m. beam has an intensity of 20 Ww^{-2} and is linearly poorised in the vertical direction. Find the intensity of the transmitted beam by a polaroid when its plan of transmission makes an angle of 60° with the vertical.

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84. Two polarising sheets are placed with their planes parallel, so that light intensity transmitted is max. Through what angle must either sheet be turned so that light intensity drops to half the maximum value ?

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85. Two nicols are so oriented that the maximum amount of light is transmitted. To what fraction of its maximum value is the intensity of transmitted light reduced when the analyser is rotated through (i) 30° (ii) 60° ?

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86. Two polaroids are placed at 90° to each other and the transmitted intensity is zero. What happens when one more polarid

is placed between these two bisecting two bisecting the angle between them?

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87. As polaroid examines two adjacent plane polarised beam A and B whose planes of polarisation are mutually perpendicular. In the first position of the analyser, beam B shows zero intensity. From this position a rotation 30° shows that thebeams have same intensity. The ratio of intensity of the two beam $I_Z \& I_B$

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88. Two 'crossed' polaroids A and B are placed in the path of a light-beam. In between these, a third polaroid is C is placed whose polarisation axis makes an angel θ with a polarisation axis of the polaroid A. If the intensity of light emerging from the poloaroid a is

I_o then show that the intensity of light emerging from polaroid B will be $\frac{1}{4} I_o \sin^2 \theta$.

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

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90. Yellow light is incident on the smooth surface of a block of dense flint glass for which the refractive index is 1.6640. Find he polarising angle. Also find the angle of refraction.

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91. A ray of light in incident on a glass plate at an angle of 60°. What is the refractive index of glass if the reflected and refracted rays are perpendicular to each other?

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92. At what angle of incidence will the light reflected from water $(\mu = 1.3)$ be completely polarised?

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93. Show that when a ray of light is incident on the surface of a transparent medilum at the polarising angle, the reflected and transmitted rays are perpendicular to each other.

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

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95. The velocity of light in air is $3 \times 10^8 ms^{-1}$ and that in water is $2.2 \times 10^8 ms^{-1}$. Find the polrising an gle of incidence.

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96. The refractive index of water is 4/3 and that of glass 3/2. A beam of light travelling in wter enters glass. For what angle of incidence the refected light will be completely plane-polarised? (than $48^\circ 22$ = 1.125)

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97. Calculate the thickness of (i) a quarter wave plate (ii) a half-wave plate, given that μ_e=1.533 μ_o=1.544 $\lambda = 5000\text{Å}$.

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98. A beam of linearly polarised is change into circularly palarised light by passing it through a slice of cryslal 0.003 cm thick. Calculate the difference n the refractive index of the two rays in the crystal assuming this to be minimum thickness that wil produce the effect and that the wavelength is 6×10^{-5} cm.

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99. Calculate the specific rotation if the plane of polarization is turned through 13.2° traversing a length of 20 cm of 10% sugar solution.

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100. A certain length of 50% solution produces an optical rotation of 20°. How much length of 10% solution of the same substance will produce a rotation of 30°

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101. For a given wavelength one mm of the quartz cur perpendicular to the optic axis rotates the plane of polarisation by 18°. Find for what tichness will no light of this wavelwength be transmitted, when the quartz pices is interpsoed between the pair of pariallel nicols.

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102. A 200 mm long tube containing 48 cm^3 of sugar solution produces an optical rotation of 11° when placed in a suucharimeter.

If the specific rotation of sugar is 66° calculate the quantity of sugar contained in the solution of the tube.

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Exercise

1. On putting a polarimeter tube 25cm long comtaining sugar solution of unknown strength, the plane of polarisation gets rotated through 10°. Find the strength of sugar solution I ngcm^{-3} specific rotation of sugar is $60\,\%\,(\circ)/\text{decimeter}/\text{unit concenteration}.$

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2. Calculate the thickness of quartz plate cut with its faces perpendicular to the optic axis, which will produce the same rotation as that of a 0.1m long solution of concentration $400kgm^{-3}$. Given

specific rotation of quartz $380 radm^{-1}$ and that of sugar rad $m^{-1}m^3$.

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Problems From Competitive Examination

1. Two sources of intensity I and 4 are used in an interference experiment. Find the intensity at point where the waves from two sources superimpose with a phase difference (i) zero (ii) $\pi/2$ and (iii) π.

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2. A narrow monochromatic beam of light of intensity I is incident on a glass plate. Another identical glass plate is kept close to the first one and parallel to it. Each plate reflects 25% of the incident light

and transmits the remaining. Calculate the ratio of minimum and maximum intensity in the interference pattern fromed by two beams obtained after reflection from each plate.

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3. In a ratio slit experiment with monochromatic light, fringses are obtained on a screen placed at some distance from the slits. If the screen is moved $5 \times 10^{-2} m$ towards the slits, the change in fringe width is 3×10^{-5}. If the distance. Between the slits is $10^{-3} m$, calculate the wavelength of the light used.

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4. In a Yong's double-slit experiment, the separration between slits is 2×10^{-3}m whereas the distance of screen from the slits is 2.5m. A light of wavelength in the range of 2000-8000Å is allowed to fall on

the slits. Find the wavelength length in the visisble region that will be present on the screen at 10^{-3}m, from the central maximum. Also find the wavelength that will that will be present at that point of screen in the infrarred as awil as in the ultraviolet region.

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5. 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?

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6. A double slit arrangement produces interference fringes for sodium light $(\lambda = 5890\text{Å})$ that are 0.40° apart. What is the angular fringe separation if the entire arrangement is immersed in water?

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7. The interference fringes for sodium light $(\lambda = 5890\text{Å})$ in a double slit experiment have an angular width of 0.2°. For what wavelength will width be $10\,\%$ greater.

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8. A two slit Young's interference is done with monochromatic light of wavelength 6000Å. The slites ar e2mm apart and fringes are observed on a screen placed 10cm away fromm the slits and it is found that the interference pattern shifts by 5mm, when a transparent plate of thickness 0.5mm is introduced in the path of one of slits. What is the refractive index of the transparent plate?

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9. A double slit apparatus is immersed in a liquid of refractive index 1.33. It has slit and the screen 1 mm. The slits are illuminated by a parallel beam of light whose wavelength in air is 6300Å

a. calculate the fringe width.

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

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10. In a Young's experimenttje upper slit is covered by a thin glass plate of refractive index. 1.4 while the lower slit is covered with another glass plate, having the same thickness as the first one but having refravtive index 1.7. Interference pattern is observed using light of wavelength 5400Å. It is found that the point P on the sreen where the central where the central maximum (n=0) fell before the glass plates were inserted now has 3/4 the original intensity. It is

further observed that what used to be the fifth maximum earlie, lies shown the point P while the sixth minimum lies above P. Calculate the thickness of glass plate. (Absorption of light by a glass may be neglected).

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11. In a Young's interference experimental arrangement, the incident yellow light is composed of twpo wavelength 5890Å. The distance between of the two slits is $10^{-3}m$ and screen is placed 1m away. Upto what order can frings be seen on the screen and how far from the centre of the screen does this occur?

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12. In young,s double slit experience monochromatic light, the frings pattern shifts by a certain distance on the screen when a mica sheet

of refractive index 1.6 and thickness 1.964 microns is introduced in the path of one of the interfering waves. The mica sheet is then sheet is then removed and the distance between the slits and the screen is doubled. It is found that now the distance between succesive maximum (or minimum) is the same as the observed fringe-shift upon the introduction o fthe mica sheet. Calculate the wavelength of the monochromatic light used in the experiment.

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13. Monochromatic light of $lamba = 5000\text{Å}$ is incident on two slits separately by a distance of $5 \times 10^{-4}m$. The interference patteren is seen on a screen placed at a distance of 1m form the slits. A thing glass plate of thicknes $1.5 \times 10^{-6}m$ 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 density there is I_0 in the absence of the plate. Also find the lateral shift of the central maximum. '

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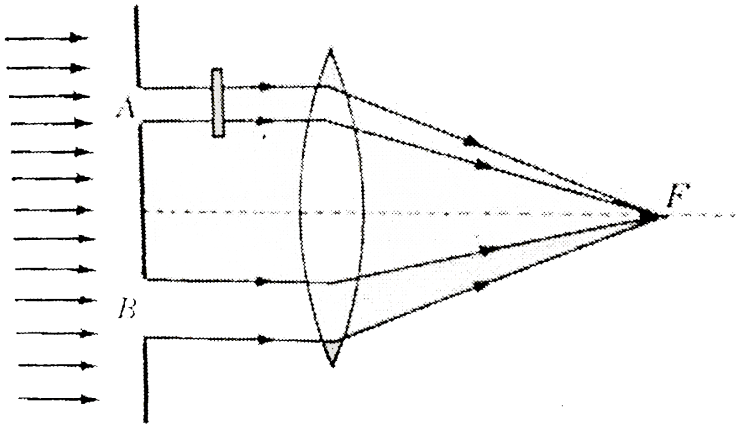
14. In a modified Young's double slit experiment a monochromatic uniform and parallel beam of light of wave length 6000Å and intensity $\left(\frac{10}{\pi}\right) Wm^{-2}$ is incident normally on two circular apertures A and B of radii 20009Å and refractive index 1.5 for the wavelength of 6000Å is placed in front of aperture. A. Calculate the power (in watt) received at the focal spot F of the lens. The lens is symmertrically placed with respect to the apertures. Assume that 10% of the power received by each aperture goes in the originally direction and is brought to the focal spot.



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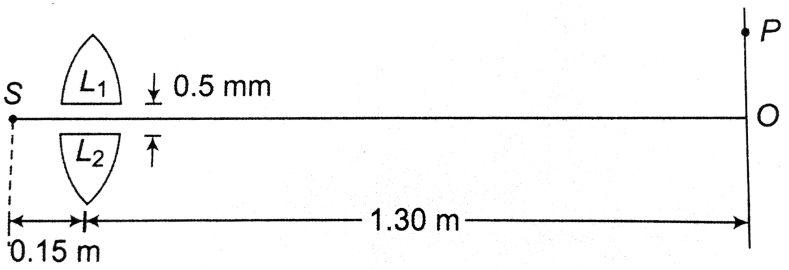
15. In figure S is a monochromatic point source emitting light of wavelength $\lambda = 500nm$. A thin lens of circular shape and focal length $0.10m$ is cut into two identical halves L_1 and L_2 by a plane passing through a doameter. The two halves are placed symmetrically about the central axis SO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

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

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



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16. 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

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17. 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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18. The limits of the visible spectrum are 4000Å to 7000Å. Show that the violet of the thrid order visible spectrum overlaps the red of the second order spectrum produced by a plane diffraction grating having 15,000 lines per inch, when visible light is incident normally on the granting.

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19. The wavelength of light coming from a distant galaxy is found to be $0.5\,\%$ more than that coming from a source on earth. Calculate the velocity of galaxy.

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20. An astronaut is approaching the moon. He sends a ratio signal of frequency $5 \times 10^9 Hz$ and find that the frequency shift in echo received is $10^3 Hz$. Find his speed of approach.

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

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22. 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 ?

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23. A beam of plane polarised falls normally on a polariser (cross section area $3 \times 10^{-4},^{2}$) Find the energy of light pssing through the polariser per revolution and the intensisty of the emergent beam if the flux of energy of the incident ray is $10^{-3}W$.

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Based On Wave Nature Of Light

1. The speed of the yellow light in a certain liquid is$2.4 \times 108ms^{-1}$. Find the refractive index of the liquid.

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2. The wavelength range of the light that is visible to an average human being is 400 nm to 700 nm . What is the frequency range of this visile light ?

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3. The wavelength of red light in air is 7890 Å . What is the wavelength in glass $(\mu = 1.5)$?

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4. Light travels a certain distance in water in 3μ s . How much time it would take for light for travel the same distance in air ? Refractive index of water = 4/3.

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5. Red light of wavelength $750nm$ enters a glass plate of refractive index 1.5. If velocity of light in vacuum is $3 \times 10^8 m/s$, calculate velocity, wavelength and frequency of light in glass.

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6. A ray of light of frequency 5×10^{14} Hz is passed through a liquid . The wavelength of light measured inside the liquid is found to be 450 nm . Calculate (i) wavelength of light in vacuum (ii) refractive index of liquid (iii) velocity of light in the liquid . Take velocity of light in vacuum as $3 \times 10^8 ms^{-1}$

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7. Absolute refractive indices of glass and water are $3/2$ and $4/3$. The ratio of velocity of light in glass and water will be

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8. The refractive index of glass with respect to water is 1.125 . If the speed of light in water is $2.25 \times 10^8 ms^{-1}$, what is the speed of light in glass ?

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9. What is the speed of light in glass of refractive index 1.5 ? Given speed of light in water is $2.25 \times 10^8 m/s$ and refractive index of water is 1.3.

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10. The ratio of the thickness of the strips of two transparent media A and B is $3:2$, if light takes the same time in passing through both of them , then what is the refractive index of B with respect to A ?

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11. The speed of light in air is $3 \times 10^8 ms^{-1}$. If refractive index of glass is 1.5 , find the time taken by light to travel a distance of 10 cm in glass .

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12. A light wave has a frequency of $5 \times 10^{14} Hz$. Find the difference in its wavelenghts in alcohol of refractive index 1.35 and glass of refractive index 1.5.

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Based On Young S Double Slit Experiment

1. In a Young's experiment , the slits are 1.5 m from the screen . The width of the fringes observed with light of wavelength 6000 Å is 1.0 nm . What is the separation of the slits .

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

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3. In Young's experiment , the distance of the screen from the two slits is 1.0 m . When a light of wavelength 6000 Å is allowed to fall on the slits , the width of the fringes obtained on the screen is 2.0 mm .

Determine (a) the distance between the two slits and (b) the width of fringe if the wavelength of the incident light is 4800 Å.

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4. In Young's double slit experiment , the distance between double slit and the screen is 1 m . If the distance between two slits is 5 mm , the separation of successive maxima is found to be 0.1092 mm , calculate the wavelength of light used .

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5. The two parallel slits used for Young's interference experiment are 0.5 mm apart . The screen on which fringes are projected is 1.5 m from the slits . How far is the third dark fringe from the central bright one ? Wavelength of light used is 6000 Å.

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6. In Young's experiment , two slits are 15×10^{-5} m apart . The interference fringes are obtained on a screen 0.75 m away . The third dark band is 55×10^{-4} m from the central fringe , find the wavelength of light used . How far is the first bright band from the centre ?

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7. The two slits in Young's double slit experiment are separated by a distance of 0.03 mm. An interference pattern is produced on a screen 1.5 m away. The 4th bright fringe is at a distance of 1 cm from the central maximum. Calculate the wavelength of light used.

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8. In YDSE, light of wavelength 5000Å is used. The third bright band on the screen is formed at a distance of $1cm$ from the central bright band. If the screen is at a distance of $1.5m$ from the centre of narrow slits, calculate the separation between the slits.

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9. In a Young's double slit experiment the distance between the slits and the screen is 1.60 m . Using light of wavelength 6×10^{-7} m, the distance between the centre of the interference pattern and fourth bright fringe on either side is 16 mm . calculate the slit separation .

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10. In a Young's double-slit experiment , the slits are separated by 0.28 mm and screen is placed 1.4 m away . The distance between the

central bright fringe and the fourth bright fringe is measured to be 1.2 cm . Determine the wavelength of light used in the experiment .

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11. In Young's experiment , the fringe width of the fringes with light of wavelength 6000 Å is 2.0 mm . What will be the fringe width if the entire apparatus is immersed in a liquid of refractive index 1.33 ?

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12. In Young's double slit experiment , red light of wavelength 620 nm is used and the two slits are 0.3 mm apart . Interference fringes are observed on a screen 1.3 mm apart . Calculate (i) the distance of slits from the screen and (ii) the fringe width if this distance is doubled .

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13. When two narrow slits separated by a small distance are illuminated by a light of wavelength 5×10^{-7} m , interference fringes of width 0.5 mm are obtained on a screen . What should be the wavelength of light source to obtain fringes 0.3 mm wide , if the distance between the screen and the slits is reduced to half of the initial value .

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14. In Young's experiment, two coherent sources are $1.5mm$ apart and the fringes are obtained at a distance of $2.5m$ from them. If the sources produce light of wavelength $589.3nm$, find the number of fringes in the interference pattern, which is $4.9 \times 10^{-3}m$ long.

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15. In a Young's double slit experiment , the interference fringes are obtained on screen 0.75 m apart . The third dark band is at a distance of 5.5 mm from the central fringes (i) Determine the wavelength of light used if the two slits are 0.15 mm apart , (ii) What will be the wavelength of light used if the entire apparatus is immersed in a liquid of refractive index 4/3 ?

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16. In Young's experiment, interference pattern is obtained on a screen at a distance of $1m$ from slits separated by $0.05cm$ and illuminated by sodium light of wavelength 5893Å. Calculate distance between $4th$ bright fringe on one side and 3rd bright fringe on other side of central bright fringe.

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17. Among two interfering sources, let A be ahead in phase by 54° relative to B. If the observations be taken from point P, such that $PB - PA = 1.5\lambda$, deduce the phase difference between the waves from A and B reaching P.

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18. In Young's experiment, what will be the phase difference and the path difference between the light waves reaching (i) third bright fringe and (ii) third dark fringe from the central fringe. Take $\lambda = 5000\text{Å}$.

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19. In a Young's double slit interference pattern at a point , we observe the 10th bright fringe (order maxima) for wavelength 7000 Å

. What order maxima will be visible if the source of light is replaced by light of wavelength 5000 Å?

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20. In Young's double slit experiment , light waves of $\lambda = 5.4 \times 10^2$ nm and $\lambda = 6.85 \times 10^1$ nm are used in turn , keeping the same geometry of the set up . Calculate the ratio of the fringe widths in the two cases .

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21. A Young's double slit apparatus has slits separated by 0.28 mm and a screen 48 cm away from the slits. The whole apparatus is immersed in water and the slits are illuminated by the red light ($\lambda = 700$ nm in vacuum). Find the fringe-width of the pattern formed on the screen.

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22. White light is passed through a double slit and interference pattern is observed on a secreen 2.5 m away. The separation between the slits is 0.5 mm. The first violet and red frings are formed 2.0 mm and 3.5 mm away from the central white fringe. Calculate the wavelegths of the violet and the red light.

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Based On Lloyd S Mirror And Fresnel Biprism

1. In Lloyd's single mirror interference experiment, the source slit is at a distance of 2 mm from the plane mirror . The screen is kept at a distance of 1.5m from the source . If light of wavelength 5890 Å is used, calculate the fringe width.

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2. In Lloyd's mirror interference experiment the source slit is at a distance of 2 mm from a plane mirror . The interference fringes , observed on a screen at a distance of 1.5 m from the slit , have a separation of 0.221 mm . Calculate the wavelength of light used .

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3. A source of light of wavelength 5000 Å is placed at one end of table 2 m long and 5 mm above its flat polished metal top. Find the fringe width of the interference bands are located on a screen at the end of the table .

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4. In a Lloyd's experiment , the path difference between the direct and reflected beam of light for the 8th maxima fringe was observed

to be 0.23 mm . Find the wavelength of light used .

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5. A Fresnel's biprism is placed at a distance of 30 cm in front of a narrow slit illuminated by a monochromatic light . The virtual images formed by the prism are 0.30 cm apart . When the screen is placed at 120 cm from the biprism , the fringe width found to be 0.235 mm . find the wavelength of light used .

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6. In a biprism experiment , the two virtual sources are 0.4 mm apart and the eyepiece is 1.25 mm away from the slit . If the wavelength of light used in 8000 Å , calculate the distance of (i) 8th bright band and (ii) 11th dark band from the central bright band

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7. In a biprism experiment , a monochromatic light of wavelength 6×10^{-7} m is used . The distance between the slit and the prism is 10 cm and that between the biprism and the eyepiece is 65 cm . If the distance between two consecutive dark bands is 0.03 m . calculate the distance between the two virtual images of the slits .

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8. In a biprism experiment , the two virtual images of the slit is 1.2 mm and the wavelength of light used in 4000 Å . If the distance of the 3rd bright band from the central bright band is 1 mm and the distance between the biprism and the focal plane of the eyepiece is 0.9 m , find the distance between the slit and the biprism .

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9. In a biprism experiment , the path length of the one of the interfering beams is increased by 25×10^{-4} mm . As a result , the central bright fringe shifts to the position perviously occupied by 5th bright band . Calculate the wavelength of light used .

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10. A narrow slit , illuminated by a monochromatic source of wavelength 5896×10^{-10} m is placed at a distance of 5 cm from a biprism . The virtual images formed by the biprism are 1 mm apart . Find the fringe-width on a screen placed 95 cm in front of the biprism .

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11. In a biprism experiment , the distance of the 15 th bright band from the centre of the interference pattern is 6 mm . Calculate the

distance of the 25th bright band and 31st dark band .

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Based On Intensity Distribution In Interference Pattern

1. The two slits in Young's experiment have widths in a rations $100:1$. Find the ratio of light intensity at the maxima and minima in the interference pattern .

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2. The ratio of intensity at maxima and minima is $25:16$. What will be the ratio of the width of the two slits in Young's double slit experiment ?

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3. Two coherent sources whose intensity ratio $81:1$ produce interference fringes . Calculate the ratio of intensity of maxima and minima in the fringe system .

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4. Two slits in Young's interference experiment have widths in the ratio $1:16$. Deduce the ratio of intensity at maxima and minima .

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

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6. Two coherent monochromatic light beam of intensities I and 4I are supposed. What will be the maximum and minimum possible intensities.

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7. the width of the one of the two sites in a Young's double slit experiment is double of the other slit. Assuming that the amplitude of the loight coming from a slit is propotional to the slit width, find the ratio of the maximum to the minimum intensity in the interference pattern.

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8. Two light waves superposing at the midpoint of the screen are coming from coherent sources of light of phase difference 3π radian.

Their amplitudes are 1 cm. What will be the resultant amplitude at the given point.

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9. Monochromatic light of wavelength 600 nm is used in a Young's double slit experiment. One of the slits is covered by a transperent sheet of thickness 1.8×10^{-5}m made of a material refrective index 1.6. How many fringes will shift due to the introduction of the sheet ?

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10. Find the thickness of a plate which will produce a change in opticle path equal to half the wavelength λ of the light passing through it normally. The refractive index of the plate is μ.

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11. In Fresnel's Biprism experiment, on inserting a thin plate of glass in the path of one of the interfering beames, it is found that the central bright fringe shifts into the position perviously occupied by the 6th bright fringe. If ther wavelength of the light used is 6×10^{-5} cm and the refractive index of glass plate is 1.5 for the wavelength, calculate thethickness of the plate.

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12. A transparent paper (μ=1.45) of thickness 0.023 mm is pasted on one of the sdlits of a Young's double slit experiment which uses monochromatic light of wavelength 620 nm. How many fringes will cross the centre if the paper is removed ?

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13. A glass plate of 1.2×10^{-6}m thickness is placed in the path of one of the interfering beams in a biprism arrangement using monochromatic light of wavelength 6000 Å. If the central bands shifts by a distance equal to the width of the bands, find the refractive index of glass

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14. A soap film of 5×10^{-15}cm thick is viewed at an angle of 35° to the normal. Find the wavelength of light in the visible spectrum which will be absent from reflected light $(\mu = 1.3)$. Given wavelength range of the visible spectrum is 3900 Å to 7800 Å.

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15. A thin film of thickness 4×10^{-5} cm and μ=1.5 is iluminated by white light incident normal to its surface. What wavelength in the

visible range be intensified in the reflected beam ?

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16. In a thin film between two points A and B, eight fringes are observed with light of wavelength 5461 Å. How many fringes will be observed between the same two points A and B if the wavelength of the light used is 6500 Å.

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17. With a thin air film between two points, 6 fringes appear when light of wavelength 5890 Å is used. Calculate the difference in the thickness of the film between the two points.

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18. White light is incident normally on a plane parallel thin film of μ=1.5. Find the minimum thickness of the film for which light of λ =4000 Å is absent from the reflected light

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19. White light is incident on a soap film at an angle of $\sin^{-1}\frac{4}{5}$ and the reflected light on examination by the spectroscope shows dark bands. The consecutive dark bands corresponds to wavelength 6100 Å and 6000 Å. If the refractive index of the film is 4/3, calculate its thickness.

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20. A soap film of refractive index 4/3 and thickness 1.5×10^{-4}cm is illuminated by white light incident at angle 45°. The reflected light is examined by a spectroscope in which a dark band corresponding to

the wavelength 5×10^{-5} cm is found. Find the order of the interference band

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21. A parallel beam of sodium light of wavelength 5896 Å is incident at angle 30°. Find the minimum thickness of the glass plate for which the transmitted beam appears to be dark.

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22. A soap bubble of μ=4/3 is illuminated by white light incident at an angle of 30°. The transmittedlight is examined by a spectroscope and bright band is found for a wavelength of 6000 Å. Find the thickness of the film.

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23. Microwaves of frequency 24,000 MHz are incident normally on a rectengular on a rectangular slit of width 5 cm. Calculate the angular spread of the central maximum of the diffraction pattern of the slit.

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24. A slit 4.0 cm wide is irradiated with microwaves od wavelengths 2.0 cm. Find the angular spread of the central maximum, assuming incidence normal to the plane of the slit.

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25. A screen is placed 2 m away from a single narrow slit which is illuminated by the light of wavelength 6×10^{-7}m. If the first minimum lies 4 mm on either side of the central maximum, find the width of the slit.

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26. The light of wavelength 600 nm is incident normally on a slit of width 3 mm. Calculate the linear width of central maximum on a screen kept m awy from the slit.

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27. A slit of width 'd' is illuminuted by red light of wavelength 6500 Å. For what value of 'd' will (i) the fiirst minimum fall at an angle of defraction of 30° and (ii) the first maximum fall at an angle of diffraction of 30°.

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28. a 0.02 m wide slit is illumijnated at normal incidence by light of wavelength 6000 Å (i) Find the width of the central maximum band

on the screen placed 1 m awayb from the slit. (ii) What should br the fringe width if the appratus Is impressed in water whose refractive index is 4/3?

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29. A parallel beam of light of wave length 6×10^{-7}m falls normally on a straight slit of width 0.2 mm. Find the totalk angular width of the central diffraction maximum and also its linear width as observed on a screen placed 2 m away.

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30. A Franhoffer diffraction pattern due to a single slit of width 0.2 mm is being obtained on a screen placed at a distance of 2 m from the slit. The first minima lie at 5mm in either side of the centre maximum on the screen. Find the wavelength of the light used .

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31. A parralel beam of monochromatic light of wavelength 5000 Å is incident normally in a narrow slit of width 0.25 mm. The diffraction pattern is observed on a screen placed at a focal lens of a convex lens placed closed to the slit between slit and screen. Find the angular seperatiion between the first secondary maxima on either side of the central maximum.

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32. A beam of light of wavelength 590 nm is focused by a convex lens of diameter 10 cm at a distance of 20 cm from it. Find the diameter of the disc image formed.

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33. A laser beam has a wavelength of 6×10^{-7}m and aperture of 6×10^{-2}m. The beam is sent towards the moon which is at a distance of 4×10^{8}m from the earth. Calculate (i) angular spread of the beam and (ii) the arel spread when it reaches the moon.

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34. A laser beam has a power of 100 mW. It has an aperture of 5×10^{-3}m and emits a wavelength 6943 Å. The beam is focused with a lens of focal length 0.1 m. Calculate the areal spread and intensity of the image.

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35. The width of an aperture is 4 mm and wavelength is 5000 Å. Calculate the distance upto which ray optics is valid.

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36. For what distance is ray optics a good approximation when the aperature is 3 mm wide and the wavelength 500 nm.

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37. Two tower are built on the hill 50 Km apart and then joining them passes 30 m above a hill halfway in between. What is the longest wavelength of radiowaves which can be sent between the toers without serious diffraction effects ?

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38. A diffraction has 5000 lines per cm. What is its grating element ?

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39. A parallel beam of monochromatic light is incident normally on a plane transmision grating having 5000 lines per cm and the second order spectral ,ine is found to be diffracted through 30°. Calculate the wavelength of light used.

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40. Sodium light of wavelength 5890 Å is incident normally on a diffraction grating of 5000 rulings per cm. Find the angle of diffraction for the second order.

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41. The angle of diffraction of the second order maximum of wavelength 5×10^{-5} cm is 30° in the case of a plane transmission grating. How many lines are there in 1 cm of the grating surface.

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42. How many orders will be visible if the wavelength of the incident radiation is 5000 Å and the number of lines on the grating is 101319 per metre.

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43. In a grating experiment red line of wavelength 7000×10^{-10}m in the third order coincides with violet line in the fifth order. What is the wavelength of the voilet line?

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44. A parallel beam of white light is incident normally on a diffraction grating having 6000 lines per cm. Calculate the angular separation of red and viotet lights to be 7×10^{-7} m and 4×10^{-4} m respectively.

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45. A plane tansmission grating 6000 lines per cm is used to obtain a spectrum of light from a sodium lamp in the second order.Find the angular separation between two sodium line s whose wavelengths are 5890Å and 5896Å ,respectively.

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46. If yellow light of 5890Å is incident on a grating that has 850 lines per mm. what will be the angle between both the first order images?

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47. Light froma galaxy, having wavelength of 6000 Å , if found to be shifted towards red by 50 Å . Calculate the velocity of recession fo the galaxy.

View Text Solution

48. The spectral line of $\lambda = 5000\text{Å}$ in the light coming from a distant star is observed at 5200 Å . Determine the recession velocity of the star.

View Text Solution

49. The spectral line in the spectrum of light from a star is found to be shifted by 0.032% from its normal position towards the red end of the spectrum . Compute the velocity of the star.

View Text Solution

50. An astronaut approaching the moon sends a radio signal of frequency 5×10^3 MHz towards moon to find the speed of his rocket

. The frequency of waves reflected back from the moon to find the speed of his rocket . The frequency .Calculate the velocity of the rocket relative to the moon.

View Text Solution

51. A star is moving away from an observer with a speed of $500 kms^{-1}$ .Calculate the Doppler shift if the wavelength of light emitted by the star is 6000Å.

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52. A star is moving towards the earth with a speed of $9.0 \times 10^{6} ms^{-1}$. If the wavelength of a particular spectral line emitted by it si 6000 Å , then find the apparent wavelength.

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53. Unplarised light falls on two polarising sheets placed one on the top of the other what must be the angle between the characteristic directions of the sheets if the intensity of the transmitted light is (a) one-third of the maximum intensity of the transmitted beam (b) one third of the intensity of the incident beam.

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

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55. When a polariser and analyser have their axes inclined to one another at 30° , the amount of light transmitted is 5 SI units. What is

the maximum intensity of light transmitted and at what angle between the two?

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56. The intensity of a light- beam is 10 Wm^{-2} and it is plane-polarised in vertical direction. It passes through a polaroid whose transmission axis is inclined at angle of 30° with the vertical. The transmitteed light- beam passes through a second polaroid whose transmission-axis is inclined at an angle of 90° with the vertical. (i) What will be the intesity of light emerging from the second polaroid? (ii) If the first polaroid is removed, then?

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57. Four polaroids are so placed that the transmission-axis of each is inclined at an angle of 30° from the axis of the previous polaroid in

the same direction. If unpolarised light-beam of intensity I_0 falls on the first, polaroid, then what will be the intensity of the light emerging from the last polaroid?

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58. Find the Brewstar angle for air-water surface for yellow light. Refractive index of water for yellow light =1.33

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59. A ray of light strikes a glass plate at an angle of incidence 57° . If the reflected and refracted rays are perpendicular to each other, what is the refractive index of glass.

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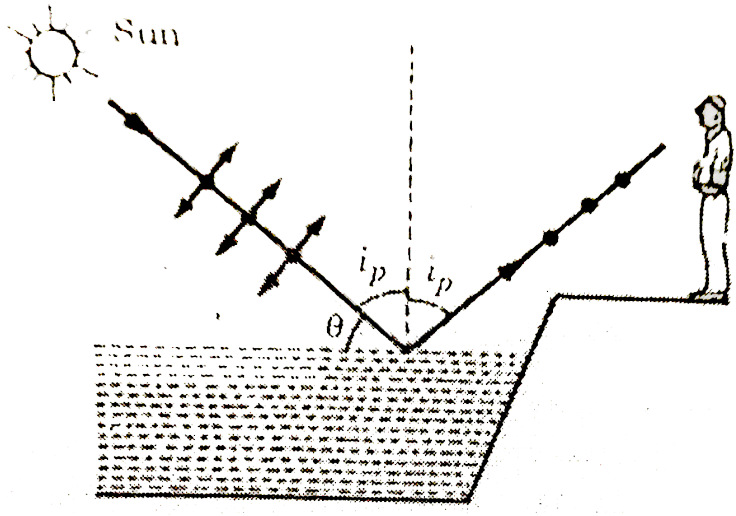
60. In Fig. 16.13, at what angle θ above the horizon should the sun be situated so that its light reflected from the surface of still water of the pond be totally polarised? Given: refractive index of water $\mu = 1.327$ and $\tan 53^\circ = 1.327$.



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61. When sunlight is incident on water at an angle of 53°, the reflected light is found to be completely plane-polarised. Determine (i) angle of refraction of light and (ii) refractive index of water.

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62. The polarising angle for a medium is 60°. Determine (i) the refraction index of the medium and (ii) the refracting angle.

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63. A ray of light is incident on a transparent plate of a material of refractive index $\sqrt{3}$ at the polarising angle. Find the angle of refraction.

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64. A ray of light is incident on a glass plate of refractive index 1.54. If the reflected ray is completely plane polarised, find (i) angle of incidence (ii) angle of refraction and (iii) crictical angle. Given $\tan 57^\circ = 1.54$ and $\sin 40.5^\circ$=0.6493.

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65. Yellow light is incident on a smooth surface of a block of dense flint glass for which the refractive index is 1.6640. Find the polarising angle and the angle of refraction.

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66. A beam of light travelling in water falls on a glass plate immersed in water. When the incident angle is 51°, the reflected beam of light is found to be completely plane polarised. Determine the refractive index of glass. Given refractive idex of water =4/3.

View Text Solution

67. The critical angle of a for a medium is 45°. What is its polarising angle.

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68. The critical angle for a certain wavelength of light is glass is 40°. Calculate the polarising angle and the angle of refraction in glass corresponding to it.

View Text Solution

69. A clear crystal has a critical angle of 24.4° for green light. What is the polaring angle of incidence ?

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70. Calculate the thickness of a quarter-wave plate of quartx for sodium light. Given $\mu_0 = 1.54425$ and $\mu_E = 1.55336$.

View Text Solution

71. Plane polarised light is inciden on a piece of quartz cut parallel to the axis Find the least thickness for which the O and E-rays suffer a phase change of $\pi/2$. Given $\mu = 1.5442$ and $\mu_E = 1.5533$ and $\lambda = 5 \times 10^{-7} m$.

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72. Plane polarised light is inciden on a piece of quartz cut parallel to the axis Find the least thickness for which the O and E-rays suffer a phase change of $\pi/2$. Given $\mu = 1.5442$ and $\mu_E = 1.5533$ and $\lambda = 5 \times 10^{-7} m$.

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73. A quartz plate is a half wve plate for light whose wave length. Is λ. Assuming that the variations is the indices of refraction with wavelength can be neglected, how would this behave with repsect to light of wavelengt $\lambda = 2\lambda$.

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74. Calculate the specific rotation of sugar solution from the following data:

length of the polaimeter tueb=0.21

concentration of sugar solution =$80kgm^{-3}$

angle of rotation =10°

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75. Calculate the amount of sugar dissolved in $10^{-3}m^3$ of water so as to produce ratation of plane of polarisation of 12°. Given the specific rotation of sugar solution is$0.01radm^{-1}kg^{-1}m^3$ and length of polarimeter tube is 0.21m

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76. A 22cm long tube containing 88cc of sugar produces an optical rotation of 9.9° when placed in a polarimeter. If the amount of sugar in the solution is 6g, calculation the specific rotation.

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77. A 0.12kg of impure sugar is dissolved in water and solution is mad eupto $8 \times 10^{-4}m^3$. A length of 20cm of this solution causes a rotation of 15°. If the specific rotation of sugar is $60 \times 10^\circ deg/decimetrekg$m^(-3)`, what is the purity of sugar?

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78. A solution of camphor in alcohol in a tube 20cm long is found to effect a rotation of the plane of viberation of light passing is of 33°. What must be the indentify of camphor in g/cm^2 in solution? The specific rotation of camphor is $+54^\circ$.

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79. A plate of crystal quartz is cut with its faces perpendicular to the optic axis. It is found that this plane exactly annuls the rotation of the plane of polarisation of sodium light produced by a 30 cm length of a 18° solution of lactose. Calculate the thickness of the quartz plate. Given 's' for lactose = 5253°, $1mmofquartxrotatsthepla \neq ofpolarisationofsodiumlightby$ 21.71^(@)`.

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80. A polarimeter tube of length 0.21m contains sugar solution of specific rotation 0.01 rad $m^{-1}kg^{-1}m^3$ concentration. If the produced is 36°, calculate the concentration of the solution. The solution is the tube is poured into a clean beaker and equal amount of water id added to it. The tube is then filled with the diluted solution. Calculate the angle of rotation produced.

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