PHYSICS

AAKASH INSTITUTE ENGLISH

WAVE OPTICS

Solved Example

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

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2. Yellow light with wavefront 0.5μm is air surface refraction in a medium in which velocity of light is $2 \times 10^{-8} m/s$. Then the wavelength of the light in the medium would be .

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3. With what speed should a star move with respect to us so that the beam at wavelength 460.0 nm is observed at 460.8 nm.

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4. A galaxy moving with speed 300km/s shows blue shift. At what wavelength sodium line at 589.0 nm will be observed ?

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5. 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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6. 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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7. 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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8. Two slits in YDSE are placed 2 millimeter from each other. Interference pattern is observed on 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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9. Two slits in YDSE are placed 2 millimeter from each other. Interference pattern is observed on 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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10. 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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11. 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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12. 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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13. In YDSE, the slits are separated 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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14. 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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15. A parallel beam of monochromatic light of wavelength 450 nm 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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16. 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 the slit.

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17. In YDSE , what should be the width of each slit to obtain 20 maxima of the double slit pattern within the central maximum of the single slit pattern ? (d=1mm)

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18. What is the approximate radius of the central bright differaction spot of light of wavelength $\lambda = 0.5\mu m$, if focal length of the lens is 20 cm and radius of aperture of the lens is 5 cm ?

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19. A light of wavelength, 5000Å is coming from a distant star. What is the limit of resolution of a telescope whose objective has a diameter of 200 cm ?

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20. Which light would produce more resolution the red light or the blue one ?

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

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22. 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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23. A plane polarized light with intensity I_0 is incident on a polaroid with Electric Field vector making an angle of 60° with transmission axis of polaroid. The intensity of the resulting light will be

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24. An unpolarized light is successively throgh two polaroids, each with their transmission axis parallel. If the intensity of unpolarized light be l_0, then intesity of the light after emerging from second polarizer will be

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25. Monochromatic light of wavelength of 600 nm is used in YDSE. One of the slits is covered by a transparent sheet of thickness $1.8 \times 10^{-5} m$ made of a material of refractive index 1.6. How may fringe will shift due to the introduction of the sheet?

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26. A thin sheet of glass $(\mu = 1.520)$ is introduced normally in the path of one of the two interfering waves. The central bright fringe is observed to shift to position originally occupied by the fifth bright fringe. If $\lambda = 5890\text{Å}$. Find the thickness of the glass sheet.

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

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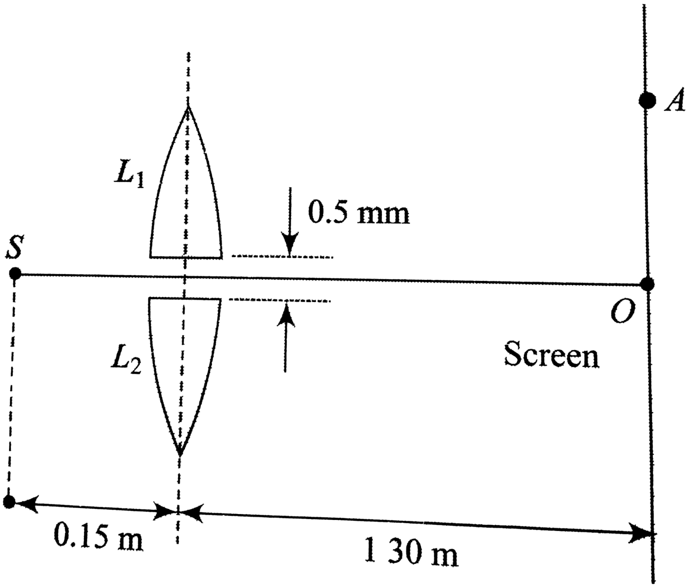
28. In figure S is a monochromatic point source emitting light of wavelength $\lambda = 500 nm$ A thin lens of circular shape and focal length 0.10 m is cut into two identical havles L_1 and L_2 a plane passing through a diameter. The two havles are placed symmetrically about the central axis SO with a gap of 0.5 mm. The distance along the axis from S TOL_1 and L_2 is 0.15 m. The screen at O is normal to SO.

a. If the third intensity maximum occurs at point A on the screen, find the distance OA.

b. If the gap between, L_1 and L_2 is reduced from its original value of 0.5 mm, will the distance OA increase, decrease, or remain the same ?



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Try Yourself

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

(a) light diverging from point source.

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

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

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2. Which of the following prediction of corpuscular theory was proved wrong by Huygens' wave model ?

A. Frequncy of the wave remains same during refraction

B. speed of the light increases in denser medium

C. Angle of of incidence is equal to angle of reflection

D. All of these

Answer: B

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3. A ray of light with wavelength 5000 nm travelling from a medium with refractive index $\left(\frac{3}{2}\right)$ suffers partial reflection and refraction in a medium of refractive index $\left(\frac{4}{3}\right)$. Find wavelength of reflected and refracted ray.

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4. A 6000 Å H_β line emitted by hydrogen in a star is observed to be red shifted by 10 Å. Find the speed with which star is receding away from the earth.

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5. Light emitted from a distant star is observed at frequency 5000 MHz for the star stationary with respect to us. If the star starts approaching us with speed $6 \times 10^5 m/s$. Then the observed frequency will be

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6. Two light sources with intensity I_0 each interfere in a medium where phase difference between them us $\frac{\pi}{2}$. Resultant intensity at the point would be.

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7. Two sources with intensity $9:4$ interfere in a medium. Then find the ratio of maximum to

the minimum intensity in the interference pattern.

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8. Two incoherent sources of light each with equal intensity I_0 interfere in a medium . Will any interference pattern be observed ? If no, then why ? Also what would be resultant intensity then ?

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9. Two slits in Young's double slits experiment are spaced 0.1 millimeter apart. If the fringe width is obtained as 5 mm on screen 1.5m away from slits. Find the wavelength of the light used.

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10. Find the angular fringe width in Young's double slit experiment using a monochromatic light of wavelength 500 nm when the slits are separated by 2.5 mm.

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11. What is the effect on the interference pattern in Young's double slit experiment if following operations are performed?

A. Screen is moved away from the plane of slits

B. The separation between the slits is decreased

C. The separation between the slits is increased

D. Red light is replaced by blue light

Answer:

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12. A Young's double slit experiment uses a monochromatic light of wavelength λ. The intensity of each slit is same and is equal to I_0. What will be the resultant intensity at a point where waves interfere at a path difference of $\frac{\lambda}{2}$?

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13. In a single slit differaction pattern a monochromatic light of wavelength 500nm is used if angular position of the point where waves interfere from slit is 10^{-3} radians from line of central maxima. If width of the slit is $500 \mu m$, then order of minima obtained on screen will be

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14. How much width of slit thickness 9 mm will contribute in the intensity due to single slit diffraction pattern at first maxima ?

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15. In double slit experiment what should be the width of each slit to obtain 10 maxima of the double slit pattern within the central maxima of single slit pattern with d=2 mm.

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16. Find the focal length of the lens used to focus an image of distant object on focal plane of the lens if the radius of central bright dot is $5\mu m$, when it illuminated by ray of wavelength 400 nm and the radius of the circular aperture is 2.5 cm.

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17. Assume that light of wavelength 500 nm is used to illuminate a telescope. What is the resolving power of a telescope whose objective has a radius of 200 cm ?

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18. Estimate the distance for which ray optics is good approximately for an aperture of 2mm and wavelength 500 nm.

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19. Calculate Fresnel distance for aperture of 1mm using Red light of wavelength 7000Å.

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20. How much a beam would diffract when it travels a distance of 5 m, after crossing an aperture of 3mm having wavelength 3000 Å ?

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21. An unpolarized light with intensity $2I_0$ is passed through a polaroid. The resultant intensity of the transmitted light will be

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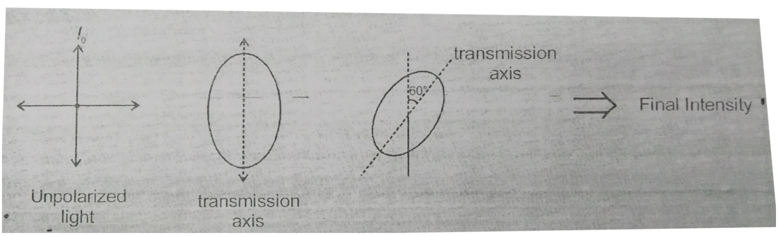
22. Unpolarized light with intensity I_0 is incident on combination of two polarizers as shown . The intensity of the light after passage through both the polaroids will be.



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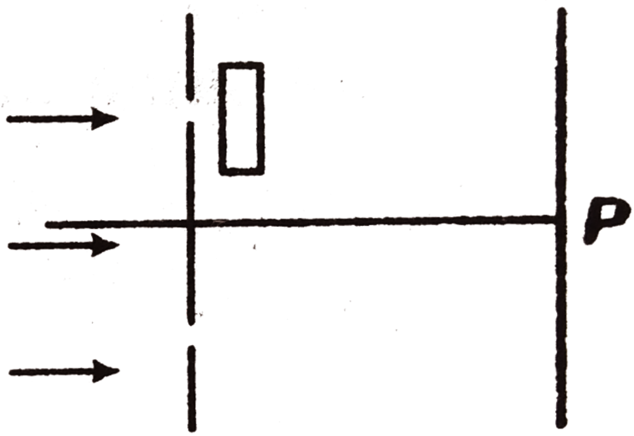
23. YDSE set up shown in figure.



A. Zero order maxima will lie above point P

B. First order maxima may lie above point P

C. First order maxima may lie below point P

D. Zero order maxima may lie at point P

Answer: 1

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24. If the lower slit has been covered by the sheet, what will be the direction of shift of the pattern?

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

Light diverging from a point source.

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

Light emerging out of a convex lens when a point source is placed at its focus.

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27. What is the shape of the wavefront on earth for sunlight ?

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28. Which of the following prediction of corpuscular theory was proved wrong by Huygens' wave model ?

A. Frequency of the wave remains same during refraction

B. Speed of the light increases to denser medium

C. Angle of incidence is equal to angle of reflection

D. All of these

Answer:

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29. A ray of light with wavelength 5000 nm travelling from a medium with refractive index $\left(\frac{3}{2}\right)$ suffers partial reflection and refraction in a medium of refractive index $\left(\frac{4}{3}\right)$. Find wavelength of reflected and refracted ray.

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30. A 6000 Å H_{β} line emitted by hydrogen in a star is observed to be red shifted by 10 Å. Find the speed with which star is receding away from the earth.

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31. Light emitted from a distant star is observed at frequency 5000 MHz for the star stationary with respect to us. If the star starts approaching us with speed $6 \times 10^5 m / s$. Then the observed frequency will be

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32. Two light sources with intensity I_0 each interfere in a medium where phase difference between them us $\frac{\pi}{2}$. Resultant intensity at the point would be.

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33. Two sources with intensity $9:4$ interfere in a medium. Then find the ratio of maximum to the minimum intensity in the interference pattern.

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34. Two incoherent sources of light each with equal intensity I_0 interfere in a medium . Will any interference pattern be observed ? If no, then why ? Also what would be resultant intensity then ?

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35. Monochromatic light of frequency $5 \times 10^{12} Hz$ travelling in vaccum enters a medium at refractive Index 15 Its wavelength in medium will be

A. 5500A

B. 6000A

C. 4000A

D. 5000A

Answer:

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36. In Young's experiment when sodium light of wavelength 5893 Å is used 62 fringes are visible in the vision -field. How many fringes will be visible if violet light of wave length 4358 Å is used ?

A. 54

B. 64

C. 74

D. 84

Answer:

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

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

B. $\dfrac{2\pi}{\lambda}(n_1L_1 - n_2L_2)$

C. $\dfrac{2\pi}{\lambda}(n_2L_1 + n_1L_2)$

D. $\dfrac{2n}{\lambda_1}\left(\dfrac{L_1}{n_1} + \dfrac{L_2}{n_2}\right)$

Answer:

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38. In YDSE the distance between the slits is 1mm and screen is 25nm away from intensities IF the wavelength of light is 6000A the fringe width on the screen is

A. 0.15mm

B. 0.30mm

C. 0.24mm

D. 0.12 mm

Answer:

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39. The path difference produced by two waves is 3.75 μm and the wavelength is 5000 Å. The point is

A. Uncertain

B. Dark

C. Partially bright

D. Bright

Answer:

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40. Two coherent monochormatic light source are located at two vertices of an equilateral trangle. If the intensity due to each of the source independently is $1Wm^{-2}$ at the third vertex. The resultant intensity due to both the sources at that point (i.e at the third vertex) is (in Wm^{-2})

A. Zero

B. $\sqrt{2}W/m^2$

C. $2W/m^2$

D. $4W/m^2$

Answer:

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41. In young's double-slit experiment , the spacing between the slits is 'd' and the wavelength of light used is 6000Å If the angular width of a fringe formed on a distance screen is 1° then calculate 'd' .

A. 1mm

B. 0.05mm

C. 0.03mm

D. 0.01mm

Answer:

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42. Two coherent sources of intensity ratio β^2 interfere. Then, the value of $(I_{\max} - I_{\min}) / (I_{\max} + I_{\min})$ is

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

B. $\sqrt{\dfrac{1+\beta}{\beta}}$

C. $\dfrac{1+\beta}{2\sqrt{\beta}}$

D. $\dfrac{2\sqrt{\beta}}{1+\beta}$

Answer:

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43. In Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index $4/3$, without disturbing the geometrical arrangement, the new fringe width will be:

A. 0.30 mm

B. 0.40 mm

C. 0.53 mm

D. 0.2 mm

Answer:

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44. In a double slit experiment to find the separation between slits by displacement method, the separations of images of slits were found to be 16mm and 9mm respectively.

The actual separation between slits will be

A. 12.5 mm

B. 12 mm

C. 3.5 mm

D. 144 mm

Answer:

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45. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 mm and refractive index 1.5 is introduced in the path of the upper beam. The location of the central maximum will:

A. Remain unshifted

B. Shift downward by nearly two fringes

C. Shift upward by nearly two fringes

D. Shift downward by ten fringes

Answer:

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

A. 0.68°

B. 0.34°

C. 2.05°

D. 6.75°

Answer:

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47. The first diffraction minimum due to single slit diffraction is θ for a light of wavelength 5000A if the width of the slit is $1 \times 10^{21} cm$ then the value of θ is

A. 30°

B. 45°

C. 60°

D. 15°

Answer:

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

A. 1.2 cm

B. 12 cm

C. 2.4 cm

D. 24 mm

Answer:

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49. In double slit experiment what should be the width of each slit to obtain 10 maxima of the double slit pattern within the central maxima of single slit pattern with d=2 mm.

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50. Find the focal length of the lens used to focus an image of distant object on focal plane of the lens if the radius of central bright dot is $5\mu m$, when it illuminated by ray of wavelength 400 nm and the radius of the circular aperture is 2.5 cm.

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51. Assume that light of wavelength 500 nm is used to illuminate a telescope. What is the resolving power of a telescope whose objective has a radius of 200 cm ?

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52. In an electron microscope the acclerating voltage is increased from 20kv to 80kv. The resolving power of the microscope will become

A. Doubled

B. Halved

C. Quadrupted

D. Tripled

Answer:

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53. We wish to see inside an atom. Assuming the atom to have a diameter of 100 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about

A. 5 KeV

B. 15 keV

C. 150 keV

D. 1.5MeV

Answer:

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54. An astronaut is looking down on earth's surface from a space shuttle at an altitude of 400 km. Assuming that the astronaut's pupil diameter is 5mn and the wavelength of visible light is 500 nm, the astronaut will be able to resolve linear objects of the size about

A. 0.5 m

B. 5 m

C. 50 m

D. 500m

Answer:

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55. The diameter of the objective lens of a telescope is $5.0m$ and wavelength of light is 6000Å. The limit of resolution of this telescope will be

A. 0.15 s

B. 0.06s

C. 0.03 s

D. 3.03s

Answer:

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56. A telescope has an objective lens of $10cm$ diameter and is situated at a distance of one kilometer feom two ovjects. The minimum dustance between these two objects. Which can be resolved by the telescope, when the mean wavelength of light is 5000Å, is of the order of

A. 0.5 m

B. 5m

C. 5mm

D. 5 cm

Answer:

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57. The working of which of the following is similar to that of a slide projector?

A. Electron microscope

B. Scanning electron microscope

C. Transmission electron microscope

D. Atomic force microscope

Answer:

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58. An unpolarized light with intensity $2I_0$ is passed through a polaroid. The resultant intensity of the transmitted light will be

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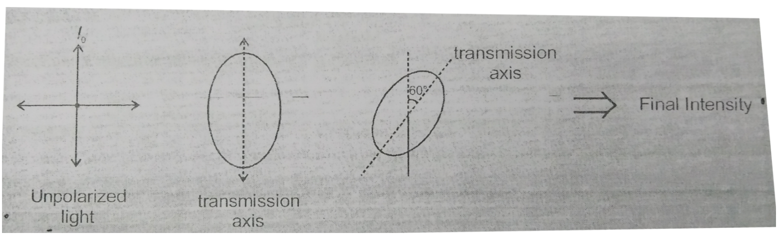
59. Unpolarized light with intensity I_0 is incident on combination of two polarizers as shown . The intensity of the light after passage through both the polaroids will be.



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60. Image of sun formed due to reflection at air water interface is found to be very highly polarised. Refractive index of water being $\mu = 4/3$, find the angle of sun above the horizon

A. 37°

B. 53°

C. 30°

D. 60°

Answer:

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61. 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 ?

A. 30°

B. 45°

C. 60°

D. 70°

Answer:

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Assignment Section A Objective Type Question One Option Is Correct

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

A. Reflection

B. interference

C. diffraction

D. Polarisation

Answer: A

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2. Two coherent source of light can be obtained by

A. Two different lamps

B. Two different lamps of different power

C. Two different lamps of same power

D. By dividing a wavefront

Answer: D

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3. The idea of secondary wavelets for the propagation of a wave was first given by

A. Newton

B. Huygens

C. Maxwell

D. Fresnel

Answer: B

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4. Two sources of waves are called coherent if

A. Both have same amplitude of vibration

B. Both produce waves of same wavelength

C. Both produce waves of the same wavelength having constant phase difference

D. Both produce waves having same velocity

Answer: C

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5. Wavefront means

A. All particles in it have same phase

B. All the particles have opposite phase of vibration

C. Few particles are in same phase, rest are in opposite phase

D. None of these

Answer: A

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6. 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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7. Two identical light waves, propagating in the same direction, have a phase difference δ. After they superpose, the intensity of the resulting wave will be proportional to

A. $\cos\delta$

B. $\cos\left(\frac{\delta}{2}\right)$

C. $\cos^2\left(\frac{\delta}{2}\right)$

D. $\cos^2 \delta$

Answer: C

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8. For constructive interference to take place between two monochromatic light waves of wavelength A, the path difference should be:

A. $\dfrac{(2n-1)\lambda}{4}$

B. $2n\lambda$

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

D. $n\lambda$

Answer: C

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9. Wavefront of a wave has direction with wave motion

A. Parallel

B. Perpendicular

C. Opposite

D. At an angle

Answer: B

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10. If the amplitude ratio of two sources producing interference is $3:5$ then 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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11. Rays diverge from a point source of a wavefront that is

A. Cylindrical

B. Spherical

C. Plane

D. Cubical

Answer: B

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12. Young's experiment establishes that

A. Light consists of waves

B. Light consits of particles

C. Light consists of neither paritcles

D. Light consists of both partices and waves

Answer: A

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13. 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 2m away is

A. 0.25mm

B. 0.1mm

C. 1.0mm

D. 0.01mm

Answer: C

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

A. 1/3 times

B. 1/9 times

C. 3 times

D. 9 times

Answer: A

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15. In young's double slit experiment, the seperation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is

A. Will not change

B. Will become half

C. Will become four times

D.

Answer: D

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16. The maximum intensity of fringes in Young's experiment is I. If one of the slit is closed, then the intensity at that place becomes I_o. Which of the following relation is true?

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17. 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. Bright

B. Dark

C. First bright then dark

D. First dark and then bright

Answer: A

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18. In Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index $4/3$, without disturbing the geometrical arrangement, the new fringe width will be:

A. 0.30 mm

B. 0.40 mm

C. 0.53mm

D. $450 \mu m$

Answer: A

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19. In YDSE, $d = 2mm, D = 2m,$ and $\lambda = 500nm$. If intensities of two slits are I_0 and $9I_0$, then find intensity at $y = \frac{1}{6}mm$.

A. $7I_0$

B. $10I_0$

C. $16I_0$

D. $4I_0$

Answer: B

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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, (λbeing the wavelength of light used). The intensity at a point where the path difference is $\lambda/4$, will be

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

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

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

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

Answer: D

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21. Two slits, 4 mm apart, are illuminated by light of wavelength 6000Å. What will be the fringe width on a screen placed 2 m from the slits

A. 0.12 mm

B. 0.3 mm

C. 3.0mm

D. 4.0mm

Answer: B

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

A. By using white light instead of monochromatic light

B. As it is narrower than other bright fringes

C. as it is wider than other brighter fringes

D. as it has a greater intensity than other bright fringes

Answer: A

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23. In a Young's double slit experiment, the source illuminating the slits is changed from blue to violet. The width of the fringes

A. Increases

B. Decreases

C. Becomes unequal

D. Remains same

Answer: B

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24. If a torch is used in place of monochromatic light in Young's experiment what will happen?

A. Fringe will appear for a moment then it will disappar

B. Fringes will appear as for monochrcmatic light

C. Only bright fringes will appear

D. No fringes will appear

Answer: D

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

A. Phase difference of 3π

B. Path difference of 3λ

C. Phase difference of $\frac{5\pi}{2}$

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

Answer: D

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26. It is believed that the universe is expanding and hence the distant stars are receding from us. Light from such a star will show

A. Shift in frequency towards longer wavelength

B. Shift in frequency towards shorter wavelength

C. No shift in frequency but a decrease in intensity

D. A shift in frequency sometimes towards longer and sometimes towards shorter wavelength

Answer: A

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27. The 6563 Ã... H_α line emitted by hydrogen in a star is found to be red-shifted by 15 Ã.... The speed with which the star is receding from the earth is

A. $17.3 \times 10^3 m/s$

B. $4.29 \times 10^7 m/s$

C. 3.39×10^5m/s

D. 2.29×10^5m/s

Answer: D

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28. In the context of Doppler effect in light, the term red shift signifies

A. Decrease in frequency

B. Increase in frequency

C. Decrease in intensity

D. Increase in intensity

Answer: A

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29. A slit of width a is illuminated by white light. The first minimum for red light $(\lambda = 6500\tilde{A}\ldots)$ will fall at $\theta = 30^{\circ}$ when a will be

A. 3250Å

B. 6.5×10^{-4}

C. $1.24\mu m$

D. 2.6×10^{-4}

Answer: C

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30. 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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31. Angular width (β) of central maximum of a diffraction pattern on a single slit does not depend upon

A. Distance between slit and source

B. Wavelength of the light used

C. Width of the slit

D. Frequency of liht used

Answer: A

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32. Red light is generally used to observe diffraction pattern from single slit. If blue light is used instead of red light, then diffraction pattern.

A. Will be more clear

B. Will contract

C. Will expand

D. Will not be visualized

Answer: B

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33. When a compact disc is illuminated by a source of white light, coloured lines are observed. This is due to

A. Dispersion

B. Diffraction

C. Interfernce

D. Refraction

Answer: B

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34. For what distance is ray optics a good approximation when the aperture is 3 mm wide and the wavelength is 500 nm?

A. 32m

B. 69m

C. 16 m

D. 8m

Answer: A

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35. To observe diffraction, the size of the obstacle

A. Should be of the same order as wavelength

B. Should be much smaller than the wavelength

C. Has no relation to wavelength

D. should be exactly $\frac{\lambda}{2}$

Answer: A

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36. In a single slit diffraction pattem

A. Central fringe has negligible width than others

B. all fringes are of same width

C. Central fringe do not exist

D. central fringe is twice as wide as other maxima

Answer: D

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37. Diffraction and interference of light refers to -

A. Nature of light is electromagnetic

B. Wave nature of light

C. Nature is quantum

D. Nature of light is transverse

Answer: B

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38. A polariser in used to

A. Reduce intensity of light

B. increases intensity of light

C. produce polarised light

D. analyse polarised light

Answer: C

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39. Light waves can be polarides as they are

A. Transverse

B. Longitudinal

C. Diffracted

D. Of highl frequency

Answer: A

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40. Through which character, we can distinguish the light waves form sound waves

A. Interference

B. reflection

C. Refraction

D. Polarisation

Answer: D

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41. 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. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Answer: D

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42. Which of the following cannot be polarised?

A. Radiowaves

B. ultraviolet rays

C. Infrared rays

D. Ultrasonic waves

Answer: D

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43. An unpolarised light of intensity I_o is passed through a polaroid. The intensity of a plain polarised light obtained is ______

A. l_0

B. $\frac{l_0}{2}$

C. $\frac{l_0}{4}$

D. zero

Answer: B

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44. Refractive index of material is equal to tangent of polarising angle. It is called

A. Brewster's law

B. Lambert's law

C. Malus' law

D. Bragg's law

Answer: A

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45. Two nicols are oriented with then principal planes making an anlge of 60°. The percentage of incident unpolarized light which passes through the system is:

A. 0.5

B. 1

C. 0.125

D. 0.375

Answer: C

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46. In the case of linearly polarized light, the magnitude of he electric field vector

A. Doesn't change with time

B. Varries periodically with time

C. Increases and decreases linearly with time

D. is parallel to the direction of propagation.

Answer: B

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

A. 3×10^{8}

B. $\frac{3}{\sqrt{2}} \times 10^{8}$

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

D. 0.5×10^{8}

Answer: C

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48. 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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49. Which of the following is conserved when light waves interfere ?

A. Intensity

B. Energy

C. Amplitude

D. Momentum

Answer: B

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50. Huygen wave theory allows us to know:

A. The wavelength of the wave

B. The velocity of the wave

C. The amplitude of the wave

D. The propagation of wavefronts

Answer: D

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51. If one of the slits in Young's double slit experiment is fully closed, the new pattern has ----------- central maximum in angular size.

A. A bright slit will be observed, no interference pattern will exist

B. The bright fringes will becomes more bright

C. The bright fringes will becomes fainter

D. diffraction pattern due to single slit will be observed

Answer: D

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52. In young's experiment, the separation between 5th maxima and 3rd minima is how many times as that of fringe width ?

A. 5 times

B. 3 times

C. 2.5 times

D. 2 times

Answer: C

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53. Choose the correct statement

A. A telescope magnifies

B. A microscope resolves

C. A telescope resolves

D. Both (2) and (3)

Answer: C

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54. The distance upto which ray optics holds good is called

A. Fresnel distance

B. Fraunhofer distance

C. Optical distance

D. Wave distance

Answer: A

55. Diffraction effect can be observed in

A. Only sound waves

B. Only light waves

C. Only ultrasonic waves

D. Sound as well as light waves

Answer: D

Assignment Section B Objective Type Question

One Option Is Correct

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

A. $l_0 \cos\left(\frac{x}{\beta}\right)$

B. $l_0 \cos^2\left(\frac{x}{\beta}\right)$

C. $l_0 \cos^2\left(\frac{\pi x}{\beta}\right)$

D. $\frac{l_0}{4} \cos^2\left(\frac{\pi x}{\beta}\right)$

Answer: C

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2. 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. λ

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

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

Answer: A

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3. 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

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

A. 18

B. 12

C. 24

D. 30

Answer: A

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5. In YDSE, $d = 5\lambda$, then the total no. of maxima observed upon screen will be

A. 9

B. 8

C. 7

D. 5

Answer: A

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Assignment Section C Objective Type Question More Than One Option Are Correct

1. In a young's doule slit experiment, wavelength of light used is λ. Let O is the centre of line joining the slits and C is centre of screen where interference pattern is being obtained. θ is the angular position of each slit with respect to C and ϕ is angular position of first maxima with respect to O. select the correct alternative

A. a. Fringe width obtained is $\dfrac{\lambda\theta}{2}$

B. b. Fringe width obtained is $\dfrac{\lambda}{2\theta}$

C. c. The distance between the slits is $\dfrac{\lambda}{\phi}$

D. d. The distance between slits and screen is $\dfrac{\lambda}{2\phi\theta}$

Answer: B::C::D

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2. In Young's double slit experiment, white light is used. The separation between the slits is b. The screen is at a distance d $(d > > b)$ from the slits, Some wavelengths are missing exactly in front of one slit. These wavelengths are

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

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

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

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

Answer: A::C

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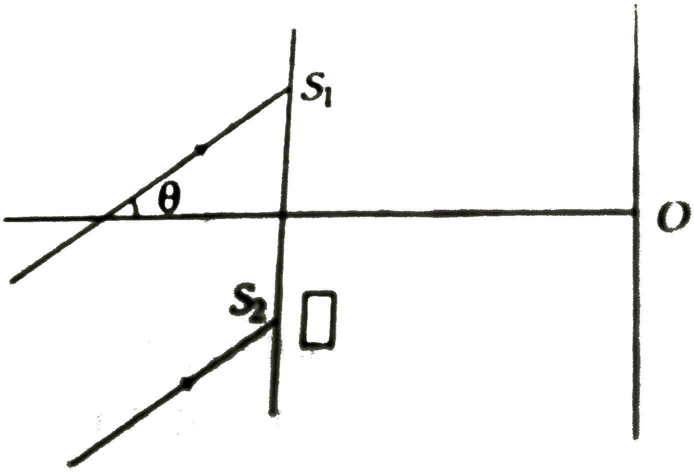
3. A monochromatic beam of light falls on YDSE apparatus at some angle $(say\theta)$ as shown in the figure, A thin sheet of glass is inserted in front of the lower slit S_2 The central bright fringe (path difference =0) will be obtained



A. Central maxima will be at O always

B. If $(\mu - 1)t = d\sin\theta$, central maxima will be at O

C. if $(\mu - 1)t > d\sin\theta$, central maxima will be below O

D. If $(\mu - 1)t = d\sin\theta + \lambda$, a maxima is formed at O

Answer: B::C::D

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4. Two monochromatic coherent point sources S_1 and S_2 are separated by a distance L. Each sources emits light of wavelength λ, where

$L >> \lambda$. The line S_1S_2 when extended meets a screen perpendicular to it at point A. Then

A. The interference fringe are circular is shape

B. Interference fringes are straight lines perpendiculars to line S_1S_2A

C. On the point A intensity is maximum if $L = n\lambda$ (n is an integer)

D. Point A is always an intensity maximum for any separation L

Answer: A::C

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5. In a YDSE, fringes are produced by monochromatic light of wavelength 5450Å. A thin plate of glass of refractive index 1.5 is placed normally in the path of one of the intefering beams and the central bright band of the fringe system is found to move into the position previoysly occupied by the third band from the centre. select the correct alternatie

A. The thickness of the plate is $3.27 \times 10^{-6} m$

B. If the separation between the sources is 1000Å , the angular position of first maxima is 0.01 rad

C. The thickness of the plate is $1.59 \times 10^{-6} m$

D. A maxima is still obtained at the centre of screen

Answer: A::D

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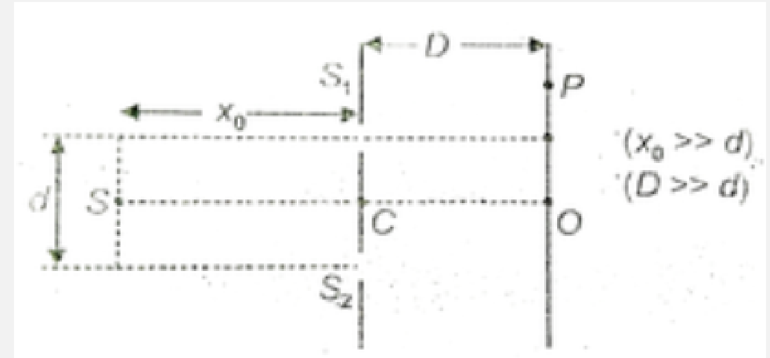
Assignment Section D Linked Comprehension Type Questions

1. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical

and source S is placed symmetrically as shown.

interference pattern is observed on a screen

at a distance D from the centre of slit. The

distance between the slits is d.

If the resultant intensity at P is same as that O,

then the distance OP can not be

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

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

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

D. $\dfrac{1.5\lambda D}{d}$

Answer: D

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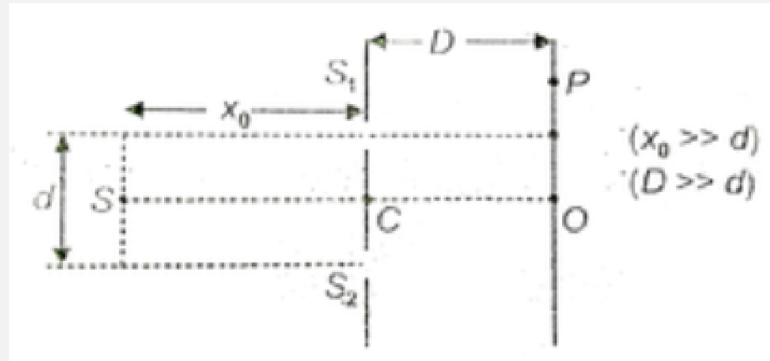
2. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the source is moved up by a very small distance y_0, the central maxima will shift

A. Up by $\frac{y_0 d}{x_0}$

B. Down by $\frac{y_0 d}{x_0}$

C. Up by $\frac{y_0 D}{x_0}$

D. Down by $\frac{y_0 D}{x_0}$

Answer: D

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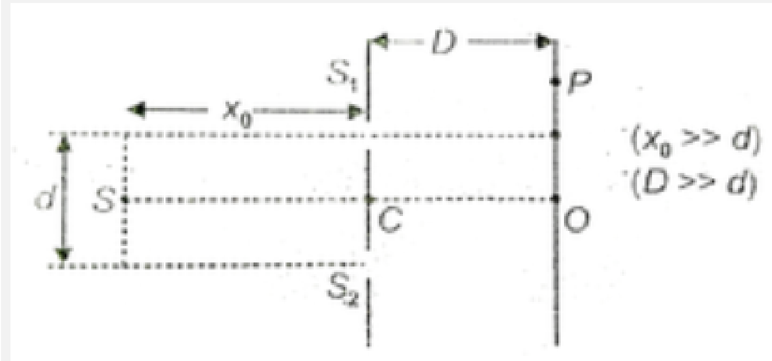
3. In a young's doule slits experiment, a monochromatic source of wavelength λ is used to illuminate the two slits



S_1 and S_2. The slitss S_1 and S_2 are identical and source S is placed symmetrically as shown. interference pattern is observed on a screen at a distance D from the centre of slit. The distance between the slits is d.

If the size of slits S_1 is slightly decreased, then

A. Intensity at central maxima will remain same q

B. Intensity at central maxima will increases

C. Intensity at first minima will slightly increases from zero

D. Intensity at first minima will remain zero

Answer: C

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

Find the distance of seventh bright fringe from third bright fringe lying on the same side of central bright fringe.

A. 0.63 mm

B. 1.26mm

C. 1.67mm

D. 2.2mm

Answer: A

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

Find the distance of seventh bright fringe from third bright fringe lying on the same side of central bright fringe.

A. 2.52mm

B. 4.41mm

C. 1.89 mm

D. 1.26 mm

Answer: A

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

One of the slits of the apparatus is covered by a thin glass sheet of refractive index 1.53. Find the fringe width

A. 0.63mm

B. 1.26mm

C. 1.67mm

D. 2.2mm

Answer: A

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Assignment Section E Assertion Reason Type Question

1. Statement -1: If an exceedingly thin soap film is seen in reflected light, it may appear dark

Statement -2 : There is a phase difference of π from the rays reflected from front and rear faces of the film.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-2

B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: C

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2. Statement-1 : When a white light passes through a prism it forms a spectrum of seven colours.

Statement-2 : The refractive index for different colour of light is different for the material of prism.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-2

B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-2

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: A

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3. Statement-1: Two separate sources of light giving out light of the same frequency do not produce sustained interference.

Statement-2 : The amplitude of the waves from the sources are never equal.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-4

B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-3

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

Answer: C

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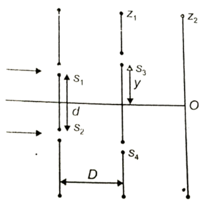
Assignment Section F Matrix Match Type Question

1. In the arrangement shown in figure, z_1 and z_2 are two screens. Line PO is the bisector line of $s_1 s_2$ and $s_3 s_4$, s_1 is removed, resultant intensity at O due to slits s_1 and s_2 is I. now z_1 is placed. For different values of y given in column-I match the resultant intensity at O given in column -II.



Column-I	Column-II
(A) $y = \frac{D\lambda}{2d}$	(p) $3I$
(B) $y = \frac{D\lambda}{6d}$	(q) Zero
(C) $y = \frac{D\lambda}{4d}$	(r) I
(D) $y = \frac{D\lambda}{3d}$	(s) None of these

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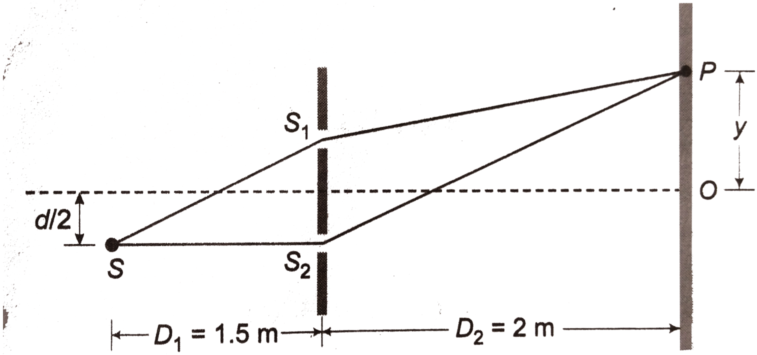
Assignment Section G Integer Answer Type Question

1. In the YDSE, the monochromatic source of wavelength λ is placed at a distance $\frac{d}{2}$ from the central axis (as shown in the figure), where d is the separation between the two slits S_1 and S_2 .



(a)Find the position of the central maxima.

(b) Find the order of interference formed at O.

(c)Now, S is placed on centre dotted line. Find the minimum thickness of the film of refractive indes $\mu = 1.5$ to be placed in front of S_2 so that intensity at O becomes $\frac{3}{4}$th of the maximum intensity.

(Take $\lambda = 6000\text{Å}, d = 6mm$.)

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Assignment Section H Multiple True False Type Question

1. Statement-1: In YDSE, if initial phase difference between waves is π, central maxima will be occupied by minima.

Statement-2: In YDSE , if incident light is white light, then central fringe is white while all other fringes are coloured.

Statement-3 : A thic transparent liquid film floating upon water, when illuminated by while light, appears coloured.

A. FTT

B. TTT

C. TFF

D. TTF

Answer: B

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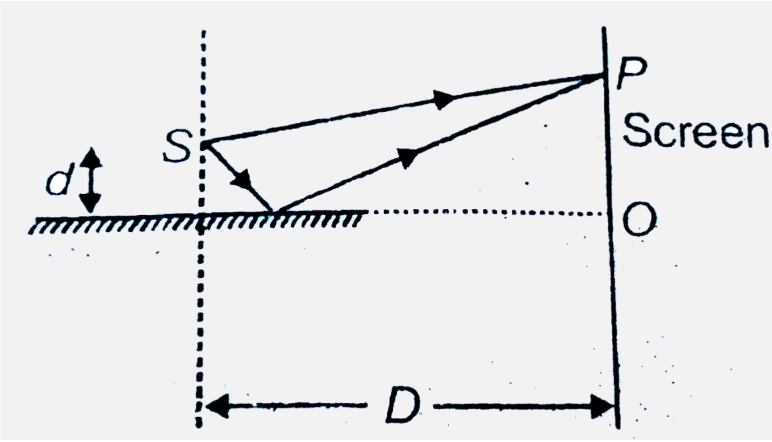
Assignment Section I Subjective Type Question

1. A narrow slit S transmitting light of wavelength $'\lambda'$. Is placed at a distance d above a large plane mirror as shown. The light coming directly from the slit and that coming after the reflection interfere at a screen S placed at a distance D from the slit. at what distance from point O, the resultant intensity is maximum ? (there is a phase change of π of reflection from the mirror)



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2. In a Young's double slit experiment, a parallel beam containing wavelengths $\lambda_1 = 4000\text{Å}$ and $\lambda_2 = 5600\text{Å}$ is incident at an angle $\phi = 30^\circ$ on a diaphragm having narrow slits at separation d=2mm. The screen is placed at a distance D =40 cm from the slits. a mica slab of thickness t=5mm is placed in front of one of the slits and whole of the apparatus is submerged in water. if the central bright fringe is observed at C, determine.

(i) The refractive index of the slab

(ii) The distance of first black line from C

both wavelength are in air. take $\mu_w = \dfrac{4}{3}$

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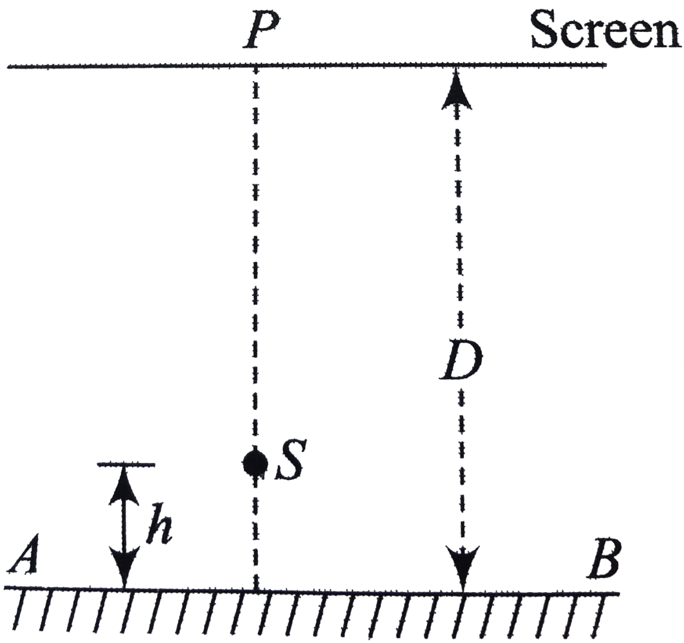
1. A point source S emitting light of wavelength 600 nm is placed at a very small height h above a flat figure. The intensity of the reflected light id 36% of the incident intensity. Interference fringe are observed on a screen placed parallel to the reflecting surface at a very large distance D from it.

a. What is the shape of the interference fringe on the screen?

b. Calculate the ratio of the minimum to the maximum intensities in the interference fringes formed near point P (shown in the figure).

c. If the intensity at point P corresponds to a maximum, calculate the mininum distance through which the reflecting surface. AB should at P again becomes maxinum.



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Example

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

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2. Yellow light with wavefront 0.5μm is air surface refraction in a medium in which

velocity of light is $2 \times 10^{-8} m / s$. Then the wavelength of the light in the medium would be .

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3. With what speed should a star move with respect to us so that the beam at wavelength 460.0 nm is observed at 460.8 nm.

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4. A galaxy moving with speed 300km/s shows blue shift. At what wavelength sodium line at 589.0 nm will be observed ?

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5. 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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6. 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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7. 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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8. Two slits in YDSE are placed 2 millimeter from each other. Interference pattern is observed on 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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9. What is the value of angular fringe width if fringe width is = 0.4 nm and separation between slit and screen is 2m.

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

12. 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 ?

13. In YDSE, the slits are separated 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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14. 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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15. A parallel beam of monochromatic light of wavelength 450 nm 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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16. 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 the slit.

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17. 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 ?

Watch Video Solution

18. Light of wavelength 6328Å is incident normally on a slit having a width of $0.2mm$ The width of the central maximum on a screen 9m away will be nearly

A. 0.36 degree

B. 0.18 degree

C. 0.72 degree

D. 0.09degree

Answer:

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19. 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:

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20. In YDSE , what should be the width of each slit to obtain 20 maxima of the double slit pattern within the central maximum of the single slit pattern ? (d=1mm)

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21. What is the approximate radius of the central bright differaction spot of light of wavelength $\lambda = 0.5 \mu m$, if focal length of the lens is 20 cm and radius of aperture of the lens is 5 cm ?

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22. A light of wavelength, 5000Å is coming from a distant star. What is the limit of resolution of a telescope whose objective has a diameter of 200 cm ?

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23. Which light would produce more resolution the red light or the blue one ?

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24. For what distance is ray optics, a good approximation when a plane light wave is incident on a circulation aperture of width 2 mm having wavelength 600 nm ?

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25. 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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26. A plane polarized light with intensity I_0 is incident on a polaroid with Electric Field vector making an angle of 60° with transmission axis of polaroid. The intensity of the resulting light will be

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27. An unpolarized light is successively throgh two polaroids, each with their transmission axis parallel. If the intensity of unpolarized light be l_0, then intesity of the light after emerging from second polarizer will be

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28. The polariser and analyser are inclined to each other at 60°. The intensity of polarised light emerging from polariser is I. The intensity of the unpolarised light incident on the polariser is

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29. Two polaroids are oriented with their planes perpendicular to incident light and transmission axis making an angle 45° with each other. Find the fraction of incident light which is transmitted.

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

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Exercise 1

1. The idea of secondary wavelets for the propagation of a wave was first given by

A. Newton

B. Huygens

C. Maxwell

D. Fresnel

Answer: B

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2. Wavefront means

A. All particles in it have same phase

B. All the particles have opposite phase of vibration

C. Few particles are in same phase , rest are in opposite phase

D. None of these

Answer: A

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

A. 5l and l

B. 5l and 3l

C. 9l and l

D. 9l and 3l

Answer: C

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4. Two identical light waves, propagating in the same direction , have a phase difference δ, after they superpose, the intensity of the resulting wave will be proportional to

A. $\cos\delta$

B. $\cos\left(\frac{\delta}{2}\right)$

C. $\cos^2\left(\frac{\delta}{2}\right)$

D. $\cos^2\delta$

Answer: C

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5. For constructive interference to take place between two monochromatic light waves of wavelength A, the path difference should be:

A. $\frac{(2n-1)\lambda}{4}$

B. $2n\lambda$

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

D. $n\lambda$

Answer: C

Watch Video Solution

6. 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

Watch Video Solution

7. In YDSE, $d = 2mm, D = 2m,$ and $\lambda = 500nm$. If intensities of two slits are I_0 and $9I_0$, then find intensity at $y = \frac{1}{6}mm$.

A. $7l_0$

B. $10l_0$

C. $16l_0$

D. $4l_0$

Answer: A

Watch Video Solution

8. In Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index $4/3$, without disturbing the geometrical arrangement, the new fringe width will be:

A. 0.30 mm

B. 0.40 mm

C. 0.53 mm

D. 450 μm

Answer: A

Watch Video Solution

9. The 6563 Ã... H_{α} line emitted by hydrogen in a star is found to be red-shifted by 15 Ã.... The speed with which the star is receding from the earth is

A. $17.3 \times 10^{3} m / s$

B. $4.29 \times 10^7 m/s$

C. $3.39 \times 10^5 m/s$

D. $2.29 \times 10^5 m/s$

Answer: D

Watch Video Solution

10. Two slits, 4mm apart, are illuminated by a light of wavelength 6000Å. What will be the fringe width on a screen placed 2m from the slits ?

A. 0.12 mm

B. 0.3 mm

C. 3.0 mm

D. 4.0 mm

Answer: B

Watch Video Solution

11. A slit of width a is illuminated by white light. The first minimum for red light

$(\lambda = 6500\tilde{A}\ldots)$ will fall at $\theta = 30^{\circ}$ when a

will be

A. 3250 A

B. 6.5×10^{-4}

C. $1.24 \mu m$

D. 2.6×10^{-4}

Answer: C

Watch Video Solution

12. Angular width of central maximum of a diffraction pattern on a single slit does not depend upon

A. Distance between slit and source

B. Wavelength of the light speed

C. Width of the slit

D. Frequency of light used

Answer: A

Watch Video Solution

13. For what distance is ray optics a good approximation when the aperture is 4 mm wide and the wavelength is 500 nm?

A. 32 m

B. 69 m

C. 16 m

D. 8 m

Answer: A

Watch Video Solution

14. In a single slit diffraction pattem

A. central fringe has negligible width than others

B. All fringes are of same width

C. Central fringe do not exist

D. Central fringe is twice as wide as other maxima

Answer: D

Watch Video Solution

15. 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. $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Answer: D

Watch Video Solution

16. An unpolarized light with intensity $2I_0$ is passed through a polaroid. The resultant intensity of the transmitted light will be

A. l_0

B. $\frac{l_0}{2}$

C. $\frac{l_0}{4}$

D. Zero

Answer: B

17. Two nicols are oriented with then principal planes making an anlge of 60°. The percentage of incident unpolarized light which passes through the system is:

A. 0.5

B. 1

C. 0.125

D. 0.375

Answer: C

Watch Video Solution

18. 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. $\frac{3}{\sqrt{2}} \times 10^8$

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

D. 0.5×10^8

Answer: C

Watch Video Solution

19. The distance upto which ray optics holds good is called

A. Fresnel distance

B. Fraunhofer distance

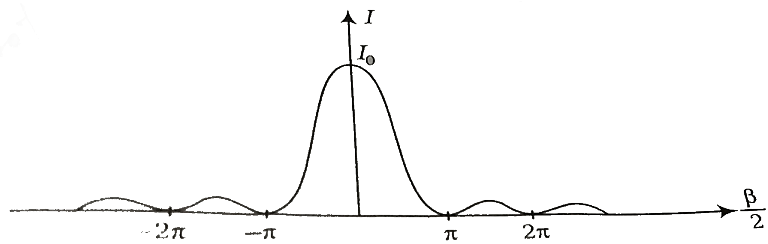
C. Optical distance

D. Wave distance

Answer: A

Watch Video Solution

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



A. 4

B. 3

C. 2

D. 1

Answer: C

Watch Video Solution

Assignment Section A Objective Type Questions

1. Huygens concepts of secondary wavelets

A. Allow us to find the focal length of a thin lens

B. Give the magnifying power of a microscope

C. Are a geometrical method to find a wavefront

D. Are used to determine the velocity of light

Answer: C

Watch Video Solution

2. The intensity of light at a distance 'r' from the axis of a long cylindrical source is inversely proportional to 'r'

A. $l \propto \frac{1}{r^2}$

B. $l \propto \frac{1}{r}$

C. $l \propto r^0$

D. $l \propto \frac{1}{r^3}$

Answer: B

Watch Video Solution

3. Four waves are expressed as

1. $y_1 = a_1 \sin \omega t$

2. $y_2 = a_2 \sin 2\omega t$

3. $y_3 = a_3 \cos \omega t$

4. $y_4 = a_4 \sin(\omega t + \phi)$

The interference is possible between

A. (i) and (iii)

B. (i) and (ii)

C. (ii) and (iv)

D. Not possible at all

Answer: A

Watch Video Solution

4. Two waves having the intensities in the ratio of $9:1$ produce interference. The ratio of maximum to minimum intensity is equal to

A. $10:8$

B. $9:1$

C. $4:1$

D. $2:1$

Answer: C

Watch Video Solution

5. Assertion : If light is polarised by reflection, then the angle between reflected and refracted ray is 180°.

Reason : Brewester's law : $\mu = \tan i_p$.

A. π

B. $\pi / 2$

C. 2π

D. $\pi / 4$

Answer: B

Watch Video Solution

6. In the interference pattern produced by two identical slits, the intensity of central maximum is l. What will the intensity of light at the same spot, if one of the slits is closed?

A. $l = l_0$

B. $l = 2l_0$

C. $I = 4I_0$

D. I and I_0 are not related to each other

Answer: C

Watch Video Solution

7. The fringe width in a Young's double slit experiment can be increased. If we decrease

A. Separation of the slits

B. Distance between the source and the screen

C. Wavelength of the source

D. All of these

Answer: A

Watch Video Solution

8. In case of Young experiment

A. There are two virtual source of light from same monochoromatic source of light

B. Both the slits get light from the single monochromatic source of light

C. Two separate monochromatic sources of light of same wavelength are used

D. None of these

Answer: B

Watch Video Solution

9. If light from a galaxy observed on the earth's surface has a red shift, then

A. Galaxy is stationary w.r.t the earth

B. Galaxy is approaching the earth

C. Galaxy is receding from the earth

D. Temperature of galaxy is increasing

Answer: C

Watch Video Solution

10. In young's double slit experiment, the seperation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is

A. Unchanged

B. Halved

C. Doubled

D. Quadrupled

Answer: D

Watch Video Solution

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

A. the fringe system would disappear

B. The bright fringes will be more bright and dark fringes will be more dark

C. The dark fringes would be less dark and bright fringes would be less bright

D. Bright as well as dark fringes would be more dark

Answer: C

Watch Video Solution

12. 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. Becomes half

Answer: D

Watch Video Solution

13. Two slits separated by a distance of 1 mm are illuminated with red light of wavelength 6.5×10^{-7}m. The interference firnges are observed on a screen placed 1 m form the slits. The distance between third bright firnge and the fifth dark fringe on the same side is equal to

A. 0.65 nm

B. 0.975 mm

C. 3.25 mm

D. 4.88 mm

Answer: B

Watch Video Solution

14. A double slit interference experiment experiment is carried out in air and the entire arrangement is dipped in water, As a result

A. The fringe width decreases

B. The fringe width increases

C. The fringe width remains unchanged

D. Fringe pattern disappears

Answer: A

Watch Video Solution

15. Double slit interference experiment is carried out with monochromatic light and interference fringes are observed. If now monochromatic light is replaced by white light, what change is expected in interference pattern?

A. NO change

B. Pattern disappears

C. White and dark fringes are observed throughout

D. A few coloured fringes are observed on either side of central white fringe

Answer: D

Watch Video Solution

16. In Young's experiment the wavelenght of red light is $7.8 \times 10^{-5} cm$ and that of blue light is 5.2×10^{-5} cm. The value of n for which $(n+1)^{th}$ blue bright band coincides with n^{th} red band is

A. 1

B. 2

C. 3

D. 4

Answer: B

Watch Video Solution

17. In a young 's double slit experiment, a glass plate of refractive index 1.5 and thickness

5×10^{-4} cm is kept in the path of one of the light rays. Then

A. There will be no shift in the interference pattern

B. The fringe width will increases

C. The fringe width will decreases

D. The optical path of the ray will increases by $2.5 \times 10^{-4} cm$

Answer: D

Watch Video Solution

18. Which of the following is correct regarding microscope and telescope?

A. telescope provides magnification,whereas microscope provides resolution

B. Telescope provides resolution whereas microscope provides magnification

C. Both provide resolution

D. Both provide magnification

Answer: B

Watch Video Solution

19. IF Young's experiment is performed using two separate identical sources of light instead of using two slits and one light source then the

A. Interference fringes will be darker

B. Interference fringes will be higher

C. Fringes will not be obtained

D. Constrast between bright and dark fringes increases

Answer: C

Watch Video Solution

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

A. l_0

B. $\frac{l_0}{2}$

C. $\frac{l_0}{\sqrt{2}}$

D. $\frac{l_0}{4}$

Answer: B

Watch Video Solution

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

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

B. $\lambda = b^2 / 5d$

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

D. All of these

Answer: D

Watch Video Solution

22. Oil floating on water looks cloured due to interference of light. What should be the approximate thickness of the film for such effects to be visible ?

A. $10^{-6} m$

B. $10^{-2} m$

C. $10^{-10} m$

D. $10^{-8} m$

Answer: A

Watch Video Solution

23. When white light is incident normally an oil film of thickness $10^{-4}cm$ and refractive index. 1.4 then the wavelength which will not be seen in the reflected system of light is

A. 7000A

B. 5600A

C. 4000A

D. All of these

Answer: D

Watch Video Solution

24. Imperfections is optical lenses can be observed with the help of

A. Newton's rings

B. Fresnel's Biprism

C. Lioyd's single miror experiment

D. Young's double slit experiment

Answer: A

Watch Video Solution

25. Choose the correct statement

A. While watching television by means of an antenne, a passing nearby aeroplane can produce wavering ghost images in the television picture

B. Solar cells are often coated with a transparent thin film, such as silicon monoxide (SIO) to minimize reflective losses.

C. Glass lenses used in cameras and other optical instrucments are usually coated with a transparent thin film, such as magnesium fluoride. (MgF_2) to reduce or eliminate unwanted reflection

D. All of these

Answer: D

Watch Video Solution

26. Some currency notes (to avoid counterfelts) change their colour as you till them. This is due to

A. Diffraction

B. Polarization

C. Interference

D. Refraction

Answer: C

Watch Video Solution

27. Rainbows are classic example of the phenomenon of

A. Interference

B. Diffraction

C. Polarization

D. Absorbtion

Answer: A

Watch Video Solution

28. The phenomenon of diffraction can be treated as interference phenomenon if the number of coherent sources is

A. infrared waves

B. Microwaves

C. X-rays

D. All of these

Answer: D

Watch Video Solution

29. Though quantum theory of light can explain a number of phenomena observed with light , it is necessary to retain the wave-nature of light to explain the phenomena of :

A. Photoelectric effect

B. Diffraction

C. Compton effect

D. Black body radiation

Answer: B

Watch Video Solution

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

A. NO change

B. Diffraction bands become narrower and get crowded together

C. Bands become broader and farther apart

D. Bands disappear

Answer: B

Watch Video Solution

31. The main difference in diffraction and inteference is

A. Diffraction is due to interaction of light from the same wave front whereas interference is the interaction of waves from two isolated sources

B. Diffraction is due to interaction of light from 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 reflected waves from a source whereas interference is caused due to refraction of waves from a surface

Answer: B

Watch Video Solution

32. The condition for observing Fraunhofer diffraction from a single slit is that the light wavefront incident on the slit should be

A. Spherical

B. Cylindrical

C. Plane

D. Elliptical

Answer: C

Watch Video Solution

33. A parallel beam of monochromatic light of wavelength 5000 A is incident normally on a single narrow slit of width 0.001 mm. 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. 50°

Answer: C

Watch Video Solution

34. Monochromatic light of wavelength 580 nm is incident on a slit of width 0.30 mm. The screen is 2m from the slit . The width of the central maximum is

A. $3.35 \times 10^{-3} m$

B. $2.25 \times 10^{-3} m$

C. $6.20 \times 10^{-3} m$

D. $7.7 \times 10^{-3} m$

Answer: D

Watch Video Solution

35. The resolving power of a compound microscope will increase with

A. Red light is used to illuminate the object

B. Violet light is used to illuminate the object instead of red light

C. Infra red light is used to illuminate the object instead of visible light

D. The microscope is in normal adjustment

Answer: B

Watch Video Solution

36. Why a DVD stores almost 30 times more information than a CD?

A. DVD uses shorter wavelength lasers of 6350A but CD uses an infarred laser of 7800A

B. CD uses shorter wavelength laser compared to a DVD

C. CD works on the principle of diffraction

D. DVD Works on diffraction of light

Answer: A

Watch Video Solution

37. If a classroom door is open just a small amount we can hear sounds coming from the room but we can't see what is going on inside the room because

A. Diffraction of sound of easier as its wavelength is large

B. Diffraction of light is easier as its wavelength is small

C. Sound waves can be polarized

D. Light waves can be polarized

Answer: A

Watch Video Solution

38. When you look at a clear blue sky you see tiny specks and hair like structures floating in your view, called "floaters" This is basically.

A. Interference pattern

B. Diffraction pattern

C. Emission spectra

D. Absorbtion spectra

Answer: B

Watch Video Solution

39. An unpolarized beam of intensity I_0 is incident on a pair of nicols making an angle of 60° with each other. The intensity of light emerging from the pair is:

A. $l \cos^2 \theta$

B. $\left(\frac{l}{2}\right) \cos^2 \theta$

C. $l \cos^4 \theta$

D. $\left(\frac{l}{2}\right)\cos\theta$

Answer: B

Watch Video Solution

40. A beam of light AO is incident on a glass slab $(\mu = 1.54)$ in a direction as shown in the diagram The reflected ray OB is passed through a polaroid On viewing through the polaroid. We find that on rotating the polaroid (given $\tan 57^{\circ} = 1.54$)

A. the intensity is reduced down to zero and remains zero

B. The intensity reduces down some what and rises again

C. There is no charge in intensity

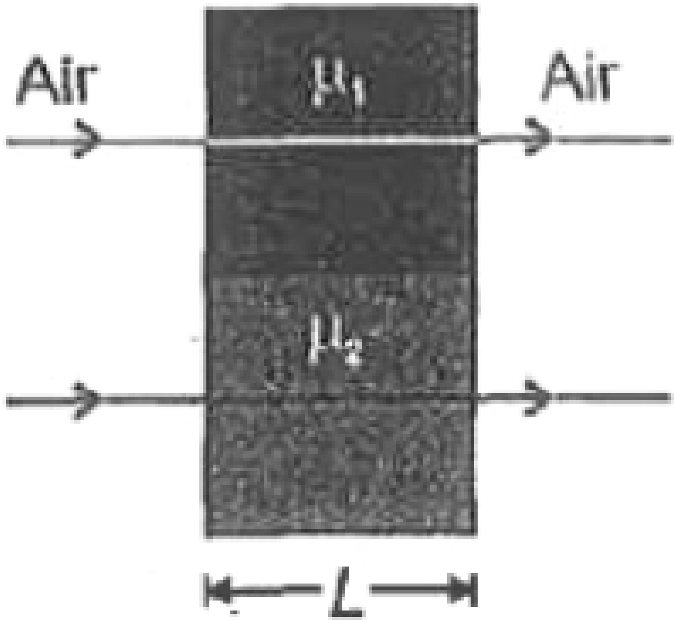
D. The intensity gradually reduces to zero and then again increases

Answer: D

Watch Video Solution

Assignment Section B Objective Type Questions

1. Two light rays initially in same phase travel through two media of equal length L having refraction index μ_1 and $\mu_2 (\mu_1 > \mu_2)$ as shown in figure. If the wavelength of light rays in air is λ, the phase difference of the emerging rays is given by



A. $\frac{L\mu_1}{\lambda\mu_2}$

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

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

D. Zero

Answer: C

Watch Video Solution

2. Light waves travels in vacuum along the X-axis. Which of the following may represent the wavefronts?

A. $x=a$

B. $y=a$

C. $z=a$

D. $x+y+z=a$

Answer: A

Watch Video Solution

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

A. 12

B. 18

C. 24

D. 30

Answer: B

Watch Video Solution

4. Two points separated by a distance of 0.1 mm can just be inspected in a microscope when light of wavelength 6000 Ã… is used. If the light of wavelength 4800 Ã... is used then limit of resolution will become

A. 0.05 mm

B. 0.0 25mm

C. 0.1mm

D. 0.15 mm

Answer: B

Watch Video Solution

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

A. Blue

B. Black

C. Yellow

D. Red

Answer: C

Watch Video Solution

6. The central fringe of the interference pattern produced by the light of wavelength 6000 Å is found to shift to the position of 4th dark fringe after a glass sheet of refractive index 1.5 is introduced. The thickness of glass sheet would be

A. $4.8\mu m$

B. $8.23\mu m$

C. $14.98\mu m$

D. $3.78\mu m$

Answer: A

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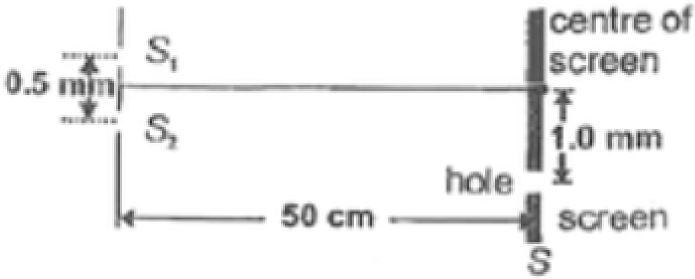
7. In young's double slit experiment shown in figure, S_1 and S_2 are coherent sources and S in the screen having a hole at a point 1.0 mm away from the central line. White light (400 to 700 nm) is sent through the slits. Which wavelength passing through the hole has strong intensity?



A. 400nm

B. 700nm

C. 500nm

D. 667nm

Answer: C

Watch Video Solution

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

A. l_0

B. $\frac{l_0}{4}$

C. $\frac{l_0}{3}$

D. $\frac{l_0}{2}$

Answer: B

Watch Video Solution

9. Four waves are expressed as

1. $y_1 = a_1 \sin \omega t$

2. $y_2 = a_2 \sin 2\omega t$

3. $y_3 = a_3 \cos \omega t$

4. $y_4 = a_4 \sin(\omega t + \phi)$

The interference is possible between

A. (i) and (ii)

B. (i) and (iv)

C. (iii) and (iv)

D. Not possible with any combination

Answer: D

Watch Video Solution

10. In YDSE a thin film $(\mu = 1.6)$ of thickness $0.01 \mu m$ is introduced in the path of one of the two interfering beams. The central fringe moves to a position occupied by the 10th bright fring earlier. The wave length of wave is

A. 6A

B. 6000A

C. 60A

D. 660A

Answer: B

Watch Video Solution

11. 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, (λbeing the wavelength of light used). The intensity at a point where the path difference is $\lambda/4$, will be

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

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

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

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

Answer: D

Watch Video Solution

12. The maximum intensity of fringes in Young's experiment is I. if one of the slits is closed, then intensity at that place becomes l_0. Then relation between I and l_0 is

A. $I = I_0$

B. $I = 2I_0$

C. $I = 4I_0$

D. There is no relation

Answer: C

Watch Video Solution

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

A. $\frac{1}{3}$ times

B. $\frac{1}{9}$ times

C. 3 times

D. 9 times

Answer: A

Watch Video Solution

14. In young's double slit experiment, the seperation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is

A. will not change

B. Will become half

C. Will be doubled

D. Will become four times

Answer: D

Watch Video Solution

15. In young's experiment, the separation between 5th maxima and 3rd minima is how many times as that of fringe width ?

A. 5 times

B. 3 times

C. 2.5 times

D. 2 times

Answer: C

Watch Video Solution

16. Refractive index of material is equal to the tangent of polrasing angle. It is called

A. Brewster's law

B. Lambert's law

C. Malus's law

D. Bragg's law

Answer: A

Watch Video Solution

17. If the amplitude ratio of two sources producing interference is $3:5$ then the ratio of intensities at maxima and minima is

A. $25:16$

B. $5:3$

C. $16:1$

D. $25:9$

Answer: C

Watch Video Solution

18. In young's double slit experiment, the source illuminating the slits is changed from blue to violet . The width of the fringes

A. Increases

B. Decreases

C. Becomes unequal

D. Remains same

Answer: B

Watch Video Solution

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

A. Phase difference by 3π

B. Path difference of 3λ

C. Phase difference of $\frac{5\pi}{2}$

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

Answer: D

Watch Video Solution

20. To observe diffraction, the size of the obstacle

A. Should be of the same order as wavelength

B. Should be much smaller than the wavelength

C. Has no relation to wavelength

D. Should be exactly $\frac{\lambda}{2}$

Answer: A

Watch Video Solution

21. If frequency of light wave propagating in water is halved its, speed

A. Is halved

B. is doubled

C. Remains same

D. Becomes four times

Answer: C

Watch Video Solution

22. In Young's double slit experiment, white light is used. The separation between the slits is b. The screen is at a distance d $(d > > b)$ from the slits, Some wavelengths are missing exactly in front of one slit. These wavelengths are

A. $\frac{y^2}{x}$

B. $\frac{y^2}{2x}$

C. $\frac{y^2}{2x}$

D. All of these

Answer: A

Watch Video Solution

23. Corpuscular theory of light predicts speed of light to be

A. independent of medium

B. Greater in water than in vaccum

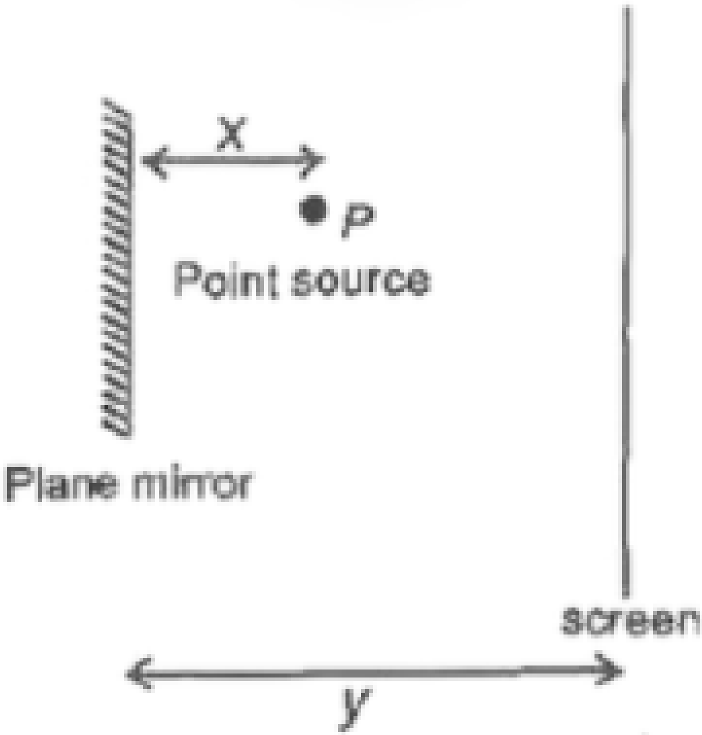
C. Greater in vaccum than in water

D. Dependent on intensity of light

Answer: B

Watch Video Solution

24. Shape of interference fringes formed on the screen due to point source P, in the case shown here



A. Parabolic

B. Elliptical

C. Circular

D. Hyperbolic

Answer: C

Watch Video Solution

25. In Fraunhoffer diffraction from a single slit, wave front incident on the slit is

A. Planar

B. Spherical

C. Cylindrical

D. Either spherical or cylindrical

Answer: A

Watch Video Solution

26. Young's double slit experiment is performed with monochromatic light. A thin film is introduced in front of one of the slits

A. Intensity at the position of central maxima must decrease

B. Intensity at the position of central maxima may increase

C. Central maxima may remain unshifted

D. Intensity at position of first maxima may decreases

Answer: D

Watch Video Solution

27. The apparent wavelength of light from a star moving away from the earth is 0.02% more than the actual wave length. What is the velocity of star

A. $30km/s$

B. $60km/s$

C. $90km/s$

D. $120km/s$

Answer: B

Watch Video Solution

28. Diffraction is easily noticeable for sound waves than for light waves because sound waves

A. Are high energy waves

B. Are low intensity waves

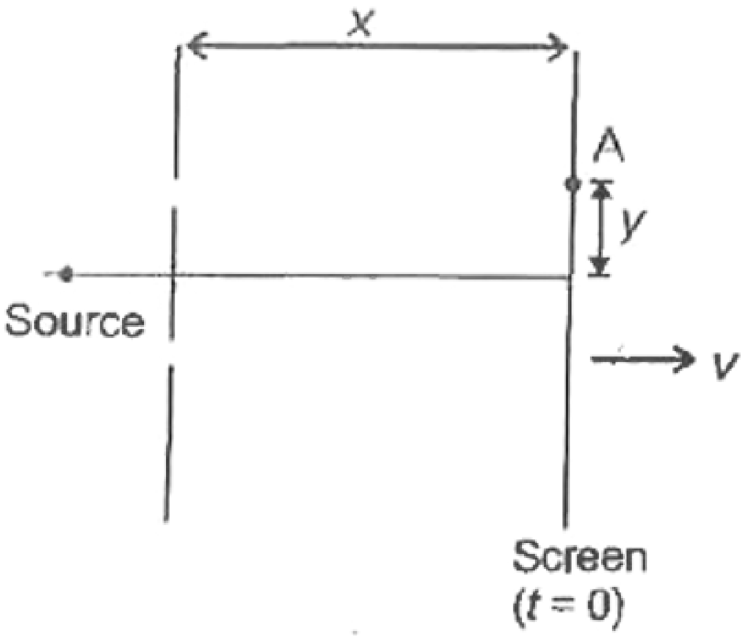
C. Have longer wavelength

D. Are mechanical in nature

Answer: C

Watch Video Solution

29. In the young's arrangement, screen starts moving towards right with constant speed,v initial distance between screen and plane of slits is x. At t=0, 1st order maxima is lying at point A. After how much time first order minima lies at point A?



A. $\dfrac{x}{2v}$

B. $\dfrac{x}{v}$

C. $\dfrac{x}{3v}$

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

Answer: B

Watch Video Solution

30. When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of the light which dows not get transmitted is

A. x

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

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

D. Zero

Answer: B

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31. Light of wavelength λ is coming from a star. What is the limit of resolution of a telescope whose objective has diameter?

A. $\frac{0.305\lambda}{r}$

B. $\frac{0.61\lambda}{r}$

C. $\frac{1.22\lambda}{r}$

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

Answer: C

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32. Brewster angle for air to water transition is (refractive index of water is $\frac{4}{3}$)

A. $\frac{\sin^{-1} 3}{4}$

B. $\dfrac{\cos^{-1}3}{4}$

C. $\dfrac{\tan^{-1}3}{5}$

D. $\dfrac{\cot^{-1}3}{4}$

Answer: D

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33. Approximate thickness of oil film to observe interference of light (due to which it looks coloured) is

A. 10 mm

B. $10^{-3} mm$

C. $10 \pm$

D. 1 cm

Answer: B

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34. Slit widths in a young double slit experiment are in the ratio $9 : 4$. Ratio of intensity at minima to that at maxima is

A. $4:9$

B. $16:81$

C. $1:25$

D. $1:16$

Answer: C

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35. Width of slit in a single slit diffraction experiment such that 20 maxima of double slit interference pattern are obtained within central maxima of the diffraction pattern is (

Slit separation for double slit arrangement

=2mm)

A. 0.05mm

B. 0.1mm

C. 0.2 mm

D. 0.4 mm

Answer: C

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36. Consider Fraunhofer diffraction pattern obtained with a single slit illuminated at normal incidence . At the angular position of the first diffraction minimum , the phase difference (in radians) between the wavelets from the opposite edges of the slit is

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

B. π

C. 2π

D. 4π

Answer: C

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37. Choose the correct alternative

A. When plane polarised light passes through polaroid, it changes it changes its nature to linearly polarised

B. Refracted light, when light is incident at Brewster angle, in linearly polarised

C. Polarised light can be produced by scattering through $\frac{\pi}{2}$ in earth's atmosphere

D. Natural light from sun is polarised

Answer: C

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Assignment Section C Previous Years Questions

1. The ratio of resolving powsers of an optical microscope for two wavelengths $\lambda_1 = 4000 A$ and $\lambda_1 = 6000 A$ is

A. $8:27$

B. $9:4$

C. $3:2$

D. $16:81$

Answer: C

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2. Young's double slit experiment is first performed in air and then in a medium other than air. It is found than 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive index of the medium is nearly

A. 1.25

B. 1.59

C. 1.69

D. 1.78

Answer: D

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3. Two ploaroids P_1 and P_2 are placed with their axes perpendicular to each other. Unpolarised light I_0 is incident on P_1 A third polaroid P_3 is kept in between P_1 and P_2 such that its axis makes an angle 45° with that of P_(1) The intensity of transmitted light through P_2 is

A. $\frac{l_0}{2}$

B. $\frac{l_0}{4}$

C. $\frac{l_0}{8}$

D. $\frac{l_0}{16}$

Answer: C

Watch Video Solution

4. The interference pattern is obtained with two coherent light sources of intensity ration

n. In the interference pattern, the ratio

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

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

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

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

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

Answer: B

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5. 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

Watch Video Solution

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

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

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

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

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

Answer: A

Watch Video Solution

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

A. $\frac{l_0}{2}$

B. l_0

C. $\frac{l_0}{4}$

D. $\frac{3}{4}l_0$

Answer: A

Watch Video Solution

8. At the first minimum adjacent to the central maximum of a single-slit diffraction pattern, the phase difference betwee the huygen's wavelet from the edge of the slit and the wavelet from the midpoint of the slit is:

A. $\frac{\pi}{8}$ radian

B. $\frac{\pi}{4}$ radian

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

D. π radian

Answer: D

Watch Video Solution

9. Two slits in Youngs experiment have widths in the ratio 1: 25 .The ratio of intensity at the maxima and minima in the interference pattern $\frac{I_{\max}}{I_{\min}} is$ is

A. $\frac{4}{9}$

B. $\frac{9}{4}$

C. $\frac{121}{49}$

D. $\frac{49}{121}$

Answer: B

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10. 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. 0.02mm

B. 0.2mm

C. 0.1mm

D. 0.5mm

Answer: B

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11. For a parallel beam of monochromatic light of wavelength λ diffraction is produced by a singe 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. $\frac{2Da}{\lambda}$

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

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

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

Answer: B

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

A. 1.2 cm

B. 1.2 mm

C. 2.4 cm

D. 2.4 nm

Answer: D

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13. 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. $\frac{k}{4}$

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

D. Zero

Answer: C

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14. In Young's double slit experiment, the slits are 2mm apart and are illuminated by photos 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 2 m from the slit will a bright fringe from one interference pattern coincide with a bright fringe from the other?

A. 6mm

B. 4mm

C. 3mm

D. 8mm

Answer: A

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15. 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. The angular width of the central maximum of the diffraction pattern will increase

B. The angular width of the central maximum will decreases

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

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

Answer: B

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16. two periodic waves of intesities l_1 and l_2 pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is

A. $2(l_1 + l_2)$

B. $(l_1 + l_2)$

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

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

Answer: A

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17. The angular resolution of a 10 cm diameter telescope at a wavelength of 5000 Ã... is of the order of

A. $10^6 rad$

B. $10^{-2} rad$

C. $10^{-4} rad$

D. $10^{-6} rad$

Answer: D

Watch Video Solution

18. A star which is emitting radiation at a wavelength of 5000A is approaching the earth with a velocity of $1.50 \times 10^6 m / s$ The change in wavelegth of the radiation as received on the earth is

A. 25A

B. 100A

C. Zero

D. 2.5A

Answer: D

Watch Video Solution

19. For a wavelength of light and scattering object is size a, all wavelengths are scattered nearly equally, if:

A. $a = \lambda$

B. $a < \; < \lambda$

C. $a > \; > \lambda$

D. $a \geq \lambda$

Answer: B

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20. If two sources have a randomly varying phase difference f(t), the resultant intensity will be given by:

A. l_0

B. $\frac{l_0}{2}$

C. $2l_0$

D. $\frac{l_0}{\sqrt{2}}$

Answer: C

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21. In young's double slit experiment, the seperation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is

A. Half

B. Double

C. Four times

D. Eigth times

Answer: C

Watch Video Solution

22. In a Fresnel biprism experiment the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. The actual distance of separation is

A. 13 cm

B. 14 cm

C. 12.5cm

D. 12 cm

Answer: D

Watch Video Solution

23. Colours appear on a thin soap film and soap bubbles due to the phenomenon of

A. Interference

B. Dispersion

C. Refraction

D. Diffraction

Answer: A

Watch Video Solution

24. On introducing a thin film in the path of one of the two interfering beam, the central fringe will shift by one fringe width. If

$\mu = 1.5,$ the thickness of the film is

(wavelength of monochromatic light is λ)

A. 4λ

B. 3λ

C. 2λ

D. λ

Answer: C

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25. 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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26. If two waves each of intensity l_0 having the same frequency but differing by a constant phase angle of 60° superimposing at a certain point in space, then the intensity of the resultant wave is

A. $2l_0$

B. $3l_0$

C. $\sqrt{3}l_0$

D. $4l_0$

Answer: B

Watch Video Solution

27. In Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index $4/3$, without disturbing the geometrical arrangement, the new fringe width will be:

A. 0.40mm

B. 0.53mm

C. 0.20mm

D. 0.30mm

Answer: D

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28. In Young's double slit experiment, if monochromatic light is replaced by white light.

A. Uniform illumination on the screen

B. Uniform darkness on the screen

C. Equally spaced white and dark bands

D. A few coloured bands and then uniform illumination

Answer: D

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29. The Young's double slit experiment is carried out with light of wavelength 5000Å. The distance between the slits is $0.2mm$ and the screen is at $200cm$ from the slits. The central maximum is at $y = 0$. The third maximum will be at y equal to

A. 1.5cm

B. 1.67cm

C. 0.5cm

D. 5.0cm

Answer: A

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30. In young's experiment when sodium light of wavelength 5893 A is used then 62 fringes are seen in the field of view. Instead if violet light of wavelength 4858A is used then the number of fringes that will be seen in the field of view will be

A. 54

B. 64

C. 74

D. 84

Answer: D

Watch Video Solution

31. If an interference pattern produced by two identical slits, the intensity of the central maximum is I. The intensity at the same spot when either of the two slits is closed is l_0.

Then

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

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

C. l

D. 2l

Answer: B

Watch Video Solution

32. If a thin mica sheet of thickness 't' and refractive index μ is placed in the path of one of the waves producing interference , then the whole interference pattern shifts towards the side of the sheet by a distance

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

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

C. $Dd(\mu - 1)t$

D. $(\mu - 1)t$

Answer: B

Watch Video Solution

33. In a young's double slit experiment that wavelength of red light is $7.8 \times 10^{-5} cm$ and that of blue light is $5.2 \times 10^{-5} cm$ The value of n for which (n+1) th blue bright band coincides with nth bright red band is

A. 4

B. 3

C. 2

D. 1

Answer: C

Watch Video Solution

34. A slit 5 cm wide when irradiated by waves of wavelength 10 mm results in the angular spread of the central maxima on either side of incident light by about :

A. $\frac{1}{5}$ radian

B. 4 radian

C. 5 radian

D. 6 radian

Answer: A

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35. In Young's double slit experiment, the 10^{th} maximum of wavelength λ_1 is at a distance y_1 from its central maximum and the 5^{th} maximum of wavelength λ_2 is at a distance y_2

from its central maximum. The ratio y_1 / y_2 will

be

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

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

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

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

Answer: D

Watch Video Solution

36. A beam of light strikes a surface at angle of incidence of 60° and reflected beam becomes completely polarised . The refractive index of glass surface is -

A. 1.5

B. $\sqrt{3}$

C. $\sqrt{2}$

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

Answer: B

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37. Waves that cannot be polarised are

A. Light waves

B. Electromagnetic waves

C. Transverse waves

D. Longitudinal waves

Answer: D

Watch Video Solution

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

A. 0.15

B. 0.25

C. 0.5

D. 0.75

Answer: B

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39. When the angle fo incidence is 60° on the surface of a glass slab, it is found that the reflected ray is completely polarized. The velocity of light in glass is

A. $\sqrt{2} \times 10^{8} m / s$

B. $\sqrt{3} \times 10^{8} m / s$

C. $2 \times 10^{8} m / s$

D. $\frac{\sqrt{3}}{2} \times 10^{8} m / s$

Answer: B

Watch Video Solution

40. Light of wavelength λ is incident on a slit width d. The resulting diffraction pattern is observed on a screen at a distance D. The linear width of the principal maximum is then equal to the width of the slit if D equals

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

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

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

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

Answer: C

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41. In a Fraunhofer diffraction at single slit of width d with incident light of wavelength 5500 Ã…, the first minimum is observed, at angle 30°. The first secondary maximum is observed at an angle $\theta =$

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

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

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

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

Answer: C

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42. Dimeter of juman eye lens is $2mm$. What will be the minumum distance between two points to resolve them, which are situated at a distance of 50 m from eye ? [The wavelength of light is 5000Å]

A. 2.32m

B. 4.28mm

C. 1.525 cm

D. 12.48 cm

Answer: C

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Assignment Section D Assertion Reason Type Question

1. A: The speed of light in vaccum doesn't depend on nature of the source, direction of propagation nature of the source, direction of propagation, motion of the source , or observer wavelength and intensity of the wave.

R: The speed of light in vaccum is a universal constant independent of all the factors listed and anything else.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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2. A: The speed of light, sound waves, water waves in a medium is independent of the nature of the source of intensity (so long it is low).

R: Speed of the waves in a medium depends on wavelength.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)
C. IF Assertion is true statement but Reason is false then mark(3)
D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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3. A: Speed of light in a medium is independent of the motion of the source relative to the medium.

R: Speed of light in a medium depends on the motion of the observer relative to the medium.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)
C. IF Assertion is true statement but Reason is false then mark(3)
D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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4. Explain the following giving reasons :

(i) When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequency as the incident frequency.

(ii) When ligjt travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave ?

(iii) In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave. What determines the intensity in the photon picture of light ?

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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5. A: When light travels from a rarer to a denser medium, it loses some speed but it doesn't imply a reduction in the energy carried by the light wave.

R: Energy carried by a wave depends on the amplitude of the wave and not on the speed of wave propagation.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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6. A: When a narrow pulse of light is sent through a medium, it doesn't retain its shape as it travels through the medium.

R: Since the speed of propagation in a medium depends on wavelength , different wavelength components of the pulse travel with different speeds.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

Watch Video Solution

7. A: In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave.

R: In the photon picture of light, for a given frequency, intensity of light is determined by the numberof photons per unit area.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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8. A: The speed of light in water is not same as that in flowing water.

R: The speed of light in water is not

independent of the relative motion between the observer and the medium.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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9. In a single-slit diffraction experiment, the width of the slit double the original width. How does this affect the size and of the central diffraction band ?

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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10. A: When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle.

R: Waves diffracted from the edge of the circular obstacle interfere constructively at the centre of the shadow producing a bright spot.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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11. A: Ray optics assumes that light travels in a straight line which is disapproved by diffraction effects, yet the ray optics assumption is so commonly used in understanding location and several other properties of images in optical instruments.

R: Typical sizes of apertures involved in ordinary optical instruments are much larger than the wavelength of light.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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12. A: The phase difference between any two points on a wavelength is zero.

R:Corresponding to a beam of parallel rays of light the wavefronts, are planes parallel to one another.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: B

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13. A: Light waves can be polarised.

R: Light waves are transverse in nature.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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14. A: The law of conservation of energy is violated during interference.

R: For sustained interference the phase difference between the two waves must charge with time.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: D

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15. A:When the apparatus of YDSE is brought in a liquid from air, the fringe width decreases.

R: The wavelength of light decreases in the liquid.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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16. A: The resolving power of a telescope decreases on decreasing the aperture of its objective lens.

R: The resolving power of a telescope is given as $\frac{D}{1.22\lambda}$ where D is aperture of the objective and λ is the wavelength of light.

A. IF both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark(2)

C. IF Assertion is true statement but Reason is false then mark(3)

D. If both Assertion and Reason are false statements, then mark (4)

Answer: A

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