1. The two coherent source with intensity ratio β produced interference. The fringe visiblilty will be:

(a) $\frac{2\sqrt{\beta}}{1+\beta}$ (b) 2β (c) $\frac{2}{(1+\beta)}$ (d) $\frac{\sqrt{\beta}}{1+\beta}$

2. A different pattern is obtained by using beam of red light what will happen, if red light is replaced by the blue light?
(a) Bands disapper.
(b) Bands become broader and father apart.
(c) No change will take place.
(d) Diffraction bands become narrow and crowded together.

3. A parallel beam of light of wavelength 600nm is incident normally on a of width d. If the distance between the slits and the screen is 0.8m and the distance of 2nd order maximum form the centre of the screen is 15mm. The width of the slit is :
(a) 40 μm (b) 80 μm (c) 160 μm (d) 200 μm

4. For what distance is ray optics a good approximation when the aperture is 4 mm wide and the wavelength is 500 nm?
(a) 22 m (b) 32 m (c) 42 m (d) 52 m

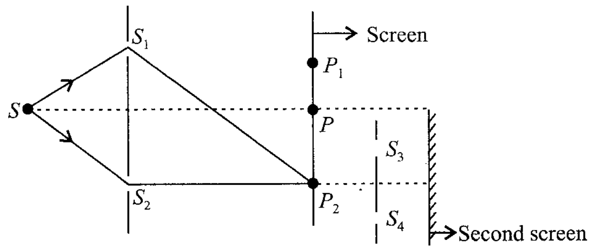
5. A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by blue light?
(a) No change.
(b) Diffraction bands become narrower and crowded together.
(c) Band become broader and father apart.
(d) Band disappears altogether.

6. In the case of linearly polarized light, the magnitude of the electric field vector:
(a) Is parallel to the direction of propagation
(b) Does not change with time
(c) Increases linearly with time
(d) Varies periodically with time

7. If the angle between the pass axis of the polarizer and the analyzer is 45^0, the ratio of the intensities of original light and the transmitted light after passing through the analyzer is:

(a) $\frac{I}{2}$ (b) $\frac{I}{3}$ (c) I (d) $\frac{I}{4}$

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



(a) There would be no interference pattern on the second screen but it would be lighted.
(b) The second screen would be totally dark.
(c) There would be a single bright point on the second screen.
(d) There would be a regular two slit pattern on the second screen

9. An unpolarized light beam is incident on a surface at and angle of incidence equal to Brewster's angle. Then,
(a) The reflected and the refracted beam are both partially polarized
(b) The reflected bam is partially polarized and the refracted beam is completely polarized and are at right angles to each other
(c) The reflected beam is completely polarized and the refracted beam is partially polarized and are at right angles to each other
(d) Both the reflected and the refracted beams are completely polarized and are at right angles to each of other.

10. 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

11. Two waves have equations :

$y_1 = a\sin(\omega t + \phi_1); y_2 = a\sin(\omega t + \phi_2)$. If the amplitude of the resultant wave is equal to the amplitude of each of superimposing waves, then what will be the phase differences between them?

(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

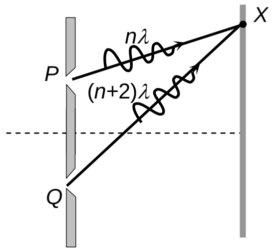
12. Yellow light emitted by sodium lamp in Young's double slit experiment is replaced by monochromatic blue light of the same intensity :

(a) fringe width will decrease.
(b) fringe width will increase.
(c) fringe width will remain unchanged.
(d) fringes will become less intense.

13. The fringe width in the Young's double slit experiment is 2×10^{-4} m. If the distance between the slits is halved and the slit screen distance is double, then the new fringe width will be:-

(a) 2×10^{-4} m (b) 1×10^{-4} m
(c) 0.5×10^{-4} m (d) 8×10^{-4} m

14. The figure shows a double slit experiment P and Q are the slits. The path lengths PX and QX are $n\lambda$ and $(n + 2)\lambda$ respectively, where n is a whole number and λ is the wavelength. Taking the central fringe as zero, what is formed at X



(a) First bright (b) First dark
(c) Second bright (d) Second dark

15. In Young's double slit experiment, 62 fringes are seen in visible region for sodium light of wavelength 5893 Å. If violet light of wavelength 4358 Å is used in place of sodium light, then number of fringes seen will be

(a) 54 (b) 64
(c) 74 (d) 84

16. A young's double slit experiment uses a monochromatic source. The shape of the interference fringes formed on a screen.

(a) Straight line (b) Parabola
(c) Hyperbola (d) Circle

17. The Young's double slit experiment is performed with blue and with green light of wavelengths 4360 Å and 5460 Å respectively. If X is the distance of 4th maximum from the central one, then :

(a) X(blue) = X(green)
(b) X(blue) > X(green)
(c) X(blue) < X(green)
(d) $\frac{X(blue)}{X(green)} = \frac{5460}{4360}$

18. What happens by the use of white light in Young's double slit experiment:-

(a) Bright fringes are obtained
(b) Only bright and dark fringes are obtained
(c) Central fringes is bright and two or three coloured and dark fringes are observed
(d) None of the above

19. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 μm and refractive index 1.5 in 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 10 fringes

20. The light of wavelength 6328 Å is incident on a slit of width 0.2 mm perpendicularly, the angular width of central maxima will be

(a) 0.36° (b) 0.18°
(c) 0.72° (d) 0.09°

21. A plane wavefront ($\lambda = 6\times10^{-7}$m) falls on a slit 0.4 mm wide. A convex lens of focal length 0.8m placed behind the slit focusses the light on a screen.What is the linear diameter of second maximum
(a) 6mm (b) 12mm
(c) 3mm (d) 9mm

22. In the far field diffraction pattern of a single slit under polychromatic illumination, the first minimum with the wavelength λ_1 is found to be coincident with the third maximum at λ_2. So

(a) $3\lambda_1 = 0.3\lambda_2$ (b) $3\lambda_1 = \lambda_2$
(c) $\lambda_1 = 3.5\lambda_2$ (d) $0.3\lambda_1 = 3\lambda_2$

23. The angle of incidence at which reflected light is totally polarized for reflection from air to glass(refraction index)

(a) $\sin^{-1}(n)$ (b) $\sin^{-1}\left(\frac{1}{n}\right)$

(c) $\tan^{-1}\left(\frac{1}{n}\right)$ (d) $\tan^{-1}(n)$

24. In the propagation of electromagnetic waves the angle between the direction of propagation and plane of polarisation is

(a) 0° (b) 45°
(c)90° (d) 180°

25. In Young's double slit experiment how many maximas can be obtained on a screen (including the central maximum) on both sides of the central fringe if λ = 2000 Å and d = 7000 Å

(a) 12 (b) 7
(c) 18 (d) 4

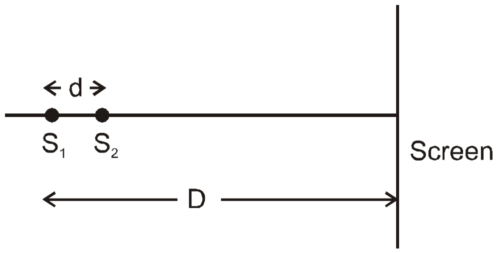
26. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then, in the interference pattern

(a) the intensities of both the maxima and the minima increase
(b) the intensity of the maxima increases and the minima has zero intensity
(c) the intensity of the maxima decreases and that of the minima increases
(d) the intensity of the maxima decreases and the minima has zero intensity.

27. 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 decrease.
(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.

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



(a) points (b) straight lines
(c) semi-circles (d) concentric circles

29. The angular width of the central maximum in a single slit diffraction pattern is 60°. The width of the slit is 1 μm. The slit is illuminated by monochromatic plane waves. If another slit of same width is made near it, Young's fringes can be observed on a screen placed at a distance 50 cm from the slits. If the observed fringe width is 1 cm, what is slit separation distance?

(i.e. distance between the centres of each slit.)
(a)75 μm (b) 100 μm
(c) 25 μm (d) 50 μm

30. In a double-slit experiment, at a certain point on the screen the path difference between the two interfering waves is $\frac{1}{8}$th of a wavelength. The ratio of the intensity of light at that point to that at the centre of a bright fringe is :

(a) 0.568 (b) 0.760

(c) 0.853 (d) 0.672

1. (a) $\frac{I_1}{I_2} = \frac{a^2}{b^2} = \beta \therefore \frac{a}{b} = \sqrt{\beta}$

Fringe visibility is given by

$$V = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{(a+b)^2 - (a-b)^2}{(a+b)^2 + (a-b)^2}$$

$$= \frac{4ab}{2(a^2+b^2)} = \frac{2(a/b)}{\left(\frac{a^2}{b^2}+1\right)} = \frac{2\sqrt{B}}{\beta+1}$$

2. (d) When red light is replaced by blue light the diffraction bands become narrow and crowded.

3. (b) Distance of 2nd order maximum from the centre of the screen

$$x = \frac{5}{2}\frac{D\lambda}{d}$$

Here, $D = 0.8\,m$

$$x = 15mm = 15 \times 10^{-3}\,m$$

$$\lambda = 600nm = 600 \times 10^{-9}\,m$$

$$\therefore d = \frac{5}{2}.\frac{D\lambda}{x} = \frac{5}{2} \times \frac{0.8 \times 600 \times 10^{-9}}{15 \times 10^{-3}}$$

$$= 80 \times 10^{-6}\,m = 80\,\mu m$$

4. (b) Fresnel distance $z_F = \frac{a^2}{\lambda} = \frac{(4 \times 10^{-3})^2}{500 \times 10^{-9}}$

$$= \frac{4 \times 4 \times 10^{-6}}{5 \times 10^{-7}}$$

$$\therefore z_F = 32\,m$$

5. (b) As $\lambda_{blue} < \lambda_{red,}$ and width of diffraction bands is directly proportional to λ, therefore diffraction bands become narrower and crowded.

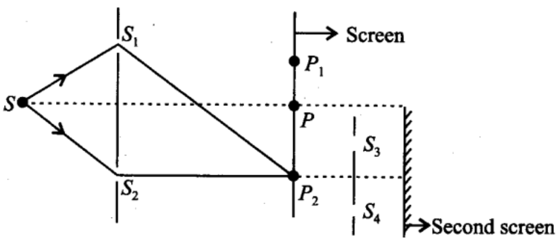
6. (d) In the case of linearly polarized light the magnitude of the electric field vector varies periodically with time.

7. (d) The intensity of the light after passing through the polariser

$$I = I_0 \cos^2\phi = I_0 \cos^2 45^o$$

$$= I_0\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{I}{2} \times \frac{1}{2} = \frac{I}{4} \quad \left(\because I_0 = \frac{1}{2}\right)$$

8. (d):



In given figure there is a hole at minima point P_2 the hole will act as a source of fresh light for the slits S_3 and S_4. Hence there will be a regular two slit pattern on the second screen

9. (c) The reflected beam is completely polarized and the refracted beam is partially polarized and are at right angles to each other.

10. (c) $I_{max} = \left(\sqrt{I_1}+\sqrt{I_2}\right)^2 = \left(\sqrt{4I}+\sqrt{I}\right)^2 = 9I.$

$I_{min} = \left(\sqrt{I_1}-\sqrt{I_2}\right)^2 = \left(\sqrt{4I}-\sqrt{I}\right)^2 = I.$

11. (a)Amplitude of the resultant wave

$A = \sqrt{a_1^2 + a_2^2 + 2a_1a_2\cos\Delta\phi}$

$\therefore A^2 = a_1^2 + a_2^2 + 2a_1a_2\cos\Delta\phi$

$A^2 = a_1^2 + a_2^2 + 2a_1a_2\cos\Delta\phi$

Given ,$A = a_1 = a_2 = a$ (say), then

$a^2 = 2a^2 + 2a^2\cos\Delta\phi$

so $a^2 = 2a^2(1+\cos\Delta\phi)$

So $1 + \cos\Delta\phi = \frac{1}{2}$

So $\cos\Delta\phi = -\frac{1}{2}$

So $\Delta\phi = 120^\circ = \frac{2\pi}{3}$ rad

12. (a)we know that $\beta = \frac{\lambda D}{d}$ & $\lambda_{yellow} > \lambda_{blue}$.

$\Rightarrow$ as λ decreases, so β also decreases.

13. (d)

14. (c)For brightness, path difference $= n\lambda = 2\lambda$

So second is bright.

15. (d) $n_1\lambda_1 = n_2\lambda_2 \Rightarrow 62\times 5893 = n_2\times 4358 \Rightarrow n_2 = 84.$

16. (c)

17. (c)Fourth maxima will be at $y = 4\beta$.

$y = 4\beta$.

$\Rightarrow \quad y = \frac{4\lambda D}{d}$

as $\lambda_{Green} > \lambda_{blue}$.

$\Rightarrow \quad \beta_{Green} > \beta_{blue} \quad \Rightarrow \quad X_{Green} > X_{blue}$

Also get $\frac{X(blue)}{X(green)} = \frac{4360}{5460}$

18. (c)

19. (c)

20. (a)

21. (a)

22. (c)Position of first minima = position of third maxima i.e., $\frac{1\times\lambda_1 D}{d} = \frac{(2\times 3+1)}{2}\frac{\lambda_2 D}{d} \Rightarrow \lambda_1 = 3.5\lambda_2$

23. (d)

24. (a)

25. (b)For maximum intensity on the screen

$$d\sin\theta = n\lambda \Rightarrow \sin\theta = \frac{n\lambda}{d} = \frac{n(2000)}{7000} = \frac{n}{3.5}$$

Since maximum value of $\sin\theta$ is 1

So $n = 0, 1, 2, 3,$ only. Thus only seven maximas can be obtained on both sides of the screen.

26. (a)In interference we know that

$$I_{max} = \left(\sqrt{I_1} + I_2\right)^2 \quad \text{and} \quad I_{min} = \left(\sqrt{I_1} \sim I_2\right)^2$$

Under normal conditions (when the widths of both the slits are equal)

$I_1 \approx I_2 = I$ (say)

$\therefore$ $I_{max} = 4I$ and $I_{min} = 0$

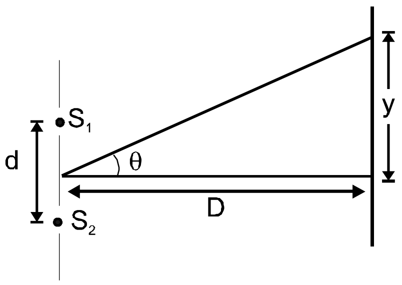
When the width of one of the slits is increased. Intensity due to that slit would increase, while that of the other will remain same. So let :

$I_1 = I$ and $I_2 = \eta I$ $(\eta > 1)$

Then $I_{max} = I\,(1+\sqrt{\eta})^2 > 4I$ and $I_{min} = I\,(\sqrt{\eta}-1)^2$ < 0

$\therefore$ Intensity of both maximum and minima is increased.

27. (b)



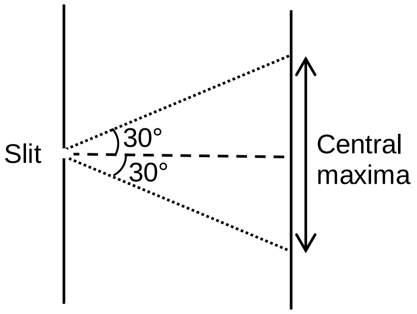
$$\theta = \frac{Y}{D} = \frac{n\lambda D}{dD}$$

so $\theta = \frac{\lambda}{d}$

$v \uparrow \lambda \downarrow \theta \downarrow$

28. (d)It will be concentric circles

29. (c)



Semi-angular width θ = 30°

$a\sin\theta = \lambda$

$a\sin 30° = \lambda$

Fringe width $\beta = \frac{\lambda D}{d} = \frac{a\sin 30° D}{d}$

$\Rightarrow \quad 10^{-2} = \frac{10^{-6} \times \frac{1}{2} \times 0.5}{d} \quad \Rightarrow \quad d = \frac{5}{2} \times 10^{-5} = 25\mu m$

30. (c) $I = I_0 \cos^2\left(\frac{\Delta\phi}{2}\right)$

$\frac{I}{I_0} = \cos^2\left[\frac{\frac{2\pi}{\lambda} \times \Delta x}{2}\right] = \cos^2\left(\frac{\pi}{8}\right); \qquad \frac{I}{I_0} = 0.853$