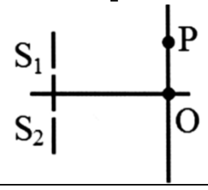
WAVE OPTICS

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



Column-I	Column-II
(A) Δx at P will	(P) increase
(B) Fringe width will	(Q) decrease
(C) Fringe pattern will	(R) remains same
(D) Number of fringes between O and P will	(S) Shift upwards
	(T) Shift downwards

(a) A→P; B→R; C→T; D→R
(b) A→Q; B→S; C→P; D→R
(c) A→T; B→Q; C→S; D→P
(d) A→S; B→P; C→T; D→Q

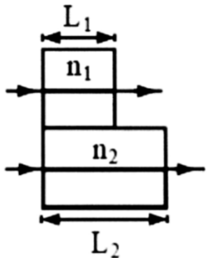
2. The interference pattern is obtained with two coherent light sources of intensity ratio η. The value of $\frac{I_{max}-I_{min}}{I_{max}+I_{min}}$ is-

(a) $\frac{2\sqrt{n}}{n+1}$ (b) $\frac{2\sqrt{n}}{n-1}$
(c) $\frac{2n}{\sqrt{n}+1}$ (d) $\frac{2n}{\sqrt{n}-1}$

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

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

4. Two waves of light in air have the same wavelength and are initially in phase. They then travel through plastic layers with thickness of L_1 = 3.5 μm and L_2 = 5.0 μm and indices of refraction n_1 = 1.7 and n_2 = 1.25 as shown in figure. The rays later arrive at a common point. The longest wavelength of light for which constructive interference occurs at the point is-



(a) 0.6 μm (b) 1.2 μm
(c) 2.4 μm (d) 0.3 μm

5. In Young's double slit experiment, 12 fringes are observed by light of λ = 600 nm ill a certain segment of the screen. If wavelength is changed to 400 nm then number of fringes in the same segment will be-

(a) 12 (b) 18
(c) 24 (d) 30

6. The contrast in the fringes in any interference pattern depends on -

(a) Fringe width
(b) Wavelength
(c) Intensity ratio of the sources
(d) Distance between the sources

7. Four independent waves are expressed as:

(i) $y_1 = a_1 \sin \omega t$ (ii) $y_2 = a_2 \sin 2\omega t$
(iii) $y_3 = a_3 \cos \omega t$ (iv) $y_4 = a_4 \sin (\omega t + \pi/3)$

The interference is possible between

(a) (i) and (ii) (b) (i) and (iv)
(c) (iii) and (iv) (d) Not possible at all

8. Two monochromatic light waves of amplitudes A and 2A interfering at a point, have a phase difference of 60°. The intensity at that point will be proportional to -

(a) $3A^2$ (b) $5A^2$
(c) $7A^2$ (d) $9A^2$

9. In Young's experiment, two coherent sources are placed 0.90 mm apart and the fringes are observed one meter away. If it produces the second dark fringe at a distance of 1 mm from central fringe the wavelength of monochromatic light used would be-

(a) 60×10^{-4} cm (b) 10×10^{-4}cm
(c) 10×10^{-5} cm (d) 6×10^{-5} cm

10. 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

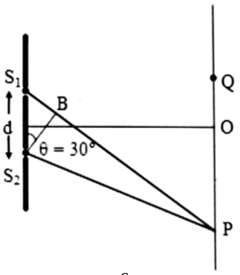
11. In an interference experiment monochromatic light is replaced by white light, we will see-

(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

12. In order that a thin film of oil floating on the surface of water should show colours due to interference, the thickness of the oil film should be of the order of -

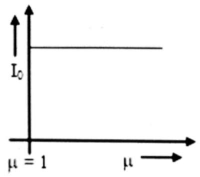
(a) 100 Å (b) 10,000 Å
(c) 1 mm (d) 1 cm

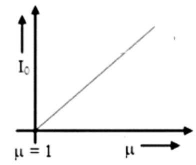
13. The double slit experiment of Young has been shown in figure. Q is the position of the first bright fringe on the right side and P is the 11th fringe on the other side as measured from Q. If wavelength of the light used is 6000Å, S_1B, will be equal to-

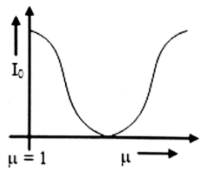


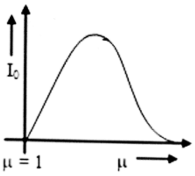
(a) 6×10^{-6} m (b) 6.6×10^{-6} m
(c) 3.138×10^{-7} m (d) 3.144×10^{-7} m

14. In a YDSE experiment if a slab whose refractive index can be varied is placed in front of one of the slits then the variation of resultant intensity at mid-point of screen with 'μ' will be best represented by ($\mu \geq 1$). [Assume slits of equal width and there is no absorption by slab]

(a) 

(b) 

(c) 

(d) 

15. **Statement-1:** The fringe obtained at the centre of the screen is known as zeroth order fringe, or the central fringe.
Statement-2 : Path difference between the wave from S_1 and S_2, reaching the central fringe (or zero order fringe) is zero.
(a) Both Statement -1 and Statement-2 are true
(b) Statement -1 is true and Statement-2 is false
(c) Statement-1 is false but Statement-2 is true.
(d) Both Statement-1 and Statement-2 are false.

16. A mixture of light waves having wavelength 560 nm & 400 nm falls normally on a YDSE setup. The distance between the slits is 0.1 mm and the distance of the screen from the slits is 1 m. Distance between two > successive total dark regions is-
(a) 4 mm (b) 14 mm
(c) 5.6 mm (d) 28 mm

17. In YDSE experiment, intensity at some point is 1/4th of the maximum intensity then angular position of this point is (d : separation between the slits & λ is the wavelength of light) -
(a) $\sin^{-1} \lambda/d$ (b) $\sin^{-1} \lambda/2d$
(c) $\sin^{-1} \lambda/3d$ (d) $\sin^{-1} \lambda/4d$

18. In a YDSE experiment, I_0 is given to be the intensity of the central bright fringe & β is the fringe width. Then, at a distance y from central bright fringe, the intensity will be -
(a) $I_0 \cos\left(\frac{\pi y}{\beta}\right)$ (b) $I_0 \cos^2\left(\frac{\pi y}{\beta}\right)$
(c) $I_0 \cos\left(\frac{2\pi y}{\beta}\right)$ (d) $I_0 \cos^2\left(\frac{\pi y}{2\beta}\right)$

19. In Young's double slit experiment's the amplitudes of two sources are 3a and a respectively. The ratio of intensities of bright and dark fringes will be -
(a) 3:1 (b) 9:1
(c) 2:1 (d) 4:1

20. A plane monochromatic light falls on a diaphragm normally on two slits separated by a distance of 2.5 mm. The fringe pattern formed on & screen at 1 m distance displaces due to glass plate (μ = 3/2) of thickness 10 μm placed in front of one slit. Then f value of displacement is -
(a) 1 mm (b) 2 mm
(c) 3 mm (d) 4 mm

21. In Young's double slit experiment, is the wavelength of light used, λ is the separation between the two slits and D is the distance of the screen from the slits. The fringe width would remain unchanged if-
(a) both λ and D are doubled
(b) both d and D are doubled
(c) D is doubled and d is halved
(d) λ is doubled and d is halved

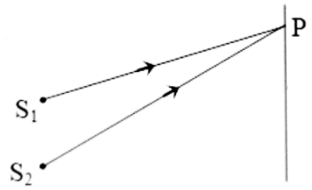
22. The distance between two slits is 1 mm, wavelength of light used is 7000 Å and distance between slit and screen is lm. Then distance between 3rd black and 5th bright fringe is -
(a) 1.75 cm (b) 1.75 mm
(c) 1.05 mm (d) 0.875 mm

23. An interference is observed due to two coherent sources A and B separated by a distance along Y-axis where λ is wavelength of source. A detector D is moved along the positive X-axis. The number of points on the X-axis excluding the points x = 0 and x = ∞ at which maximum will be observed is -
(a) 3 (b) 4
(c) 5 (d) 6

24. Two coherent monochromatic light beams of intensities I and 4 I 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

25. Figure shows Young's double slit apparatus. S_1 and S_2 are coherent sources emitting light of wavelength λ. Light waves are emitted from S_1 and S_2 in phase. A point P on the screen corresponds to position of 5^{th} maximum. What is the phase difference between waves when they arrive at P?

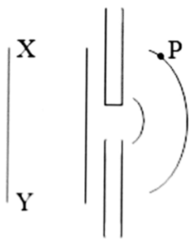


(a) 5π (b) 9π
(c) 10π (d) 15π

26. The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment is -
(a) three (b) five
(c) infinite (d) zero

27. An unpolarised beam of intensity I_0 is incident on a pair of nicol prisms making an angle of 60° with each other. The intensity of light emerging from the pair is-
(a) I_0 (b) $I_0/2$
(c) $I_0/4$ (d) $I_0/8$

28. A monochromatic plane wave of speed c and wavelength λ is diffracted at a small aperture. The diagram illustrates successive wavefronts. After what time will some portion of. the wavefront XY reach P?

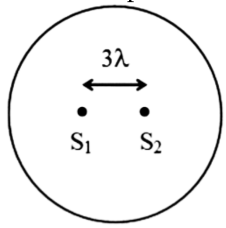


(a) $\frac{3\lambda}{2c}$ (b) $\frac{2\lambda}{c}$
(c) $\frac{3\lambda}{c}$ (d) $\frac{4\lambda}{c}$

29. If light of wavelength 4000Å incidents on a slit of width 0.5 mm and diffraction pattern is obtained on a screen 2m from slit then distance of first bright fringe from first dark ring-
(a) 1.2 mm (b) 0.8 mm
(c) 0.4 mm (d) none of these

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

31. If two coherent sources are placed at a distance 3λ from each other symmetric to the centre of the circle shown in the figure, then number of fringes shown on the screen placed along the circumference is -



(a) 16 (b) 12
(c) 8 (d) 4

32. 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) Bands become broader and farther apart
(d) Bands disappear

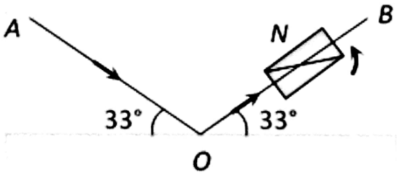
33. Yellow light is used in a single slit diffraction experiment with a slit of 0.6 mm. If yellow light is replaced by x-rays, than the observed pattern will reveal
(a) That the central maxima is narrower
(b) More number of fringes
(c) Less number of fringes
(d) No diffraction pattern

34. Light appears to travel in straight lines since
(a) It is not absorbed by the atmosphere
(b) It is reflected by the atmosphere
(c) It's wavelength is very small
(d) It's velocity is very large

35. One cannot obtain diffraction from a wide slit illuminated by a monochromatic light because
(a) The half period elements contained in a wide slit are very large so the resultant effect is general illumination
(b) The half period elements contained in a wide slit are small so the resultant effect is general illumination
(c) Diffraction patterns are superimposed by interference pattern and hence the result is general illumination
(d) None of these

36. In case of Fresnel diffraction
(a) Both source and screen are at finite distance from diffracting device
(b) Source is at finite distance while screen at infinity from diffraction device
(c) Screen is at finite distance while source at infinity from diffracting device
(d) Both source and screen are effectively at infinity from diffracting device

37. A beam of light AO is incident on a glass slab (μ = 1.54) in a direction as shown in figure. The reflected ray OB is passed through a Nicol prism oh viewing through a Nicole prism, we find on rotating the prism that



(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 change in intensity
(d) The intensity gradually reduces to zero and then again increases

38. The transverse nature of light is shown by
(a) Interference of light
(b) Refraction of light
(c) Polarisation of light
(d) Dispersion of light

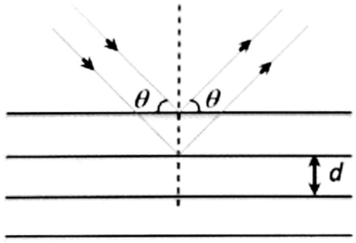
39. Which is incorrect with reference to polarisation by reflection
(a) The degree of polarisation varies with the angle of incidence
(b) Percentage of the polarising light in the reflected beam is the greatest at the angle of polarisation
(c) Reflected light is plane polarised in the plane of incidence
(d) Reflected light is plane polarised in the plane perpendicular to plane of incidence

40. Diffraction effects are easier to notice in the case of sound waves than in the case of light waves because
(a) Sound waves are longitudinal
(b) Sound is perceived by the ear
(c) Sound waves are mechanical waves
(d) Sound waves are of longer wavelength

41. What will be the angle of diffracting for the first minimum due to Fraunhoffer diffraction with sources of light of wave length 550 nm and slit of width 0.55 mm
(a) 0.001 rad (b) 0.01 rad
(c) 1 rad (d) 0.1 rad

42. In Young's double slit experiment the distance d between the slits S_1 and S_2 is 1 mm. What should be the width of each slit be so as to obtain 10 maxima of the two slit interference pattern with in the central maximum of the single slit diffraction pattern
(a) 0.1 mm (b) 0.2 mm
(c) 0.3 mm (d) 0.4 mm

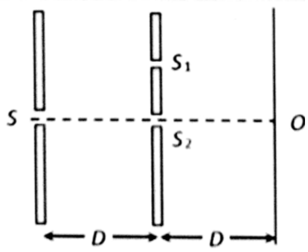
43. A beam with wavelength λ falls on a stack of partially reflecting planes with separation d. The angle θ that the beam should make with the planes so that the beams reflected from successive planes may interfere constructively is (where n = 1, 2, ...)



(a) $\sin^{-1}\left(\frac{n\lambda}{d}\right)$ (b) $\tan^{-1}\left(\frac{n\lambda}{d}\right)$
(c) $\sin^{-1}\left(\frac{n\lambda}{2d}\right)$ (d) $\cos^{-1}\left(\frac{n\lambda}{2d}\right)$

44. In a double slit experiment interference is obtained from electron waves produced in an electron gun supplied with voltage if A is the wavelength of the beam, D is the distance of screen, d is the spacing between coherent source, h is Planck's constant, e is charge on electron and m is mass of electron then fringe width is given as
(a) $\frac{hD}{\sqrt{2meV}d}$ (b) $\frac{2hD}{\sqrt{meV}d}$
(c) $\frac{hd}{\sqrt{2meV}D}$ (d) $\frac{2hd}{\sqrt{2meV}D}$

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



(a) $\sqrt{\frac{3\lambda D}{2}}$ (b) $\sqrt{\lambda D}$
(c) $\sqrt{\frac{\lambda D}{2}}$ (d) $\sqrt{3\lambda D}$

46. Three waves of equal frequency having amplitudes 10μm, 4μm, 7μm arrive at a given point with successive phase difference of $\pi/2$ the amplitude of the resulting wave in pm is given by
(a) 4 (b) 5
(c) 6 (d) 7

47. A beam of light consisting of two wavelengths 650nm and 520nm is used to illuminate the slit of a Young's double slit experiment. Then the order of the bright fringe of the longer; wavelength that coincide

with a bright fringe of the shorter wavelength at the least distance from the central maximum is
(a) 1 (b) 2
(c) 3 (d) 4

48. Two identical radiators have a separation of d = $\lambda/4$ where λ is If the wavelength of the waves emitted by either source. The initial phase difference between the sources is $\pi/4$. Then the intensity on the screen at a distant point situated at an angle $\theta = 30°$ from the radiators is (here I_0 is intensity at that point due to one radiator alone)
(a) I_0 (b) $2I_0$
(c) $3I_0$ (d) $4I_0$

49. In Young's double slit experiment, the 8th maximum with wavelength λ_1 is at a distance d_1 from the central maximum and the 6th maximum with a wavelength λ_2 is at a distance d_2. Then (d_1/d_2) is equal to
(a) $\frac{4}{3}\left(\frac{\lambda_2}{\lambda_1}\right)$ (b) $\frac{4}{3}\left(\frac{\lambda_1}{\lambda_2}\right)$
(c) $\frac{3}{4}\left(\frac{\lambda_2}{\lambda_1}\right)$ (d) $\frac{3}{4}\left(\frac{\lambda_1}{\lambda_2}\right)$

50. Light of wavelength 500 nm is used to form interference pattern in Young's double slit experiment. A uniform glass plate of refractive index 1.5 and thickness 0.1 mm is introduced in the path of one of the interfering beams. The number of fringes which will shift the cross wire due to this is
(a) 100 (b) 200
(c) 300 (d) 400