# Exercise-1

## ONLY ONE OPTION CORRECT TYPE

### SECTION (A) : PRINCIPLE OF SUPERPOSITION, PATH DIFFERENCE, WAVEFRONTS, AND COHERENCE

**1.** Ratio of intensities of two light waves is given by 4 : 1. The ratio of the amplitudes of the waves is :
(1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 4

**2.** Two coherent monochromatic light beams of intensities I and 4I are superposed; the maximum and minimum possible intensities in the resulting beam are :
(1) 5I and I (2) 5I and 3I (3) 9I and I (4) 9I and 3I

**3.** Two sources of waves are called coherent if:-
(1) Both have the same amplitude of vibrations
(2) Both produce waves of the same wavelength
(3) Both produce waves of the same wavelength having constant phase difference
(4) Both produce waves having the same velocity

**4.** The meaning of wave front is:-
(1) All the particles on its surface vibrate in same phase
(2) All the particles on its surface vibrate in opposite phase
(3) Some particles vibrate in same phase and some in opposite phase
(4) None of the above

**5.** Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are
**[IIT-JEE 1988; RPMT 1995; AIIMS 1997; MP PMT 1997; MP PET 1999; BHU 2002; KCET 2000, 05]**
(1) 5I and I (2) 5I and 3I (3) 9I and I (4) 9I and 3I

**6.** 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 **[IIT JEE (Screening) 2001]**
(1) 2I (2) 4I (3) 5I (4) 7I

**7.** The phase difference between incident wave and reflected wave is 180° when light ray : **[RPMT 2001]**
(1) incident on glass from air (2) incident on air from glass
(3) incident on glass from diamond (4) incident on water from glass

**8.** Which one of the following statement is true ? **[AIPMT2006]**
(1) Both light and sound waves in air are transverse
(2) The sound waves in air are longitudinal while the light waves are transvers
(3) Both light and sound waves in air are longitudinal
(4) Both light and sound waves can travel in vacuum

**9.** Two waves have equations : **[AIPMT2007]**
$y_1$ = 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?
(1) $\frac{2\pi}{3}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$

**10.** Two periodic waves of intensities $I_1$ and $I_2$ pass through a region at the same time in the same direction. The sum of the maximum and minimum intensities is **[AIPMT-2008]**

(1) $I_1 + I_2$ (2) $(\sqrt{I_1}+\sqrt{I_2})^2$ (3) $(\sqrt{I_1}-\sqrt{I_2})^2$ (4) $2(I_1+I_2)$

**11.** Two points are located at a distance of 10 m and 15 m from the source of oscillation. The period of oscillation is 0.05 s and the velocity of the wave is 300 m/s. What is the phase difference between the oscillations of two points? **[AIPMT-2008]**

(1) $\frac{\pi}{3}$ (2) $\frac{2\pi}{3}$ (3) $\pi$ (4) $\frac{\pi}{6}$

**12.** Electromagnetic waves are transverse in nature is evident by **[AIEEE-2002]**

(1) polarization (2) interference (3) reflection (4) diffraction

**13.** To demonstrate the phenomenon of interference we require two sources which emit radiation of **[AIEEE-2003]**

(1) nearly the same frequency
(2) the same frequency
(3) different wavelength
(4) the same frequency and having a definite phase relationship

## SECTION (B) : YDSE WITH MONOCHROMATIC LIGHT

**1.** The contrast in the fringes in any interference pattern depends on :

(1) Fringe width (2) Wavelength
(3) Intensity ratio of the sources (4) Distance between the sources

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

(1) fringe width will decrease. (2) fringe width will increase.
(3) fringe width will remain unchanged. (4) fringes will become less intense.

**3.** Young's experiment is performed in air and then performed in water, the fringe width:-

(1) Will remain same (2) Will decrease
(3) Will increase (4) All the above types of waves

**4.** In Young's double slit experiment, the phase difference between the light waves reaching third bright fringe from the central fringe will be [$\lambda$ = 6000 $A_0$]:-

(1) Zero (2) $2\pi$ (3) $4\pi$ (4) $6\pi$

**5.** Interference was observed in interference chamber when air was present, now the chamber is evacuated and if the same light is used, a careful observer will see **[CBSE PMT 1993; DPMT 2000; BHU 2002]**

(1) No interference
(2) Interference with bright bands
(3) Interference with dark bands
(4) Interference in which width of the fringe will be slightly increased

**6.** In double slits experiment, for light of which colour the fringe width will be minimum:-

(1) Violet (2) Red (3) Green (4) Yellow

**7.** If two line slits are illuminated by a wavelength $5 \times 10^{-7}$ m and the distance between two bright fringes is 0.005 m on a screen 1 m away, then the distance between the slits is:-

(1) 10 cm (2) 1 cm (3) $10^{-1}$ cm (4) $10^{-2}$ cm

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

(1) $2 \times 10^{-4}$ m (2) $1 \times 10^{-4}$ m (3) $0.5 \times 10^{-4}$ m (4) $8 \times 10^{-4}$ m

**9.** Fringe width observed in the Young's double slit experiment is β. If the frequency of the source is doubled, the fringe width will :

(1) become 2 β (2) become $\frac{3\beta}{2}$ (3) remain as β (4) become $\frac{\beta}{2}$

**10.** The distance between two slits in a double slit experiment is 1 mm. The distance between the slits and the screen is 1 m. If the distance of 10th fringe from the central fringe is 5 mm, then the wavelength of light is:-

(1) 5000 $A^0$ (2) 6000 $A^0$ (3) 7000 $A^0$ (4) 8000 $A^0$

**11.** If the slit distance in Young's double slit experiment is reduced to $\frac{1}{3}$ rd, the fringe width becomes n times. The value of n is:

(1) 3 (2) 1/3 (3) 9 (4) 1/9

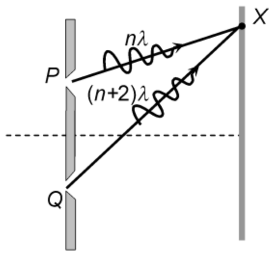
**12.** In Young's double slit experiment, if the slit widths are in the ratio 1 : 9, then the ratio of the intensity at minima to that at maxima will be **[MP PET 1987]**

(1) 1 (2) 1/9 (3) 1/4 (4) 1/3

**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 2 m away is

(1) 0.25 mm (2) 0.1 mm (3) 1.0 mm (4) 0.01 mm

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




(1) First bright (2) First dark (3) Second bright (4) Second dark

**15.** In Young's double slit experiment, a glass plate is placed before a slit which absorbs half the intensity of light. Under this case

(1) The brightness of fringes decreases
(2) The fringe width decreases
(3) No fringes will be observed
(4) The bright fringes become fainter and the dark fringes have finite light intensity

**16.** In double slit experiment, the angular width of the fringes is 0.20° for the sodium light (λ =5890 Å). In order to increase the angular width of the fringes by 10%, the necessary change in the wavelength is

(1) Increase of 589 Å (2) Decrease of 589 Å (3) Increase of 6479 Å (4) Zero **[MP PMT 1997]**

**17.** 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 **[RPET 1997]**

(1) 54 (2) 64 (3) 74 (4) 84

**18.** If in a Young's double slit experiment, the slit distance is 3 cm, the separation between slits and screen is 70cm and wavelength of light is 1000 Å, then fringe width will be **[RPMT 2004]**
(1) $2 \times 10^{-5}$ m (2) $2 \times 10^{-3}$ m (3) $0.2 \times 10^{-3}$ m (4) none of these

**19.** Seperation between slits is halved and between screen and slits is doubled. Final fringe width if original is w : **[RPMT 2006]**
(1) w (2) 9w (3) 4w (4) 2w

**20.** The maxium number of possible interference maxima for slit – separation equal to twice the wavelength in Young' s double slit experiment is **[RPMT-2008]**
(1) infinite (2) five (3) three (4) zero

**21.** To demonstrate the phenometion of interference we require two sources which emit radiations of **[RPMT-2008]**
(1) nearly the same frequency
(2) the same frequency
(3) different wavelegth
(4) the same frequency and having a defnite phase relationship

**22.** Monochromatic light of frequency $5 \times 10^{14}$ Hz travelling in vacuum enters medium of refractive index 1.5. Its wavelength in the medium is **[RPMT-2009]**
(1) 4000 Å (2) 5000 Å (3) 6000 Å (4) 5500 Å

**23.** In Young's double slit experiment when wavelength used 6000 $A^0$ and the screen is 40 cm from the slits, the fringes are 0.012 cm apart. What is the distance between the slits:–
(1) 0.024 cm (2) 2.4 cm (3) 0.24 cm (4) 0.2 cm

**24.** The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment is **[AIEEE - 2004]**
(1) infinite (2) five (3) three (4) zero

**25.** A young's double slit experiment uses a monochromatic source. The shape of the interference fringes formed on a screen. **[AIEEE - 2005]**
(1) Straight line (2) Parabola (3) Hyperbola (4) Circle

**26.** In a Young's double slit experiment the intensity at a point where the path difference is $\frac{\lambda}{6}$ (λ being the wavelength of the light used) is I. If $I_0$ denotes the maximum intensity, $I/I_0$ is equal to:**[AIEEE - 2007]**
(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{\sqrt{3}}{2}$ (3) $\frac{1}{2}$ (4) $\frac{3}{4}$

**27.** In Young's double slit experiment an electron beam is used to form a fringe pattern instead of light. If speed of the electrons is increased then the fringe width will : **[JEE 2005 [Screening] 3/84]**
(1) increase (2) decrease
(3) remains same (4) no fringe pattern will be formed

## SECTION (C) : YDSE WITH POLYCHROMATIC LIGHT

**1.** What happens by the use of white light in Young's double slit experiment:-
(1) Bright fringes are obtained
(2) Only bright and dark fringes are obtained
(3) Central fringes is bright and two or three coloured and dark fringes are observed
(4) None of the above

**2.** The length of the optical path of two media in contact of length $d_1$ and $d_2$ of refractive indices $\mu_1$ and $\mu_2$ respectively, is

(1) $\mu_1 d_1 + \mu_2 d_2$ (2) $\mu_1 d_2 + \mu_2 d_1$ (3) $\frac{d_1 d_2}{\mu_1 \mu_2}$ (4) $\frac{d_1 + d_2}{\mu_1 \mu_2}$

## SECTION (D) : YDSE WITH GLASS SLAB, OPTICAL PATH, THIN FILM INTERFERENCE

**1.** In Young's experiment, light wavelength 4000 $A_0$ is used, and fringes are formed at 2 metre distance and has a fringe width of 0.6 mm. If whole of the experiment is performed in a liquid of refractive index 1.5, then width of fringe will be:-

(1) 0.2 mm (2) 0.3 mm (3) 0.4 mm (4) 1.2 mm

**2.** The slits in a Young's double slit experment have equal widths and the source is placed symmetrically relative to the slits. The intensity at the central fringe is $I_0$. If one of the slits is closed, the intensity at this ponit will be:

(1) $I_0$ (2) $I_0/4$ (3) $I_0/2$ (4) $4I_0$

**3.** A thin mica sheet of thickness $2 \times 10^{-6}$ m and refractive index ($\mu$ = 1.5) is introduced in the path of the first wave. The wavelength of the wave used is 5000Å. The central bright maximum will shift **[CPMT1999]**

(1) 2 fringes upward (2) 2 fringes downward (3) 10 fringes upward (4) None of these

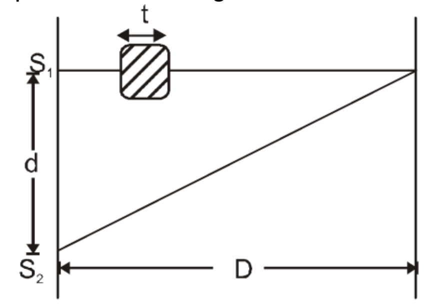
**4.** Colours of thin films results from:-

(1) Dispersion of light (2) Interference if light
(3) Absorption of light (4) Scattering of light

**5.** White light may be considered to be a mixture of waves with $\lambda$ ranging between 3900 Å and 7800 Å. An oil film of thickness 10,000 Å is examined normally by reflected light. If $\mu$ = 1.4, then the film appears bright for

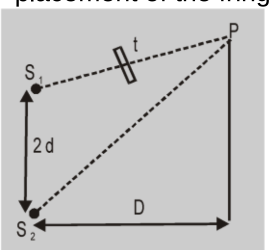
(1) 4308 Å, 5091 Å, 6222 Å (2) 4000 Å, 5091 Å, 5600 Å
(3) 4667 Å, 6222 Å, 7000 Å (4) 4000 Å, 4667 Å, 5600 Å, 7000Å

**6.** If a mica sheet of thickness t and refractive index $\mu$ is placed in the path of one of interfering beam in a double slit experiment then displacement of fringes will be : **[RPMT 2003]**




(1) $\frac{D}{d}\mu t$ (2) $\frac{D}{d}(\mu-1)t$ (3) $\frac{D}{d}(\mu+1)t$ (4) $\frac{D}{d}(\mu^2-1)t$

**7.** If a thin mica sheet of thickness t and refractive index $\mu$ = [5/3] is placed in the path of one of the interfering beams as shown in fig. then the distance placement of the fringe system is-




(1) $\frac{Dt}{3d}$ (2) $\frac{Dt}{5d}$ (3) $\frac{Dt}{4d}$ (4) $\frac{2Dt}{5d}$

**8.** A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 mm and refractive index 1.5 in introduced in the path of the upper beam. The location of the central maximum will **[AIPMT 2003]**

(1) Remain unshifted (2) Shift downward by nearly two fringes
(3) Shift upward by nearly two fringes (4) Shift downward by 10 fringes

## SECTION (E) : FRESNAL BIPRISM AND DIFFRACTION OF LIGHT

**1.** In Fresnel's biprism ($\mu$ = 1.5) experiment the distance between source and biprism is 0.3 m and that between biprism and screen is 0.7m and angle of prism is 1°. The fringe width with light of wavelength 6000 Å will be **[RPMT 2002]**

(1) 3 cm (2) 0.011 cm (3) 2 cm (4) 4 cm

**2.** In a Fresnel biprism experiment, the two positions of lens give separation between the slits as 16 cm and 9 cm respectively. What is the actual distance between the slits?

(1) 10.5 cm (2) 12 cm (3) 13 cm (4) 14 cm

**3.** What is effect on fresnel biprism experiment when the white light is used:-

(1) Fringe are effected
(2) Diffraction pattern is spreaded more
(3) Central fringes are white and all others are coloured
(4) None of these

**4.** A slit of width a is illuminated by light. For red light ($\lambda$ = 6500Å), the first minima is obtained at $\theta$ = 30° Then the value of a will be **[MP PMT 1987; CPMT 2002]**

(1) 3250 Å (2) $6.5\times10^{-4}$ mm (3) 1.3 µm (4) $2.6\times10^{-4}$ cm

**5.** 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 **[MP PMT 1987; CPMT 2002]**

(1) 0.36° (2) 0.18° (3) 0.72° (4) 0.09°

**6.** A slit of size 0.15 cm is placed at 2.1 m from a screen. On illuminated it by a light of wavelength $5 \times 10^{-5}$ cm. The width of central maxima will be. **[RPMT1999]**

(1) 70 mm (2) 0.14 mm (3) 1.4 mm (4) 0.14 cm

**7.** A diffraction is obtained by using a beam of red light. What will happen if the red light is replaced by the blue light. **[KCET 2000; BHU 2001]**

(1) Bands will narrower and crowd full together (2) Bands become broader and further apart
(3) No change will take place (4) Bands disappear

**8.** 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. **[Pb.PMT 2001]**

(1) 0.001 rad (2) 0.01 rad (3) 1 rad (4) 0.1 rad

**9.** Angular width ($\beta$)of central maximum of a diffraction pattern on a single slit does not depend upon **[AMU (Med) 2002]**

(1) Distance between slit and source (2) Wavelength of ligth used
(3) Width of the slit (4) Frequency of light used

**10.** A single slit of width 0.20 mm is illuminated with light of wavelength 500nm.The observing screen is placed 80 cm from the slit.The width of the central bright fringe will be

(1) 1mm (2) 2mm (3) 4mm (4) 5mm

**11.** 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 **[RPMT 2001]**

(1) 6mm (2) 12mm (3) 3mm (4) 9mm

**12.** Yellow light is used in single slit diffraction experiment with slit width 0.6 mm. If yellow light is replaced by X-rays then the pattern will reveal **[IIT-JEE (Screening) 1999; MP PMT 2002; KCET 2003]**
(1) That the central maxima is narrower (2) No diffraction pattern
(3) More number of fringes (4) Less number of fringes

**13.** 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 **[IIT-JEE 1994; KCET 2004]**
(1) 1.2 mm (2) 1.2 cm (3) 2.4 cm (4) 2.4 mm

**14.** In the far field diffraction pattern of a single slit under polychromatic illumination, the first minimum with the wavelength $\lambda_1$ is found to be coincident with the third maximum at $\lambda_2$. So
(1) $3\lambda_1 = 0.3\lambda_2$ (2) $3\lambda_1 = \lambda_2$ (3) $\lambda_1 = 3.5\lambda_2$ (4) $0.3\lambda_1 = 3\lambda_2$

**15.** If in Fraunhofer diffraction due to a single slit, the slit width is increased, the width of the central maximum will
(1) increase
(2) decrease
(3) not change
(4) change depending upon the wave length of light used

**16.** A slit of size 0.15 cm is placed at 2.1 m from a screen. On illuminated it by a light of wavelength 5 x $10^{-5}$ cm. The width of diffraction pattern will be:-
(1) 70 mm (2) 0.14 mm (3) 1.4 cm (4) 0.14 cm

**17.** What is the effect on Fresnel's biprism experiment when the use of white light is made **[RPMT 1998]**
(1) Fringe are affected (2) Diffraction pattern is spread more
(3) Central fringe is white and all are coloured (4) none of these

**18.** A slit of size 0.15 cm is placed at 2.1 m form a screen. On illuminated it by a light of wavelength 5 × $10^{-5}$ cm. The width of central maxima will be **[RPMT 1999]**
(1) 70 mm (2) 0.14 mm (3) 1.4 mm (4) 0.14 cm

**19.** Diameter of human eye lens is 2 mm, what will be the minimum distance between two points to resolve them, which are situated at a distance of 50 meter from eye. The wavelength of light is 5000 Å: **[AIPMT2002]**
(1) 2.32 m (2) 4.28 mm (3) 1.25 cm (4) 12.48 cm

**20.** If $I_0$ is the intensity of the principal maximum in the single slit diffraction pattern, then what will be its intensity when the slit width is doubled ? **[AIEEE-2005]**
(1) $I_0$ (2) $I_0/2$ (3) $2I_0$ (4) $4I_0$

## SECTION (F) : POLARISATION

**1.** The angle of polarisation for any medium is 60° what will be critical angle for this **[UPSEAT 1999]**
(1) $\sin^{-1}\sqrt{3}$ (2) $\tan^{-1}\sqrt{3}$ (3) $\cos^{-1}\sqrt{3}$ (4) $\sin^{-1}\frac{1}{\sqrt{3}}$

**2.** The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refraction index) **[AIEEE2004;UPSEAT2005]**
(1) $\sin^{-1}(n)$ (2) $\sin^{-1}\left(\frac{1}{n}\right)$ (3) $\tan^{-1}\left(\frac{1}{n}\right)$ (4) $\tan^{-1}(n)$

**3.** A polaroid is placed at 45° to an incoming light of intensity $I_0$. Now the intensity of light passing through polaroid after polarisation would be **[CPMT1995]**
(1) $I_0$ (2) $I_0/2$ (3) $I_0/4$ (4) Zero

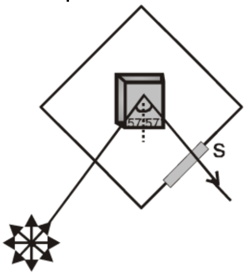
**4.** Plane polarised light is passed through a polaroid. On viewing through the polaroid we find that when the polariod is given one complete rotation about the direction of the light one of the following is observed **[MNR1993]**

(1)The intensity of light gradually decreases to zero and remains at zero
(2) The intensity of light gradually increases to a maximum and remains at maximum
(3)There is no change in intensity
(4) The intensity of light is twice maximum and twice zero

**5.** A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewster's angle $\phi$. If $\mu$ reprents the refractive index of glass with respect to air then the angle between reflected and refracted rays is **[CPMT1989]**

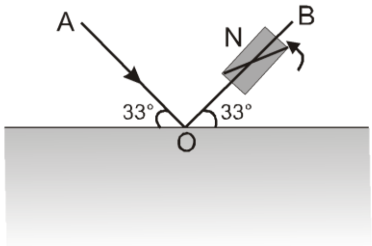
(1) $90 + \phi$ (2) $\sin^{-1}(\mu\cos\phi)$ (3) 90° (4) $90° - \sin^{-1}(\sin\phi/\mu)$

**6.** Figure represents a glass plate placed vertically on a horizontal table with a beam of unpolarised light falling on its surface at the polarising angle of 57° with the normal. The electric vector in the reflected light on screen S will vibrate with respect to the plane of incidence in a **[CPMT1988]**




(1)Vertical plane
(2) Horizontal plane
(3) Plane making an angle of 45° with the vertical
(4) Plane making an angle of 57° with the horizontal

**7.** A beam of light AO is incident on a glass slab ($\mu$= 1.54) in a direction as shown in figure. The reflected ray OB is passed through a Nicol prism. On viewing through a Nicole prism we find on rotating the prism that **[CPMT1986]**




(1) The intensity is reduced down to zero and remains zero
(2) The intensity is reduced down some what and rises again
(3) There is no change in intensity
(4) The intensity gradually reduces to zero and then again increases

**8.** In the propagation of electromagnetic waves the angle between the direction of propagation and plane of polarisation is **[CPMT1978]**

(1) 0° (2) 45° (3)90° (4) 180°

**9.** Unpolarized light falls on two polarizing sheets placed one on top of the other. What must be the angle between the characteristic directions of the sheets if the intensity of the final transmitted light is one-third the maximum intensity of the first transmitted beam

(1) 75° (2) 55° (3) 35° (4) 15°

**10.** Unpolarized light of intensity $32Wm^{-2}$ passes through three polarizers such that transmission axes of the first and second polarizer makes and angle 30° with each other and the transmission axis of the last polarizer is crossed with that of the first. The intensity of final emerging light will be
(1) $32\ Wm^{-2}$ (2) $3\ Wm^{-2}$ (3) $8\ Wm^{-2}$ (4) $4\ Wm^{-2}$

**11.** Two polaroids are placed in the path of unpolarized beam of intensity $I_0$ such that no light is emitted from the second polaroid. If a third polaroid whose polarization axis makes an angle θ with the polarization axis of first polaroid, is placed between these polaroids then the intensity of light emerging from the last polaroid will be **[UPSEAT 2005]**
(1) $\left(\frac{I_0}{8}\right)\sin^2 2\theta$ (2) $\left(\frac{I_0}{4}\right)\sin^2 2\theta$ (3) $\left(\frac{I_0}{2}\right)\cos^4 \theta$ (4) $I_0 \cos^4 \theta$

**12.** A beam of natural light falls on a system of 6 polaroids, which are arranged in succession such that each polaroid is turned through 30° with respect to the preceding one. The percentage of incident intensity that passes through the system will be
(1) 100% (2) 50% (3) 30% (4) 12%

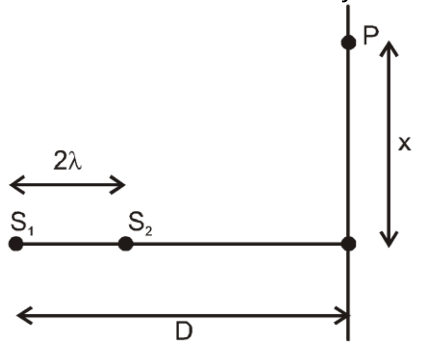
**13.** When an unpolarized light of intensity $I_0$ is incident on a polarizing sheet, the intensity of the light which does not get transmitted is **[AIEEE - 2005]**
(1) zero (2) $I_0$ (3) $\frac{1}{2}I_0$ (4) $\frac{1}{4}I_0$

# Exercise-2

## ONLY ONE OPTION CORRECT TYPE

**1.** The distance between two successive atomic planes of a calcite crystal is 0.3 nm. The minimum angle for Brag scattering of 0.3 Å X-rays will be **[RPMT-2007]**
(1) 1.43° (2) 1.56° (3) 2.86° (4) 30°

**2.** Two coherent sources $S_1$ and $S_2$ having same phase, emit light of wavelength λ. The separation between $S_1$ and $S_2$ is 2λ. The light of collected on a screen placed at a distance D > > λ from slit $S_1$ as shown in figure. Find the minimum distance so that the intensity at P is equal to intensity at O.

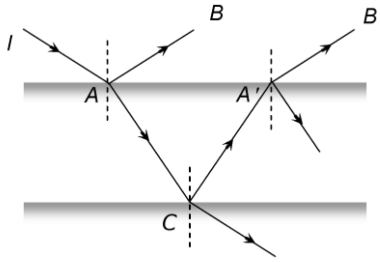



(1) $\frac{D}{\sqrt{2}}$ (2) $\sqrt{2}D$ (3) $\frac{D}{\sqrt{3}}$ (4) $D\sqrt{3}$

**3.** What happens to the fringe pattern when the Young's double slit experiment is performed in water instead or air then fringe width **[AFMC 2005]**
(1) Shrinks (2) Disappear (3) Unchanged (4) Enlarged

**4.** Due to effect of interference, floating oil layer in water is visible in coloured, for observation of this event the thickness of oil layer should be : **[RPMT 2002, 2004]**
(1) 100 nm (2) 1000 nm (3) 1 mm (4) 10 mm

**5.** A ray of light of intensity I is incident on a parallel glass-slab at a point A as shown in fig. It undergoes partial reflection and refraction. At each reflection 25% of incident energy is reflected. The rays AB and A'B' undergo interference. The ratio $I_{max}/I_{min}$ is **[IIT 1990]**




(1) 4 : 1 (2) 8 : 1 (3) 7 : 1 (4) 49 : 1

**6.** In Young's double slit experiment, the intensity on the screen at a point where path difference is λ is K. What will be the intensity at the point where path difference is λ/4 **[RPET 1996]**

(1) $\frac{K}{4}$ (2) $\frac{K}{2}$ (3) K (4) Zero

**7.** When one of the slits of Young's experiment is covered with a transparent sheet of thickness 4.8 mm, the central fringe shifts to a position originally occupied by the $30^{th}$ bright fringe. What should be the thickness of the sheet if the central fringe has to shift to the position occupied by $20^{th}$ bright fringe **[KCET 2002]**

(1) 3.8 mm (2) 1.6 mm (3) 7.6 mm (4) 3.2 mm

**8.** 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 $\lambda = 2000\,\text{Å}$ and d = 7000 Å

(1) 12 (2) 7 (3) 18 (4) 4

**9.** In a single slit diffraction of light of wavelength λ by a slit of width e, the size of the central maximum on a screen at a distance b is

(1) $2b\lambda + e$ (2) $\frac{2b\lambda}{e}$ (3) $\frac{2b\lambda}{e} + e$ (4) $\frac{2b\lambda}{e} - e$

**10.** Among the two interfering monochromatic sources A and B; A is ahead of B in phase by 66°. If the observation be taken from point P, such that PB – PA = λ/4. Then the phase difference between the waves from A and B reaching P is

(1) 156° (2) 140° (3) 136° (4) 126°

**11.** In an experiment the two slits are 0.5 mm apart and the fringes are observed to 100 cm from the plane of the slits. The distance of the 11th bright fringe from the Ist bright fringe is 9.72 mm. Calculate the wavelength-

(1) $4.86 \times 10^{-5}$ cm (2) $4.86 \times 10^{-8}$ cm (3) $4.86 \times 10^{-6}$ cm (4) $4.86 \times 10^{-7}$ cm

**12.** In the Young's double slit experiment, a mica slip of thickness t and refractive index μ is introduced in the ray from the first source $S_1$. By how much distance, the fringe pattern will be displaced-[d= separation between slits]

(1) $\frac{d}{D}(\mu-1)\,t$ (2) $\frac{D}{d}(\mu-1)\,t$ (3) $\frac{d}{(\mu-1)D}$ (4) $\frac{D}{d}(\mu-1)$

**13.** 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 :

(1) X(blue) = X(green) (2) X(blue) > X(green)

(3) X(blue) < X(green) (4) $\frac{X(\text{blue})}{X(\text{green})} = \frac{5460}{4360}$

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

(1) 0.65 mm (2) 1.63 mm (3) 3.25 mm (4) 4.88 mm

**15.** A two slit Young's interference experiment is done with monochromatic light of wavelength 6000 Å. The slits are 2 mm apart. The fringes are observed on a screen placed 10 cm away from the slits. Now a transparent plate of thickness 0.5 mm is placed in front of one of the slits and it is found that the interference pattern shifts by 5 mm. The refractive index of the transparent plate is : **[REE 1985]**

(1) 1.2 (2) 0.6 (3) 2.4 (4) 1.5

**16.** In the Young's experiment, using light of $\lambda$ = 5893 $A_0$, 62 fringes are observed in the field of view. How many fringes will be formed in the field of view for wavelength of 5461 $A_0$:-

(1) 62 (2) 66 (3) 67 (4) 68

**17.** In two separate set-ups of the Young's double-slit experiment, fringes of equal width are observed when lights of wavelengths in the ratio 1 : 2 are used. If the ratio of the slit separation in the two cases is 2 : 1, the ratio of the distances between the plane of the slits and the screen in the two set-ups is:-

(1) 4 : 1 (2) 1 : 1 (3) 1 : 4 (4) 2 : 1

**18.** White light is incident normally on a glass plate (in air) of thickness 500 nm and refractive index of 1.5. The wavelength (in nm) in the visible region (400 nm - 700nm) that is strongly reflected by the plate is:

(1) 450 (2) 600 (3) 400 (4) 500

**19.** Which of the following phenomena exhibits particle's nature of light ? **[AIPMT 2001]**

(1) Interference (2) Diffraction (3) Polarisation (4) Photoelectric effect

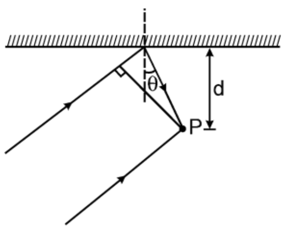
**20.** In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then, in the interference pattern **[JEE' 2000 (Screening), 1/35]**

(1) the intensities of both the maxima and the minima increase
(2) the intensity of the maxima increases and the minima has zero intensity
(3) the intensity of the maxima decreases and that of the minima increases
(4) the intensity of the maxima decreases and the minima has zero intensity.

**21.** 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 $\lambda$), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is:
**[JEE 2002 Screening, 3/90]**

(1) $2\lambda$ (2) $2\lambda/3$ (3) $\lambda/3$ (4) $\lambda$

**22.** A parallel beam of light of wavelength $\lambda$ is incident on a plane mirror at an angle $\theta$ as shown in the figure. With maximum intensity at point P, which of the following relation is correct.
**[JEE 2003 Screening, 3/90]**




(1) $\cos\theta - \sec\theta = \frac{\lambda}{4d}$ (2) $\cos\theta = \frac{\lambda}{4d}$

(3) $\cos\theta - \sin\theta = \frac{\lambda}{d}$ (4) $\cos\theta = \frac{\lambda}{2d}$

**23.** In a YDSE arrangement composite lights of different wavelengths $\lambda_1$ = 560 nm and $\lambda_2$ = 400 nm are used. If D = 1m, d = 0.1 mm. Then the distance between two completely dark regions is : **[JEE 2004 Screening, 3/84]**

(1) 4 mn (2) 5.6 mm (3) 14 mm (4) 28 mm

**24.** In Young's double slit experiment an electron beam is used to form a fringe pattern instead of light. If speed of the electrons is increased then the fringe width will : **[JEE 2005 Screening 3/84 ]**

(1) increase (2) decrease
(3) remains same (4) no fringe pattern will be formed

**25.** In Young's double slit experiment maximum intensity is I than the angular position where the intensity becomes $\frac{I}{4}$ is : **[JEE 2005 Screening 3/84 ]**

(1) $\sin^{-1}\left(\frac{\lambda}{d}\right)$ (2) $\sin^{-1}\left(\frac{\lambda}{3d}\right)$ (3) $\sin^{-1}\left(\frac{\lambda}{2d}\right)$ (4) $\sin^{-1}\left(\frac{\lambda}{4d}\right)$

**26.** Young's double slit experiment is carried out by using green, red and blue light, one color at time. The fringe widths recorded are $\beta_G$, $\beta_R$ and $\beta_B$, respectively. Then **[IIT-JEE-2012, Paper-1; 3/70, –1]**

(1) $\beta_G > \beta_B > \beta_R$ (2) $\beta_B > \beta_G > \beta_R$ (3) $\beta_R > \beta_B > \beta_G$ (4) $\beta_R > \beta_G > \beta_B$

**27.** A light source, which emits two wavelengths $\lambda_1$ = 400 nm and $\lambda_2$ = 600 nm, is used in a Young's double slit experiment. If recorded fringe widths for $\lambda_1$ and $\lambda_2$ are $\beta_1$ and $\beta_2$ and the number of fringes for them within a distance y on one side of the central maximum are $m_1$ and $m_2$, respectively, then the incorrect statment is

(1) $\beta_2 > \beta_1$
(2) $m_1 > m_2$
(3) From the central maximum, $3^{rd}$ maximum of $\lambda_2$ overlaps with $5^{th}$ minimum of $\lambda_1$
(4) The angular separation of fringes for $\lambda_1$ is greater than $\lambda_2$

# Exercise-3

## PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS )

**1.** In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelength λ1 = 12000 Å and λ2 = 10000 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 ? **[NEET-2013, 4/180, –1]**

(1) 6 mm (2) 4 mm (3) 3 mm (4) 8 mm

**2.** 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 ? **[NEET-2013, 4/180, –1]**

(1) The angular width of the central maximum of the diffraction pattern will increase.
(2) The angular width of the central maximum will decrease.
(3) The angular width of the central maximum will be unaffected.
(4) Diffraction pattern is not observed on the screen in the case of electrons.

**3.** In a double slit experiment, the two slits are 1mm apart and the screen is placed 1 m away. A monochromatic light wavelength 500 nm is used. Wht will be the width of each slit for obraining ten maxima of double slit within the central maxima of single slit patter ? **[AIPMT-2015]**

(1) 0.1 mm (2) 0.5 mm (3) 0.02 mm (4) 0.2 mm

**4.** For a parallel beam of monochromatic light of wavelength 'λ', diffraction is produced by a single slit whose width 'a' is 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 **[AIPMT-2015]**

(1) $\frac{D\lambda}{a}$ (2) $\frac{D\lambda}{a}$ (3) $\frac{2Da}{\lambda}$ (4) $\frac{2D\lambda}{a}$

**5.** 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 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of : **[AIPMT-2016]**

(1) sin–1 $\left(\frac{3}{4}\right)$ (2) sin–1 $\left(\frac{1}{4}\right)$ (3) sin–1 $\left(\frac{2}{3}\right)$ (4) sin–1 $\left(\frac{2}{3}\right)$

**6.** A linear aperture whose width is 0.02 cm is placed immediately in front of a lens of focal length 60 cm. The aperture is illuminated normally by a parallel beam of wavelength $5 \times 10^{-5}$ cm. The distance of the first dark band of the diffraction pattern from the centre of the screen is : **[NEET 2016-17]**

(1) 0.15 cm (2) 0.10 cm (3) 0.25 cm (4) 0.20 cm

**7.** The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1$ = 4000 Å and $\lambda_2$ = 6000 Å is : **[NEET 2017]**

(1) 8 : 27 (2) 9 : 4 (3) 3 : 2 (4) 16 : 81

**8.** Young's double slit experiment is first performed in air and then in a medium other than air. It is found that $8^{th}$ brigh fringe in the medium lies where $5^{th}$ dark fringe lies in air. The refractive index of the medium is nearly : **[NEET 2017]**

(1) 1.25 (2) 1.59 (3) 1.69 (4) 1.78

**9.** Unpolarised light is incident from air on a plane surface of a material of refractive index 'μ'. At a particular angle of incidence 'i', it is found that the reflected and refracted rays are perpendicular to each other. Which of the following options is correct for this situation? **[NEET 2018]**

(1) Reflected light is polarised with its electric vector parallel to the plane of incidence

(2) $i = \tan^{-1}\left(\frac{1}{\mu}\right)$

(3) $i = \sin^{-1}\left(\frac{1}{\mu}\right)$

(4) Reflected light is polarised with its electric vector perpendicular to the plane of incidence

**10.** In Young's double slit experiment the separation d between the slits is 2 mm, the wavelength λ of the light used is 5896 Å and distance D between the screen and slits is 100 cm. It is found that the angular width of the fringes is 0.20º. To increases the fringe angular width to 0.21º (with same λ and D) the separation between the slits needs to be changed to : **[NEET 2018]**

(1) 1.8 mm (2) 1.7 mm (3) 2.1 mm (4) 1.9 mm

**11.** In a double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1 m away, was found to be 0.2º. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water? ($\mu_{water}$ = 4/3) **[NEET_2019-I]**

(1) 0.1º (2) 0.266º (3) 0.15º (4) 0.05º

**12.** In Young's double slit experiment, if there is no initial phase difference between the light from the two slits, a point on the screen corresponding to the fifth minimum has path difference **[NEET_2019-II]**

(1) $5\frac{\lambda}{2}$ (2) $10\frac{\lambda}{2}$ (3) $9\frac{\lambda}{2}$ (4) $11\frac{\lambda}{2}$

**13.** Angular width of the central maximum in the Fraunhofer diffraction for λ = 6000 Å is $\theta_0$. When the same slit is illuminated by another monochromatic light, the angular width decreases by 30%. The wavelength of this light is : **[NEET_2019-II]**

(1) 1800 Å (2) 4200 Å (3) 6000 Å (4) 420 Å

## PART - II : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

**1.** At two points P and Q on a screen in Young's double slit experiment, waves from slits $S_1$ and $S_2$ have a path difference of 0 and $\frac{\lambda}{4}$ respectively. The ratio of intensities at P and Q will be :

**[AIEEE 2011, 11 May; 4, –1]**

(1) 2 : 1 (2) $\sqrt{2}:1$ (3) 4 : 1 (4) 3 : 2

**2.** In a Young's double slit experiment, the two slits act as coherent sources of waves of equal amplitude A and wavelength λ. In another experiment with the same arrangement the two slits are made to act as incoherent sources of waves of same amplitude and wavelength. If the intensity at the middle point of the screen in the first case is $I_1$ and in the second case is $I_2$ , then the ratio $\frac{I_1}{I_2}$ is :

**[AIEEE 2011, 11 May; 4, –1]**

(1) 2 (2) 1 (3) 0.5 (4) 4

**3.** **Statement - 1 :** On viewing the clear blue portion of the sky through a Calcite Crystal, the intensity of transmitted light varies as the crystal is rotated.

**Statement - 2 :** The light coming from the sky is polarized due to scattering of sun light by particles in the atmosphere. The scattering is largest for blue light **[AIEEE 2011, 11 May; 4, –1]**

(1) Statement-1 is true, statement-2 is false.

(2) Statement-1 is true, statement-2 is true, statement-2 is the correct explanation of statment-1

(3) Statement-1 is true, statement-2 is true, statement-2 is not the correct explanation of statement-1

(4) Statement-1 is false, statement-2 is true.

**4.** **Direction :**

The question has a paragraph followed by two statements, Statement –1 and Statement –2. Of the given four alternatives after the statements, choose the one that describes the statements.

A thin air film is formed by putting the convex surface of a plane-convex lens over a plane glass plate. With monochromatic light, this film gives an interference pattern due to light reflected from the top (convex) surface and the bottom (glass plate) surface of the film. **[AIEEE 2011, 1 MAY; 4, –1]**

**Statement –1 :** When light reflects from the air-glass plate interface, the reflected wave suffers a phase change of π

**Statement –2 :** The centre of the interference pattern is dark.

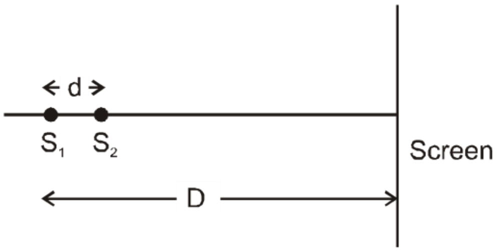
(1) Statement –1 is true, statement –2 is false.

(2) Statement –1 is true, Statement –2 is true, Statement–2 is the correct explanation of Statement–1

(3) Statement –1 is true, Statement –2 is true, Statement–2 is not the correct explanation of Statement–1

(4) Statement–1 is false, Statement –2 is true

**5.** 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 : **[JEE-Mains 2013, 4/120]**




(1) points (2) straight lines (3) semi-circles (4) concentric circles

**6.** Tow beams, A and B, of plane polarized light with mutually perpendicular planes of polarization are seen through a polaroid. From the position when the beam A has maximum intensity (and beam B has zero intensity), a rotation of polaroid through 30º makes the two beams appear equally bright. If the initial intensities of the two beams are $I_A$ and $I_B$ respectively, then $\frac{I_A}{I_B}$ equals **[JEE-Main-2014]**

(1) 3 (2) $\frac{3}{2}$ (3) 1 (4) $\frac{1}{3}$

**7.** On a hot summer night, the refractive index of air is smallest near the ground and increases with height from the ground. When a light beam is directed horizontally, the Huygens' principle leads us to conclude that as it travels, the light beam : **[JEE(Main)-2015; 4/120, –1]**

(1) becomes narrower (2) goes horizontally without any deflection

(3) bends downwards (4) bends upwards

**8.** Assuming human pupil to have a radius of 0.25 cm and a comfortable viewing distance of 25 cm, the minimum separation between two objects that human eye can resolve at 500 nm wavelength is :

**[JEE(Main)-2015; 4/120, –1]**

(1) 1 μm (2) 30 μm (3) 100 μm (4) 300 μm

**9.** The box of a pin hole camera, of length L, has hole of radius a. it is assumed that when the hole is illuminated by a parallel beam of light of wavelength λ the spread of the spot (obtained on the opposite wall of the camera) is the sum of its geometrical spread and the spread due to diffraction. The spot would then have its minimum size (say $b_{min}$) when : **[JEE(Main)-2016; 4/120, –1]**

(1) $a = \sqrt{\lambda L}$ and $b_{min} = \left(\frac{2\lambda^2}{L}\right)$ (2) $a = \sqrt{\lambda L}$ and $b_{min} = \sqrt{4\lambda L}$

(3) $a = \frac{\lambda^2}{L}$ and $b_{min} = \sqrt{4\lambda L}$ (4) $a = \frac{\lambda^2}{L}$ and $b_{min} = \left(\frac{2\lambda^2}{L}\right)$

**10.** Unpolarized light of intensity I passes through an ideal polarizer A. Another identical polarizer B is placed behind A. The intensity of light beyond B is found to be $\frac{I}{2}$. Now another identical polarizer C is placed between A and B. The intensity beyond B is now found to be $\frac{I}{8}$. The angle between polarizer A and C is : **[JEE-Main-2018]**

(1) 45° (2) 60° (3) 0° (4) 30°

**11.** 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.) **[JEE-Main-2018]**

(1) 75 μm (2) 100 μm (3) 25 μm (4) 50 μm

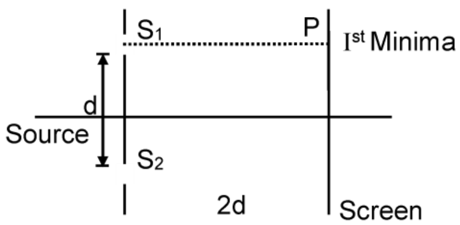
**12.** Two coherent sources produce waves of different intensities which interfere. After interference, the ratio of the maximum intensity to the minimum intensity is 16. The intensity of the waves are in the ratio : **[JEE-Main-2019]**

(1) 4 : 1 (2) 16 : 9 (3) 5 : 3 (4) 25 : 9

**13.** In Young's double slit experiment, the slits are placed 0.320 mm apart. Light of wavelength λ = 500 nm is incident on the slits. The total number of bright fringes that are observed in the angular range $-30^o \le \theta \le 30^o$ is : **[JEE-Main-2019]**

(1) 320 (2) 641 (3) 640 (4) 321

**14.** Consider a Young's double slit experiment as shown in figure. What should be the slit separation d in terms of wavelength λ such that the first minima occurs directly in front of the slit ($S_1$)**[JEE-Main-2019]**




(1) $\frac{\lambda}{(\sqrt{5}-2)}$ (2) $\frac{\lambda}{2(5-\sqrt{2})}$ (3) $\frac{\lambda}{2(\sqrt{5}-2)}$ (4) $\frac{\lambda}{(5-\sqrt{2})}$

**15.** In a double-slit experiment, green light (5303Å) falls on a double slit having a separation of 19.44 μm The number of bright fringes between the first and second diffraction minima is : **[JEE-Main-2019]**

(1) 09 (2) 05 (3) 04 (4) 10

# Answers

## EXERCISE # 1

**SECTION (A) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (1) | **2.** | (3) | **3.** | (3) | **4.** | (1) | **5.** | (3) | **6.** | (2) | **7.** | (1) |
| **8.** | (2) | **9.** | (1) | **10.** | (4) | **11.** | (2) | **12.** | (1) | **13.** | (4) | | |

**SECTION (B) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (3) | **2.** | (1) | **3.** | (2) | **4.** | (4) | **5.** | (4) | **6.** | (1) | **7.** | (4) |
| **8.** | (4) | **9.** | (4) | **10.** | (1) | **11.** | (1) | **12.** | (3) | **13.** | (3) | **14.** | (3) |
| **15.** | (4) | **16.** | (1) | **17.** | (4) | **18.** | (4) | **19.** | (3) | **20.** | (2) | **21.** | (4) |
| **22.** | (1) | **23.** | (4) | **24.** | (2) | **25.** | (3) | **26.** | (4) | **27.** | (2) | | |

**SECTION (C) :**

| | | | |
|---|---|---|---|
| **1.** | (3) | **2.** | (1) |

**SECTION (D) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (3) | **2.** | (2) | **3.** | (1) | **4.** | (2) | **5.** | (1) | **6.** | (2) | **7.** | (1) |
| **8.** | (3) | | | | | | | | | | | | |

**SECTION (E) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (2) | **2.** | (2) | **3.** | (3) | **4.** | (3) | **5.** | (1) | **6.** | (3) | **7.** | (1) |
| **8.** | (1) | **9.** | (1) | **10.** | (3) | **11.** | (1) | **12.** | (2) | **13.** | (4) | **14.** | (3) |
| **15.** | (2) | **16.** | (4) | **17.** | (3) | **18.** | (3) | **19.** | (3) | **20.** | (4) | | |

**SECTION (F) :**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (4) | **2.** | (4) | **3.** | (2) | **4.** | (4) | **5.** | (3) | **6.** | (1) | **7.** | (4) |
| **8.** | (1) | **9.** | (2) | **10.** | (2) | **11.** | (1) | **12.** | (4) | **13.** | (2) | | |

## EXERCISE # 2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (3) | **2.** | (4) | **3.** | (1) | **4.** | (1) | **5.** | (4) | **6.** | (2) | **7.** | (4) |
| **8.** | (2) | **9.** | (3) | **10.** | (1) | **11.** | (1) | **12.** | (2) | **13.** | (3) | **14.** | (2) |
| **15.** | (1) | **16.** | (3) | **17.** | (1) | **18.** | (2) | **19.** | (4) | **20.** | (1) | **21.** | (1) |
| **22.** | (2) | **23.** | (4) | **24.** | (2) | **25.** | (2) | **26.** | (4) | **27.** | (4) | | |

## EXERCISE # 3

**PART – I**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (1) | **2.** | (2) | **3.** | (4) | **4.** | (4) | **5.** | (1) | **6.** | (1) | **7.** | (3) |
| **8.** | (4) | **9.** | (4) | **10.** | (4) | **11.** | (3) | **12.** | (3) | **13.** | (2) | | |

**PART – II**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | (1) | **2.** | (1) | **3.** | (2) | **4.** | (1) | **5.** | (4) | **6.** | (4) | **7.** | (4) |
| **8.** | (2) | **9.** | (2) | **10.** | (1) | **11.** | (3) | **12.** | (4) | **13.** | (2) | **14.** | (2) |
| **15.** | (3) | | | | | | | | | | | | |