Wave Optics Practice MCQs

1. Young's double slit experiment is carried out by using green, red and blue light, one color at a time. The fringe widths records are **(IIT 2012)**

a) $\beta_G > \beta_B > \beta_R$ b) $\beta_B > \beta_G > \beta_R$ c) $\beta_R > \beta_B > \beta_G$ d) $\beta_R > \beta_G > \beta_B$

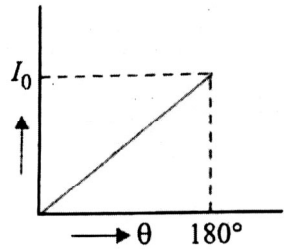
2. In the Young's double slit experiment using a monochromatic clight of wavelength λ, the path diffference (in terms of an integer n) corresponding to any point having half the peak intensity is **(JEE advanced 2013)**

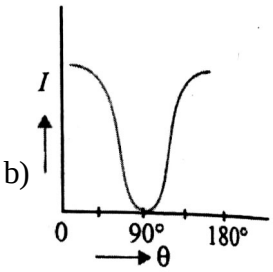
a) $(2n+1)\frac{\lambda}{2}$ b) $(2n+1)\frac{\lambda}{4}$ c) $(2n+1)\frac{\lambda}{8}$ d) $(2n+1)\frac{\lambda}{16}$

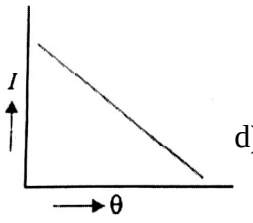
3. In the experiment of diffraction at a single slit, if the slit width is decreased, the width of the central maximum **(UPSEAT 2004, VITEEE 2008)**

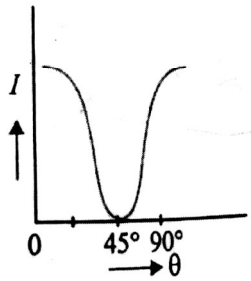
a) increases in both Fresnel and Faunhoffer diffraction
b) decreases both in Fresnel and Fraunhoffer diffraction
c) increases in Fresnel; diffractin but decreases in Faunhoffer diffraction
d) decreases in Fresnel diffraction but increases is Fraunhoffer diffraction

4. Figure shows the dependencce of intensity of transmitted light on the angle between the polariser and analyser. Choose the correct option **(AIIMS 2007)**

a) 

b) 

c) 

d) 

5. A beam of unpolarised light of intensity I_0 is passed through a polaroid A and then through another polaroid B which is oriented so that its principal plane makes an angle of 45^0 relative to that of A. The intensity of emergent light is

a) I_0 b) $I_0/2$ c) $I_0/4$ d) $I_0/8$

6. For a parallel beam of monochromatic light of wavelength 'λ' diffraction is produced by a single 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 cenral maxima will be **(CBSE AIPMT 2015)**

a) $\frac{2D\lambda}{a}$ b) $\frac{D\lambda}{a}$ c) $\frac{Da}{\lambda}$ d) $\frac{2Da}{\lambda}$

7. In a double slit experiment, the two slits are 1 mm apart and the screen is placed 1 m away. A monochromatic light of wavelength 500 nm is used. What will be the width of each slit for obtaining ten maxima of double slit within the ccentral maxima of single slit patttern ? **(CBSE AIMT 2015)**

a) 0.2 mm b) 0.1 mm c) 0.5 mm d) 0.02mm

8. The ratio of resolving powers of an optical microscope for two wavelengths $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å is **(NEET 2017)**

a) 8 : 27 b) 9 : 4 c) 3 : 2 d) 16 : 81

9. Two polaroids P_1 and P_2 are placed with their axis perpendiccular 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 45^0 with that of P_1. The intensity of transmitted light through P_2 is **(NEET 2017)**

a) $\frac{I_0}{2}$ b) $\frac{I_0}{4}$ c) $\frac{I_0}{8}$ d) $\frac{I_0}{16}$

10. The Young's double slit experiment is performed with blue and green light of wavelengths 4360Å and 5460Å respectively. If x is the distance of 4th maxima from the central one, then **(AIIMS 2017)**

a) $x_{blue} = x_{green}$ b) $x_{blue} > x_{green}$ c) $x_{blue} < x_{green}$ d) x_{blue} / x_{green}

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 (λ being the wavelength of light used). The intensity at a point where path diff. is λ/4 will be **(AIPMT 2014)**

a) K b) K/4 c) K/2 d) zero

12. A parallel beam of fast moving electrons is incident normally in 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)**

a) The angular width of central maximum will be unaffected
b) diffraction attern is not observed on the screen in the case of electrons.
c) The angular width of the central maximum of the diffraction pattern will increase
d) The angular width of the central maximum will decrease.

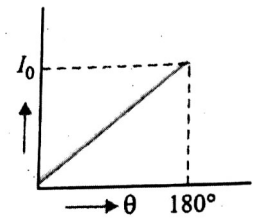
13. A single slit Fraunhoffer diffraction pattern is formed with white light. For what wavelength of light the third secondary maximum in the diffraction pattern coincides with the second secondary maximum in the pattern for red light of wavelength 6500Å?

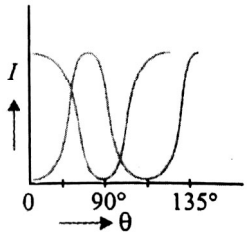
a) 4400Å b) 4100Å c) 4642Å d) 9100Å

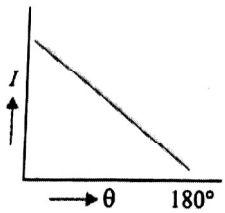
14. The diameter of the objective of a telescope is 0.1m and the wavelength of the light is 6000Å. Its resolvin power would be approximately **(AIIMS 2011)**

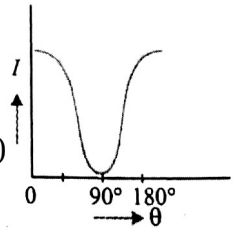
a) 6×10^{-5} rad b) 6×10^{-4} rad c) 6×10^{-3} d) 6×10^{-6} rad

15. The graph showing the dependencce of intensity of transmitted light on the angle between polariser and analyser is **(AIIMS 2007)**

a) 

b) 

c) 

d) 

16. Two polaroids P_1 and P_2 are placced with their axis perpendicular to eachother. Unpolarised light I_0 is incicdent on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its axis makes an angle 45^0 with that of P_1. The intensity of transmitted light through P_2 is **(NEET 2017)**

a) $\frac{I_0}{2}$ b) $\frac{I_0}{4}$ c) $\frac{I_0}{8}$ d) $\frac{I_0}{16}$

17. At the first minimum adjacent to the central maximum of a single-slit diffraction pattern, the phase difference between the Huygen's wavelenth from the edge of the slit and the wavelet from the midpoint of the slit is **(NEET 2015)**

a) $\frac{\pi}{3}$ radian b) $\frac{\pi}{4}$ radian c) $\frac{\pi}{2}$ radian d) π radian

18. Two slits in Young's 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 **(NEET 2015)**

a) $\frac{4}{9}$ b) $\frac{9}{4}$ c) $\frac{121}{49}$ d) $\frac{49}{121}$

19. In a diffraction pattern due to a single slit of sidth 'a' the first minimum is observed at an angle 30^0 when light of wavelength 5000 Å is incident o n the slit. The first secondary maximum is observed at an angle of **(NEET 2016)**

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

20. The intensity at the maximum in a Young's double slit experiment is I_0. Distance between two slits is $d = 5\lambda$, where λ is the wavelength of light used in the experiment. What will be the intensity in front of one of the slits on the screen placed at a distance D = 10 d ? **(NEET 2016)**

a) I_0 b) $\frac{I_0}{4}$ c) $\frac{3}{4}I_0$ d) $\frac{I_0}{2}$

21. The interference pattern is obtained with two coherent light sources of intensity ratio n. In the interference pattern, the ratio $\frac{I_{max} - I_{min}}{I_{max} + I_{min}}$ will be **(NEET 2017)**

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

22. 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 $5\times10^{-5} cm$. The distance of the first dark band of the diffraction patttern from the centre of the screen is **(NEET 2017)**

a) 0.10 cm b) 0.25 cm c) 0.20 cm d) 0.15 cm

23. Young's double slit experiment is first performed in air and then in a medium other than air. It is found that 8th bright fringe in the medium lies where 5th dark fringe lies in air. The refractive inde of the medium is nearly **(NEET 2017)**

a) 1.25 b) 1.59 c) 1.69 d) 1.78

24. 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)**

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

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

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

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

25. 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 0.20^0. To increase the fringe angular width to 0.21' (with same λ and D) the separation between the slits needs to be chaned to **(NEET 2018)**

a) 2.1 mm b) 1.9 mm c) 1.8 mm d) 1.7 mm

26. In double slit experiment, when light of wavelength 400 nm was used, the angular width of the first minima formed on a screen placed 1m away, was found to be 0.2^0. What will be the angular width of the first minima, if the entire experimental apparatus is immersed in water $\left(\mu_{water} = 4/3\right)$ **(NEET 2019)**

(a) 0.05^0 (b) 0.1^0 (c) 0.266^0 (d) 0.15^0

27. Assume that light of wavelength 600 nm is coming from a star. The limit of resolution of telescope whose objective has a diameter of 2 m is : **(NEET 2020)**

(1) 6.00×10^{-7} rad (2) 3.66×10^{-7} rad

(3) 1.83×10^{-7} rad (4) 7.32×10^{-7} rad

28. The Brewsters angle ib for an interface should be: **(NEET 2020)**

(1) $i_b = 90°$ (2) $0° < i_b < 30°$ (3) $30° < i_b < 45°$ (4) $45° < i_b < 90°$

29. In Young's double slit experiment, if the separation between coherent sources is halved and the distance of the screen from the coherent sources is doubled, then the fringe width becomes : **(NEET 2020)**

(1) one-fourth (2) double (3) half (4) four times

30. Unpolarised light of intensity I passes through an ideal polariser A. Another identical polariser B is placed behind A. The intensity of light beyond B is found to be $\frac{I}{2}$. Now another identical polariser C is placed between A and B. The intensity beyond B is now found to be $\frac{I}{8}$. The angle between polariser A and C is

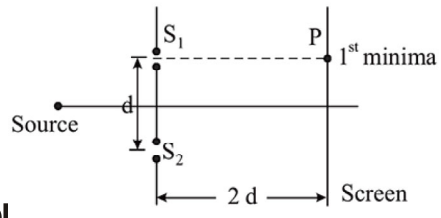
(A) 45^0 (B) 60^0 (C) 0^0 (D) 30^0

31. Unpolarized light of intensity I_0, is made to pass through three polarizers P_1, P_2 and P_3 successively. Thge polarization axis of P_2 makes an angle of θ_1 with that of P_1, while that of P_3 makes an angle θ_2 with that of the P_2. What will be the intensity of light coming out of P_3 ? **(Home Work)**

32. In a young's double slit experiment, slits are separated by 0.5 mm and the screen is placed 150 cm away. A beam of light consisting of two wavelengths, 650 nm and 520 nm, is used to obtain interference fringes on the screen. The least distance from the common central maximum to the point where the bright fringes due to both the wavelengths coincide, is **[JEE - 2017]**

a) 7.8 mm b) 9.75 mm c) 15.6 mm d)1.56 mm

33. Consider Young's double slit experiment as shown in figure. What whould be the slit separation d interms of wavelength λ such that the first minima occurs directly in front of t he slit (S_1)



[JEE - 10 Jan 2019 Evening]

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

34. In a Young's double slit experiment, the path difference, at a certain point on the screen, betwen two interfering waves is $\frac{1}{8}th$ of wavelength. The ratio of the intensity at this point to that at the centre of a bright fringe is close to: **[JEE - 11 Jan 2019 Morning]**

(1) 0.74 (2) 0.85 (3) 0.94 (4) 0.80

35. In an interference experiment the ratio of amplitudes of the ratio of amplitudes of coherent waves is $\frac{a_1}{a_2}=\frac{1}{3}$. The ratio of maximum and minimum intensities of fringes will be : **[JEE - 8 April 2019 Mor]**

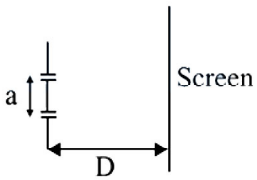
(1) 2 (2) 18 (3) 4 (4) 9

36. Calculate the limit of resolution of a telescope objectiv having a diameter of 200 cm, if it has to detect light of wavelength 500 nm coming from a star. **[JEE - 8 April 2019 Evening]**

(1) 305×10^{-9} radian (2) 610×10^{-9} radian

(3) 152.5×10^{-9} radian (4) 457.5×10^{-9} radian

37. The figure shows a Young's double slit experimental setup. It is observed that when a thin transparent sheet of thickness t and refractive index μ is put in front of one of the slits, the central maximum gets shifted by a distance equal to n fringe widths. If the wavelength of light used is λ , t will be:



[JEE - 9 April 2019 Morning]

(1) $\frac{2n\lambda}{(\mu-1)}$ (2) $\frac{n\lambda}{(\mu-1)}$ (3) $\frac{\lambda}{a(\mu-1)}$ (4) $\frac{2\lambda}{a(\mu-1)}$

38. Diameter of the objective lens of a telescope is 250 cm. For light of wavelength 600 nm. Coming from a distant object, the limit of resolution of the telescope is close to **[JEE - 9 April 2019 Evening]**

(1) 1.5×10^{-7} rad (2) 2.0×10^{-7} (3) 3.0×10^{-7} (4) 4.5×10^{-7}

39. In a Young s double slit experiment, the ratio of the slit s width is 4 : 1. The ratio of the intensity of maxima to minima, close to the central fringe on the screen, will be : **[JEE - 10 April 2019 Evening]**

(1) 25:9 (2) 9 : I (3) 4 : 1 (4) $\left(\sqrt{3}+1\right)^4$:16

40. The value of numerical aperature of the objective lens of a microscope is 1.25. If light of wavelength 5000 *A* is used, the minimum separation between two points, to be seen as distinct, will be : **[JEE - 12 April 2019 Morning]**

(1) 0.24 μ m (2) 0.38 μ m (3) 0.12 μ m (4) 0.48 μ m

41. In a double slit experiment, when a thin film of thickness *t* having refractive index μ is introduced in front of one of the slits, the maximum at the centre of the fringe pattern shifts by one fringe width. The value of *t* is (X is the wavelength of the light used) : **[JEE - 12 April 2019 Morning]**

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

42. A system of three polarizers P_1 P_2, P_3 is set up such that the pass axis of P_3 is crossed with respect to that of P_1 The pass axis of P_2 is inclined at 60° to the pass axis of P_3 When a beam of unpolarized light of intensity I_o is incident on P_1 the intensity of light transmitted by the three polarizers is I. The ratio (I_0/I) equals (nearly): **[JEE - 12 April 2019 Evening]**

(1) 5.33 (2) 16.00 (3) 10.67 (4) 1.80

43. In a single slit diffraction set up, second minima is observed at an angle of 60^0. The expected position of first minima is **(JEE Mains 2020)**

(1) 25^0 (2) 20^0 (3) 30^0 (4) 45^0

44. If 10% of intensity is passed from analyser, then, the angle by which analyser should be rotated such that transmitted intensity becomes zero. **(JEE Mains 2020)**

(1) 60^0 (2) 18.4^0 (3) 45^0 (4) 71.6^0

45. In YDSE, separation between slits is 0.15 mm, distance between slits and screen is 1.5 m and wavelength of light is 589 nm, then fringe width is **(JEE Mains 2020)**

(1) 5.9 mm (2) 3.9 mm (3) 1.9 mm (4) 2.3 mm

46. In YDSE path difference at a point on screen is $\frac{\lambda}{8}$. Find ratio of intensity at this point with maximum intensity **(JEE Mains 2020)**

(1) 0.853 (2) 0.533 (3) 0.234 (4) 0.123