20 - WAVE OPTICS

(Answers at the end of all questions)

1) Two point white dots are 1 mm apart on a black paper. They are viewed by eye of pupil diameter 3 mm. Approximately, what is the maximum distance at which these dots can be resolved by the eye ? [Take wavelength of light = 500 nm]
(a) 1 m (b) 5 m (c) 3 m (d) 6 m [AIEEE 2005]

2) A Young's double-slit experiment uses a monochromatic source. The shape of the interference fringes formed on a screen is
(a) circle (b) hyperbola (c) parabola (d) straight line [AIEEE 2005]

3) 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 ?
(a) $4I_0$ (b) $2I_0$ (c) $I_0/2$ (d) I_0 [AIEEE 2005]

4) When an unpolarized light of intensity I_0 is incident on a polarizing sheet, the intensity of light which does not get transmitted is
(a) $I_0/4$ (b) $I_0/2$ (c) I_0 d) zero [AIEEE 2005]

5) The angle of incidence at which reflected light is totally polarized for reflection from air to glass (refractive index n) is
(a) $\sin^{-1}(n)$ (b) $\sin^{-1}(1/n)$ ( ) $\tan^{-1}(1/n)$ (d) $\tan^{-1}(n)$ [AIEEE 2004]

6) The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double slit experiment is
(a) infinite (b) five (c) three (d) zero [AIEEE 2004]

7) To demonstrate the phenomenon of interference, we require two sources which emit radiations
(a) of the same frequency (b) of different wavelengths
(c) of nearly the same frequency
(d) of the same frequency having a definite phase relationship [AIEEE 2003]

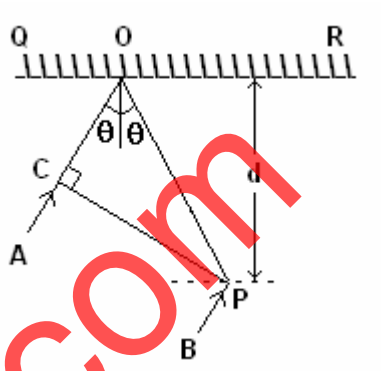
8) Which of the following is conserved when light waves interfere with each other ?
(a) energy (b) intensity (c) amplitude (d) momentum [AIEEE 2002]

9) In Young's double-slit experiment, an electron beam is used. If the velocity of the electrons is increased,
(a) there will be no interference pattern in the first place
(b) fringe width increases (c) fringe width decreases
(d) fringe width remains the same [IIT 2005]

10) In Young's double-slit experiment, intensity at a point is 1 / 4 th the maximum intensity. Angular position of this point is
(a) $\sin^{-1}\left(\frac{\lambda}{d}\right)$ (b) $\sin^{-1}\left(\frac{\lambda}{2d}\right)$ (c) $\sin^{-1}\left(\frac{\lambda}{3d}\right)$ (d) $\sin^{-1}\left(\frac{\lambda}{4d}\right)$ [IIT 2005]

11) In a YDSE bi-chromatic light of wavelengths 400 nm and 560 nm are used. The distance between the slits is 0.1 mm and the distance between the plane of the slits and the screen is 1 m. The minimum distance between two successive regions of complete darkness is
(a) 4 mm (b) 5.6 mm (c) 14 mm (d) 28 mm [IIT 2004]

12) In the adjacent diagram, CP represents a wavefront and AO and BP, the corresponding two rays. Find the condition on θ for constructive interference at P between the ray BP and reflected ray OP.



(a) $\cos\theta = \frac{3\lambda}{2d}$ (b) $\cos\theta = \frac{\lambda}{4d}$

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

[IIT 2003]

13) 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 (wave-length λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is

(a) 2λ (b) $\frac{2\lambda}{3}$ (c) $\frac{\lambda}{3}$ (d) λ [IIT 2002]

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

(a) 2 I (b) 4 I (c) 5 I (d) 7 I [IIT 2001]

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

(a) 12 (b) 18 (c) 24 (d) 30 [IIT 2001]

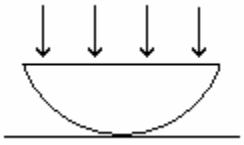
16) In a double slit experiment instead of taking slits of equal widths, if one slit is made twice as wide as the other, then in the interference pattern

(a) the intensity 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 maxima decreases and that of minima increases
(d) the intensity of maxima decreases and the minima has zero intensity [IIT 2000]

17) Yellow light is used in a single slit diffraction experiment with slit width of 0.6 mm. If yellow light is replaced by X-rays, then the observed pattern will reveal

(a) that the central maximum is narrower (b) more number of fringes
(c) less number of fringes (d) no diffraction pattern [IIT 1999]

18) A thin slice is cut out of a glass cylinder along a plane parallel to its axis. The slice is placed on a flat plate as shown in the figure. The observed interference fringes from this combination shall be (a) straight (b) circular (c) equally spaced (d) having fringe spacing which increases as we go outwards



[IIT 1999]

19) A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of the slit is

(a) 0 (b) $\pi/2$ (c) π (d) 2π [IIT 1998]

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(Answers at the end of all questions)

20) A beam of light of wavelength 600 nm from a distant source falls on a single slit 1.00 mm wide and the resulting diffraction pattern is bserved on a screen 2 m away. The distance between the first dark fringes on either side of the central bright fringe is
(a) 1.2 cm (b) 1.2 mm (c) 2.4 cm (d) 2.4 mm [IIT 1994]

21) Two coherent monochromatic light beams of intensities I and 4 I are superpo ed. The maximum and minimum possible intensities in the resulting beam are
(a) 5 I and I (b) 5 I and 3 I (c) 9 I and I (d) 9 I and 3 I [IIT 1988]

22) In Young's double-slit experiment, the two slits act as coherent sources of equal amplitude A and of wavelength λ. In another experiment with the same set-up, the sources are incoherent. The ratio of intensity of light at the midp int of the screen in the first case to that in the second case is
(a) 1 (b) 2 (c) 3 (d) 4 [IIT 1986]

23) White light is used to illuminate the two slits in a oung double-slit experiment. The separation between the slits is b and the screen is at a distance d (>> b) from the slits. At a point on the screen directly in front of on of the slits, certain wavelengths are missing. Some of the missing wavelength are
(a) $\lambda = \frac{b^2}{d}$ (b) $\lambda = \frac{2b^2}{d}$ (c) $\lambda = \frac{b^2}{3d}$ (d) $\lambda = \frac{2b^2}{3d}$ [IIT 1984]

24) In the Young's double slit experiment the interference pattern is found to have an intensity ratio between bright and da k fringes as 9. This implies that
(a) the intensities at the screen due o the two slits are 5 units and 4 units
(b) the intensities at the screen due to the two slits are 5 units and 4 units
(c) the amplitude ratio is 3 (d) the amplitude ratio is 2 [IIT 1982]

25) In Young's double-slit e periment, the separation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is
(a) unchanged (b) halved (c) doubled (d) quadrupled [IIT 1981]

26) In Young's experimen , if one slit is covered with blue filter and the second slit with yellow, we shall find that the interference pattern will appear to be
(a) blu (b) yellow (c) green (d) absent

27) Monoch omatic blue light has been used to obtain the diffraction pattern of a narrow slit on a screen. Keeping the experimental set up unchanged if blue light is replaced by red monochromatic light, the diffraction pattern will
(a) be wider (b) be narrower (c) be unchanged (d) disappear

28) The first diffraction minima due to a single slit diffraction is at $\theta = 30°$ for a light of wavelength 5000 A°. The width of the slit is
(a) 5×10^{-5} cm (b) 10×10^{-5} cm
(c 2.5×10^{-5} cm (d) 1.25×10^{-5} cm

Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
b	b	d	b	d	a	d	a	c	c	d	b	a	b	b	a	d	a	d	d

21	22	23	24	25	26	27	28
c	b	a,c	b,d	d	d	a	b