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CLASS 12 PHYSICS · NCERT CHAPTER 10 · IMU CET PRACTICE

Wave Optics

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Questions: 44 MCQs

Each question has exactly one correct option. Attempt all questions first, then check the Answer Key and Solutions at the end.

- 1 According to Huygens' principle, each point on a wavefront acts as a source of
 - (A) photons only
 - (B) particles
 - (C) longitudinal waves
 - (D) secondary wavelets
- 2 The wavefront due to a point source at a large distance is
 - (A) plane
 - (B) elliptical
 - (C) spherical
 - (D) cylindrical
- 3 The wavefront from a linear (slit) source is
 - (A) conical
 - (B) plane
 - (C) cylindrical
 - (D) spherical
- 4 The phase difference between two points on the same wavefront is
 - (A) 2π
 - (B) π
 - (C) zero
 - (D) $\pi/2$
- 5 Coherent sources are those which have
 - (A) different frequencies
 - (B) a constant phase difference and same frequency
 - (C) the same amplitude only
 - (D) random phase differences
- 6 Two independent light bulbs cannot produce a sustained interference pattern because
 - (A) light does not interfere
 - (B) they are not coherent
 - (C) they emit only white light
 - (D) their intensities differ
- 7 In Young's double-slit experiment, the fringe width is
 - (A) Dd/λ
 - (B) $\lambda d/D$
 - (C) $\lambda D/d$
 - (D) λ/Dd
- 8 In YDSE, if the distance between the slits is doubled, the fringe width becomes
 - (A) half
 - (B) four times
 - (C) unchanged
 - (D) double

- 9 In YDSE, if the screen is moved farther away (D doubled), the fringe width
(A) becomes four times (B) halves
(C) doubles (D) remains same
- 10 In YDSE, $\lambda = 600 \text{ nm}$, $d = 1 \text{ mm}$, $D = 1 \text{ m}$. The fringe width is
(A) 0.06 mm (B) 0.6 mm
(C) 6 mm (D) 1.2 mm
- 11 If the YDSE apparatus is immersed in water ($n = 4/3$), the fringe width
(A) remains unchanged (B) increases to $4/3$ of its value
(C) becomes zero (D) decreases to $3/4$ of its value
- 12 The condition for constructive interference is a path difference of
(A) $(2n + 1)\lambda/2$ (B) $(n + \frac{1}{4})\lambda$
(C) $\lambda/4$ (D) $n\lambda$
- 13 The condition for destructive interference is a path difference of
(A) $n\lambda$ (B) $(2n + 1)\lambda/2$
(C) $2n\lambda$ (D) zero
- 14 A phase difference of π corresponds to a path difference of
(A) $\lambda/2$ (B) $\lambda/4$
(C) 2λ (D) λ
- 15 Two coherent waves of intensities I and $4I$ interfere. The maximum and minimum intensities are
(A) $9I$ and 0 (B) $9I$ and I
(C) $4I$ and I (D) $5I$ and $3I$
- 16 Two coherent waves of equal intensity I_0 interfere. The maximum intensity is
(A) zero (B) $2I_0$
(C) I_0 (D) $4I_0$
- 17 In YDSE, if one slit is covered, the pattern
(A) shifts by one fringe
(B) disappears and is replaced by single-slit diffraction-like uniform illumination
(C) becomes brighter
(D) remains the same
- 18 If white light is used in YDSE, the central fringe is
(A) white (B) violet
(C) red (D) dark
- 19 Interference of light demonstrates that light is
(A) longitudinal (B) a wave
(C) always polarised (D) a stream of particles
- 20 In single-slit diffraction, the first minimum occurs at angle θ given by
(A) $a \sin \theta = \lambda/2$ (B) $a \sin \theta = \lambda$
(C) $a \sin \theta = 3\lambda/2$ (D) $a \sin \theta = 2\lambda$



- 21 In single-slit diffraction, the width of the central maximum is
(A) $\lambda D/a$ (B) $\lambda D/2a$
(C) $2\lambda D/a$ (D) $4\lambda D/a$
- 22 If the slit width in single-slit diffraction is decreased, the central maximum
(A) remains unchanged (B) becomes wider
(C) becomes narrower (D) disappears
- 23 Diffraction effects are most noticeable when the size of the obstacle is
(A) much larger than the wavelength (B) infinite
(C) comparable to the wavelength (D) zero
- 24 Sound waves diffract more readily around buildings than light because
(A) they are transverse (B) they travel faster
(C) they have higher frequency (D) their wavelength is much larger
- 25 Polarisation of light proves that light is
(A) a longitudinal wave (B) a mechanical wave
(C) a transverse wave (D) a stream of particles
- 26 Malus' law gives the intensity of light transmitted by an analyser as
(A) $I_0 \cos^2 \theta$ (B) $I_0 / \cos \theta$
(C) $I_0 \sin^2 \theta$ (D) $I_0 \cos \theta$
- 27 Unpolarised light of intensity I_0 passes through a polariser. The transmitted intensity is
(A) I_0 (B) $I_0/2$
(C) $I_0/4$ (D) zero
- 28 Unpolarised light of intensity I_0 passes through two polaroids with axes at 60° . The final intensity is
(A) $I_0/8$ (B) $I_0/2$
(C) $I_0/4$ (D) $3I_0/8$
- 29 Two polaroids are crossed (axes at 90°). The transmitted intensity is
(A) $I_0/2$ (B) $I_0/4$
(C) zero (D) maximum
- 30 Brewster's law states that at the polarising angle θ_B ,
(A) $\tan \theta_B = n$ (B) $\cos \theta_B = n$
(C) $\tan \theta_B = 1/n$ (D) $\sin \theta_B = n$
- 31 At the Brewster angle, the angle between the reflected and refracted rays is
(A) 90° (B) 180°
(C) 0° (D) 45°
- 32 The Brewster angle for glass of $n = \sqrt{3}$ is
(A) 45° (B) 90°
(C) 30° (D) 60°

- 33 Light reflected from a water surface at the Brewster angle is
(A) circularly polarised (B) of zero intensity
(C) plane polarised (D) unpolarised
- 34 Huygens' wave theory could NOT explain
(A) interference (B) refraction
(C) reflection (D) the photoelectric effect
- 35 When light enters a denser medium, according to the wave theory, its speed
(A) becomes zero (B) increases
(C) remains constant (D) decreases
- 36 The resolving power of a microscope can be increased by
(A) using light of longer wavelength (B) using light of shorter wavelength
(C) using a weaker objective (D) decreasing the aperture
- 37 The resolving power of a telescope increases with
(A) shorter tube length (B) smaller aperture
(C) longer wavelength (D) larger aperture of the objective
- 38 In YDSE, the 5th bright fringe is at 5 mm from the centre. The fringe width is
(A) 5 mm (B) 2 mm
(C) 1 mm (D) 0.5 mm
- 39 In YDSE, the distance between the 3rd bright fringe and the central bright fringe is 6 mm. The distance of the 2nd dark fringe from the centre is
(A) 5 mm (B) 2 mm
(C) 4 mm (D) 3 mm
- 40 A thin transparent sheet of thickness t and refractive index n is placed in front of one slit in YDSE. The central fringe shifts by
(A) $(n - 1)tD/d$ (B) ntD/d
(C) $tD/(n - 1)d$ (D) $(n + 1)tD/d$
- 41 The colours seen in thin films (soap bubbles, oil on water) are due to
(A) interference (B) polarisation
(C) dispersion (D) diffraction only
- 42 The angular separation between fringes in YDSE is
(A) λD (B) λ/D
(C) d/λ (D) λ/d
- 43 In YDSE with $\lambda = 500$ nm, the angular fringe width is 0.2° . If λ is changed to 600 nm, the angular fringe width becomes
(A) 0.24° (B) 0.2°
(C) 0.17° (D) 0.3°

44 The ratio of intensities of two waves is 9 : 1. The ratio of maximum to minimum intensity in their interference is

(A) 16 : 1

(B) 9 : 1

(C) 4 : 1

(D) 3 : 1

Answer Key

1	2	3	4	5	6	7	8	9	10
D	A	C	C	B	B	C	A	C	B
11	12	13	14	15	16	17	18	19	20
D	D	B	A	B	D	B	A	B	B
21	22	23	24	25	26	27	28	29	30
C	B	C	D	C	A	B	A	C	A
31	32	33	34	35	36	37	38	39	40
A	D	C	D	D	B	D	C	D	A
41	42	43	44						
A	D	A	C						

Hints & Solutions

- (D) The envelope of secondary wavelets gives the new wavefront.
- (A) A small portion of a very large sphere is nearly plane.
- (C) A line source emits cylindrical wavefronts.
- (C) A wavefront is the locus of points in the same phase.
- (B) Sustained interference requires coherent sources.
- (B) The phase relationship between independent sources changes randomly and rapidly.
- (C) $\beta = \lambda D/d$.
- (A) $\beta \propto 1/d$.
- (C) $\beta \propto D$.
- (B) $\beta = 600 \times 10^{-9} \times 1/10^{-3} = 6 \times 10^{-4} \text{ m}$.
- (D) $\lambda \text{ in water} = \lambda/n \rightarrow \beta' = \beta/n = 3\beta/4$.
- (D) Waves arrive in phase for path difference $n\lambda$.
- (B) Waves arrive out of phase by π for odd multiples of $\lambda/2$.
- (A) $\Delta\phi = (2\pi/\lambda)\Delta x \rightarrow \Delta x = \lambda/2$.
- (B) $I_{\max} = (\sqrt{I} + \sqrt{4I})^2 = 9I$; $I_{\min} = (\sqrt{I} - \sqrt{I})^2 = 0$.
- (D) $I_{\max} = (\sqrt{I_0} + \sqrt{I_0})^2 = 4I_0$.
- (B) No second coherent source means no two-slit interference.
- (A) At the centre path difference is zero for all wavelengths, so all colours overlap to give white.
- (B) Interference is a characteristic wave phenomenon.
- (B) Minima at $\sin \theta = n\lambda$, $n = 1, 2, \dots$
- (C) Angular half-width $\lambda/a \rightarrow$ linear width $2\lambda D/a$.
- (B) Width $\propto 1/a$.
- (C) Bending around obstacles is appreciable when $a \sim \lambda$.

24. (D) Sound λ ($\sim m$) is comparable to obstacle sizes; light λ ($\sim 10^{-7} m$) is not.
25. (C) Only transverse waves can be polarised.
26. (A) $I = I_0 \cos^2 \theta$, θ = angle between polariser and analyser axes.
27. (B) Averaging $\cos^2 \theta$ over all orientations gives $\frac{1}{2}$.
28. (A) $I_0/2 \times \cos^2 60^\circ = I_0/2 \times 1/4 = I_0/8$.
29. (C) $\cos^2 90^\circ = 0$.
30. (A) The reflected light is fully polarised when $\tan \theta_B = n$.
31. (A) $\theta_B + r = 90^\circ$, so reflected and refracted rays are perpendicular.
32. (D) $\tan \theta_B = \sqrt{3} \rightarrow \theta_B = 60^\circ$.
33. (C) The reflected component is completely polarised perpendicular to the plane of incidence.
34. (D) The photoelectric effect requires the particle (photon) nature of light.
35. (D) Huygens' construction gives $n = c/v > 1$, so v decreases — confirmed experimentally.
36. (B) Resolution limit $\propto \lambda$, so shorter wavelengths resolve finer detail.
37. (D) Angular resolution $\approx 1.22\lambda/D$; larger D resolves smaller angles.
38. (C) $y_n = n\beta \rightarrow \beta = 5/5 = 1 \text{ mm}$.
39. (D) $\beta = 2 \text{ mm}$. Dark fringes at $(n - \frac{1}{2})\beta \rightarrow 2\text{nd dark at } 1.5\beta = 3 \text{ mm}$.
40. (A) Extra optical path $(n - 1)t$ shifts the pattern by $(n - 1)t \times D/d$ towards the covered slit.
41. (A) Light reflected from the top and bottom surfaces of the film interferes.
42. (D) $\theta = \beta/D = \lambda/d$.
43. (A) $\theta \propto \lambda \rightarrow 0.2 \times 600/500 = 0.24^\circ$.
44. (C) Amplitude ratio $3 : 1 \rightarrow I_{\max}/I_{\min} = (3 + 1)^2/(3 - 1)^2 = 16/4 = 4$.

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