DPP No: 41

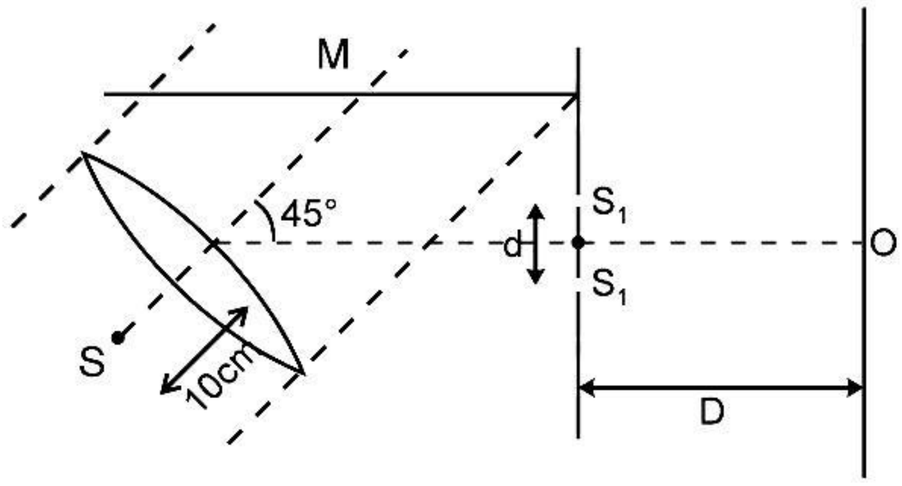
Maximum Time
50 Min

PHYSICS

TARGET
JEE-MAINS

SYLLABUS : WAVE OPTICS

1. In youngs double slit experiment, distance between the slits is d and that between the slits and screen is D. Angle between principle axis of lens and perpendicular bisector of S_1 and S_2 is 45°. The point source S is placed at the focus of lens and aperture of lens is much larger than d. Assuming only the reflected light from plane mirror M is incident on slits, distance of central maxima from O will be :



(A) D (B) $\frac{D}{\sqrt{3}}$ (C) $D\sqrt{3}$ (D) $\frac{D}{\sqrt{4}}$

2. Minimum thickness of a mica sheet having $\mu = \frac{3}{2}$ which should be placed in front of one of the slits in YDSE is required to reduce the intensity at the centre of screen to half of maximum intensity is-

(A) $\lambda/4$ (B) $\lambda/8$ (C) $\lambda/2$ (D) $\lambda/3$

3. 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:

(A) 450 (B) 600 (C) 400 (D) 500

4. A soap film of thickness 0.3 μm appears dark when seen by the refracted light of wavelength 580 nm. What is the index of refraction of the soap solution, if it is known to be between 1.3 and 1.5?

(A) 0.45 (B) 1.45 (C) 2.25 (D) 3.15

5. A parallel beam of light of wavelength 560 nm falls on a thin film of oil (refractive index = 1.4). What should be the minimum thickness of the film so that it weakly transmits the light?

(A) 10 nm (B) 60 nm (C) 75 nm (D) 100 nm

6. A parallel coherent beam of light falls on fresnel biprism of refractive index μ and angle α. The fringe width on a screen at a distance D from biprism will be (wavelength = λ)

(A) $\frac{\lambda}{2(\mu-1)\alpha}$ (B) $\frac{\lambda D}{2(\mu-1)\alpha}$ (C) $\frac{D}{2(\mu-1)\alpha}$ (D) None of these

7. Electromagnetic waves are transverse in nature is evident by

(A) polarization (B) interference (C) reflection (D) diffraction

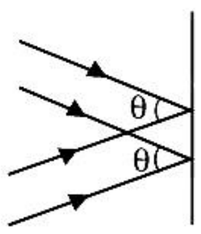
8. If I_0 is the intensity of the principal maximum in the single slit diffraction pattern, then what will be its intensity when the slit width is doubled ?

(A) $I_0\pi/\omega$ (B) $I_0/2$ (C) $2I_0$ (D) $4I_0$

9. 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

(A) zero (B) I_0 (C) $\frac{1}{2}I_0$ (D) $\frac{1}{4}I_0$

10. Two parallel beams of light of wavelength λ inclined to each other at angle θ (<<1) are incident on a plane at near normal incidence. The fringe width will be :

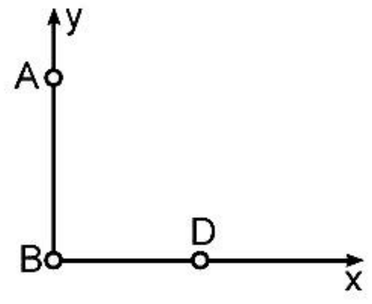


(A) $\frac{\lambda}{2\theta}$ (B) $\frac{2\lambda}{\theta}$ (C) $\frac{\lambda}{\theta}$ (D) $2\lambda\sin\theta$

11. If the first minima in a Young's slit experiment occurs directly infornt of one of the slits. (distance between slit & screen D = 12 cm and distance between slits d = 5 cm) then the wavelength of the radiation used is :

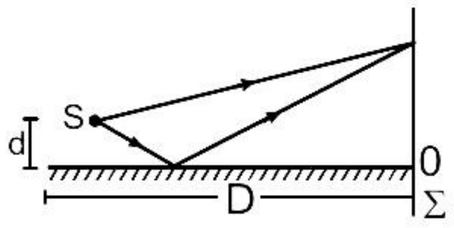
(A) 2 cm only (B) 4 cm only (C) 2m, $\frac{2}{3}$ cm, $\frac{2}{5}$ cm (D) 4cm, $\frac{4}{3}$ cm, $\frac{4}{5}$ cm

12. An interference is observed due to two coherent sources 'A' & 'B' having phase constant zero separated by a distance 4 λ along the y – axis where λ is the wavelength of the source. A detector D is moved on the positive x – axis. The number of points on the x – axis excluding the points, x = 0 & x = ∞ at which maximum will be observed is



(A) three (B) four (C) two (D) infinite

13. A long narrow horizontal slit lies 1 mm above a plane mirror. The interference pattern produced by the slit and its image is viewed on a screen Σ distant 1m from the slit. The wavelength of light is 600 nm. Then the distance of the first maxima above the mirror is equal to (d << D):

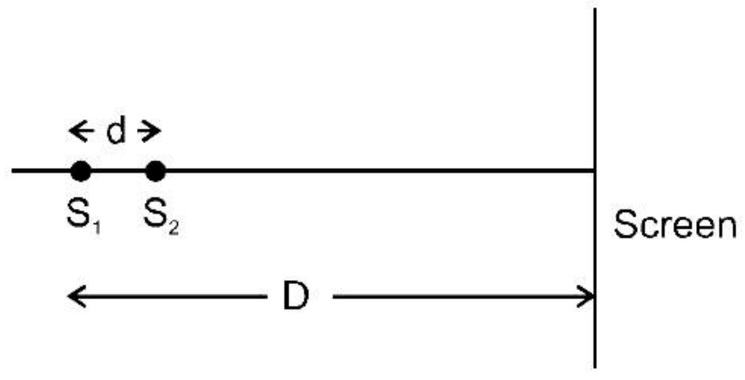


(A) 0.30 mm (B) 0.15 mm (C) 60 mm (D) 7.5 mm

14. 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 :

(A) 2 (B) 1 (C) 0.5 (D) 4

15. 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 :



(A) points

(B) straight lines

(C) semi-circles

(D) concentric circles

16. 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

(A) 3 (B) $\frac{3}{2}$ (C) 1 (D) $\frac{1}{3}$

17. 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 :

(A) becomes narrower (B) goes horizontally without any deflection

(C) bends downwards (D) bends upwards

18. 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 :

(A) 1 μm (B) 30 μm (C) 100 μm (D) 300 μm

19. 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 :

(A) 45° (B) 60° (C) 0° (D) 30°

20. 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.)

(A) 75 μm (B) 100 μm (C) 25 μm (D) 50 μm

21. In a double slit experiment, green light (5303 Å) falls on a double slit having a separation of 19.44 μm and a width of 4.05 μm. The number of bright fringes between the first and the second diffraction minima is

(A) 05 (B) 09 (C) 10 (D) 04

22. In a Young's double slit experiment, the path difference, at a certain point on the screen, between 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

(A) 0.74 (B) 0.94 (C) 0.80 (D) 0.85

23. In a 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 $-30^{\circ} \le \theta \le 30^{\circ}$ is

(A) 640 (B) 320 (C) 321 (D) 641

24. 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 :

(A) 4 : 1 (B) 16 : 9 (C) 5 : 3 (D) 25 : 9

25. If the source of light used in a Young's double slit experiment is changed from red to violet :

(A) consecutive fringe lines will come closer.

(B) the central bright fringe will become a dark fringe.

(C) the fringes will become brighter.

(D) the intensity of minima will increase.

ANSWER KEY

1.	(A)	**2.**	(C)	**3.**	(B)	**4.**	(B)	**5.**	(D)
6.	(A)	**7.**	(A)	**8.**	(C)	**9.**	(C)	**10.**	(C)
11.	(A)	**12.**	(A)	**13.**	(B)	**14.**	(A)	**15.**	(D)
16.	(D)	**17.**	(D)	**18.**	(B)	**19.**	(A)	**20.**	(C)
21.	(D)	**22.**	(D)	**23.**	(D)	**24.**	(D)	**25.**	(A)