Additional Problems For Self Practice (APSP)

PART-I : PRACTICE TEST PAPER

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions :

1. The test is of **1 hour** duration and max. marks 120.
2. The test consists **30** questions, **4 marks** each.
3. Only one choice is correct **1 mark** will be deducted for incorrect response. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
4. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 3 above.

1. Find the half angular width of the central bright maximum in the Fraunhofer diffraction pattern of a slit of width 12×10^{-5} cm when the slit is illuminated by monochromatic light of wavelength 6000Å.
(1) 15° (2) 45° (3) 60° (4) 30°

2. In Fraunhofer diffraction due to a narrow slit a screen is placed 2 m away from the lens to obtain the pattern. If the slit width is 0.2 mm and the first minima lie 5 mm on either side of the central maximum, find the wavelength of light.
(1) 5000Å (2) 3000Å (3) 2000Å (4) 4000Å

3. Light of wavelength 6000Å is incident on a slit of width 0.30 nm. The screen is placed 2m from the slit. Find
(a) the position of the first dark fringe.
(1) 4×10^{-3}m (2) 2×10^{-3}m (3) 1×10^{-3}m (4) 3×10^{-3}m
(b) the width of the central bright fringe.
(1) 8 mm (2) 4 mm (3) 6 mm (4) 8 cm

4. A signal slit of width 0.14 mm is illuminated normally by monochromatic light and diffraction bands are observed on a screen 2m away. If the centre of the second dark band is 1.6 cm from the middle of the central bright band, deduce the wavelength of light used.
(1) 5000Å (2) 5600Å (3) 2000Å (4) 4000Å

5. A screen is placed 2m away from a narrow slit which is illuminated with light of wavelength 6000Å. If the first minimum lies 50 mm on either side of the central maximum, calculate the slit width.
(1) 2.4 mm (2) 0.24 mm (3) 0.21 mm (4) 0.2 mm

6. Find the angular width of the central bright maximum in the Fraunhofer diffraction pattern of a slit of width 12×10^{-5} cm when the slit is illuminated by monochromatic light of wavelength 6000Å.
(1) 15° (2) 45° (3) 60° (4) 30°

7. Diffraction pattern of a signal slit of width 0.5 cm is formed by a lens of focal length 40 cm. Calculate the distance between the first dark and the next bright fringe from the axis. Wave length = 4890Å.
(1) 1.956×10^{-5} m (2) 2×10^{-2} mm (3) 1.596×10^{-1} mm (4) 1.596×10^{2} mm

8. Find the separation of two points on the moon that can be resolved by a 500 cm telescope. The distance of the moon is 3.8×10^{5} km. The eye is most sensitive to light of wavelength 5500 Å.
(1) 50.996 meters (2) 40.996 meters (3) 30.996 meters (4) 20.996 meters

9. Calculate the aperture of the objective of a telescope which may by used to resolve stars separated by 4.88×10^{-6} radian for light of wavelength 6000Å
(1) 20 cm (2) 15 cm (3) 10 cm (4) 12 cm

10. Two pin holes 1.5 mm apart are placed in front of a source of light of wavelength 5.5×10^{-5} cm and seen through a telescope with its objectives stopped down to a diameter of 0.4 cm. Find the maximum distance from the telescope at which the pin holes can be resolved.
(1) 8.942 m (2) 7.942 m (3) 6.942 m (4) 9.942 m

11. In a YDSE: D = 1 m, d = 1 mm and λ = 500 n m. The distance of 1000th maxima from the central maxima is:

(1) 0.5 m (2) 0.577 m (3) 0.495 m (4) does not exist

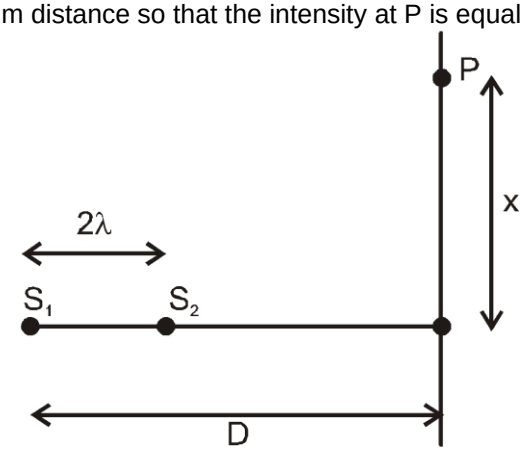
12. An unpolarised light of intensity I_0 falls on a polaroid whose optic axis is inclined at 45° to the incident light. Then the intensity of light emerging from the polaroid is

(1) I_0 (2) $\frac{I_0}{2}$ (3) $\frac{I_0}{4}$ (4) zero

13. If a mica sheet of thickness t and refractive index μ is placed in the path of one of interfering beam in a double slit experiment, then displacement of fringes will be

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

14. 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) $D\sqrt{3}$

15. 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 :

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

16. Diffraction pattern for a plane progressive wave is obtained from the edges of a disc. If screen is taken near by the disc then the intensity of diffraction pattern will be :

(1) increases (2) decreases
(3) remain unchanged (4) first increase and then decreases

17. If a light wave passes through a transparent medium (like as glass). Then :

(1) Velocity of all light waves will be same
(2) Velocity of longer wavelength will be less
(3) Velocity of longest wavelength will be maximum
(4) Velocity of shorter wavelength will be maximum

18. The wavelength of light in air and some other medium are respectively λ_a and λ_m . The refractive index of medium is :

(1) λ_a / λ_m (2) λ_m / λ_a (3) $\lambda_a \times \lambda_m$ (4) None

19. If seperation between screen and source is increased by 2%, what would be the effect on the intensity ?

(1) Increases by 4% (2) Increases by 2%
(3) Decreases by 2% (4) Decreases by 4%

20. Light waves travel in vacuum along the y-axis. Which of the following may represent the wavefront
(1) y = constant (2) x = constant (3) z = constant (4) x + y + z = constant

21. In refraction, light waves are bent on passing from one medium to the second medium, because in the second medium :
(1) the frequency is different (2) the coefficient of elasticity is different
(3) the speed is different (4) the amplitude is smaller

22. A point source emits sound equally in all directions in a non-absorbing medium, two points P and Q are at distances of 2 m and 3m respectively from the source. The ratio of the intensities of the waves at P and Q is:-
(1) 9 : 4 (2) 2 : 3 (3) 3 : 2 (4) 4 : 9

23. In the propagation of light waves, the angle between the direction of vibration and plane of polarisation is :-
(1) 0° (2) 90° (3) 45° (4) 80°

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

25. In single slit diffraction pattern :
(1) Central fringe has negligible width than others
(2) All fringes are of same width
(3) Central fringe does not exist
(4) None of the above

26. The maximum number of possible interference maxima for slit-separation equal to twice the wavelength in Young's double-slit experiment, is :
(1) Infinite (2) five (3) three (4) zero

27. Monochromatic light of frequency 5×10^{14} Hz travelling in vacuum enters medium of refractive index 1.5. Its wavelength in the medium is :
(1) 4000 Å (2) 5000 Å (3) 6000 Å (4) 5500 Å

28. In rainy days oil layer on water surface appears coloured this is due to :
(1) dispersion of light (2) Interference of light
(3) Absorption of light (4) Scattering of light

29. Two waves of intensity ratio 25 : 4 produce interference then ratio of maximum to minimum intensity:
(1) 5 : 2 (2) 7 : 3 (3) 49 : 9 (4) 9 : 49

30. 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
(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

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

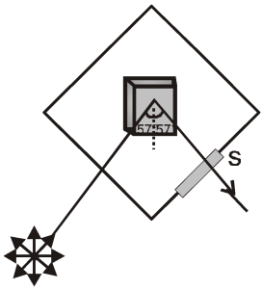
Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

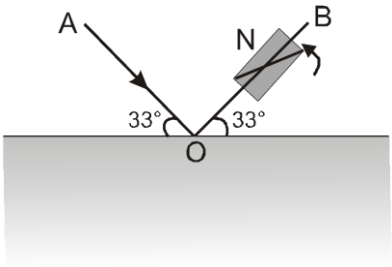
1. Out of the following statements which is not correct
(1) When upolarised light passes through a Nicol's prism the emergent light is elliptically polarised
(2) Nicol's prism works on the principle of double refraction and total internal reflection
(3) Nicol's prism can be used to produce and analyse polarised light
(4) Calcite and Quartz are both doubly refracting crystals

2. A ray of light is incident on the surface of a glass plate at an angle of incidence equal to Brewster's angle φ. If μ reprents the refractive index of glass with respect to air then the angle between reflected and refracted rays is
(1) $90 + \varphi$ (2) $\sin^{-1}(\mu\cos\varphi)$ (3) 90° (4) $90° - \sin^{-1}(\sin\varphi/\mu)$

3. 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
(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



4. A beam of light AO is incident on a glass slab (μ = 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
(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



5. Polarised glass is used in sun glasses because
(1) It reduces the light intensity to half an account of polarisation
(2) It is fashionable
(3) It has good colour
(4) It is cheaper

6. In the propagation of electromagnetic waves the angle between the direction of propagation and plane of polarisation is
(1) 0° (2) 45° (3)90° (4) 180°

7. The transverse nature of light is shown by

(1) Interference of light (2) Refraction of light
(3) Polarisation of light (4) Dispersion of light

8. 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
(1) 2.32 m (2) 4.28 mm (3) 1.25 cm (4) 12.48 cm

9. A double slit experiment is performed with light of wavelength 500 nm. A thin film of thickness 2 μm and refractive index 1.5 in introduced in the path of the upper beam. The location of the central maximum will
(1) Remain unshifted (2) Shift downward by nearly two fringes
(3) Shift upward by nearly two fringes (4) Shift downward by 10 fringes

10. Which one of the following statement is true ?
(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

11. Two waves have equations :
$y_1 = a \sin(\omega t + \phi_1)$; $y_2 = a \sin(\omega t + \phi_2)$. 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?

12. In Young's double slit experiment, the slits are 2 mm apart and are illuminated by photons of two wavelength λ_1 = 12000 Å and λ_2 = 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 ?
(1) 6 mm (2) 4 mm (3) 3 mm (4) 8 mm

13. 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 ?
(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.

14. 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 ?
(1) 0.1 mm (2) 0.5 mm (3) 0.02 mm (4) 0.2 mm

15. 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
(1) $\frac{D\lambda}{a}$ (2) $\frac{Da}{\lambda}$ (3) $\frac{2Da}{\lambda}$ (4) $\frac{2D\lambda}{a}$

16. 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 :
(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) $\sin^{-1}\left(\frac{1}{3}\right)$

17. A single-slit diffraction pattern is obtained using a beam of red light. if the red light is replaced by blue light which one of the following observations is true ?
(1) no change in diffraction pattern

(2) diffraction fringes become narrower and crowded together
(3) diffraction fringes become broader and further apat
(4) diffraction pattern disappears

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

APSP Answers

PART – I

1.	(4)	**2.**	(1)	**3.**	(1)	**4.**	(2)	**5.**	(2)	**6.**	(3)	**7.**	(1)
8.	(1)	**9.**	(2)	**10.**	(1)	**11.**	(2)	**12.**	(2)	**13.**	(2)	**14.**	(4)
15.	(4)	**16.**	(1)	**17.**	(3)	**18.**	(1)	**19.**	(4)	**20.**	(1)	**21.**	(3)
22.	(1)	**23.**	(1)	**24.**	(3)	**25.**	(4)	**26.**	(3)	**27.**	(1)	**28.**	(2)
29.	(3)	**30.**	(4)										

PART – II

1.	(1)	**2.**	(3)	**3.**	(1)	**4.**	(4)	**5.**	(1)	**6.**	(1)	**7.**	(3)
8.	(3)	**9.**	(3)	**10.**	(2)	**11.**	$\Delta\phi = 120^\circ = \frac{2\pi}{3}\text{rad}$			**12.**	(1)	**13.**	(2)
14.	(4)	**15.**	(4)	**16.**	(1)	**17.**	(2)	**18.**	(1)				