Shiksha Classes Bhandara
CHAPTER TEST

Subject : Physics **Topic : Wave Optics** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Suppose you are using a microscope to view two closely spaced cells. For a given lens diameter, which color of light would you use to achieve the best possible resolving power?

(A) Red (B) Yellow
(C) Green (D) Blue

Q.2 A plane transmission grating having 6000 lines per cm. is illuminated by white light. Calculate the angular separation between the two lines of wavelengths 5882 Å and 5852 Å in the first order spectrum.

(A) 0.8×10^{-3} rad (B) 1.8×10^{-3} rad
(C) 2.2×10^{-5} rad (D) 4.8×10^{-6} rad

Q.3 How far in advance can one detect two headlights of a car if they are separated by a distance of 1.57 m ?

(A) 2.1 km (B) 1.2 km
(C) 8 km. (D) 5.4 km.

Q.4 The two coherent sources of intensity that ratio 2 : 8 produce an interference pattern. The values of maximum and minimum intensities will be respectively.

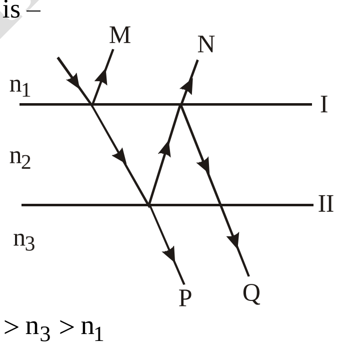
(A) I_1 and $9I_1$ (B) $9I_1$ and I_1
(C) $2I_1$ and $8I_1$ (D) $8I_1$ and $2I_1$

Where I_1 is the intensity of first source

Q.5 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) 2λ/3
(C) λ/3 (D) λ

Q.6 A ray of light is incident on a thin film. As shown in figure M, N are two reflected rays and P, Q are two transmitted rays. Rays N and Q undergo a phase change of π. Correct ordering of the refracting indices is –



(A) $n_2 > n_3 > n_1$
(B) $n_3 > n_2 > n_1$
(C) $n_3 > n_1 > n_2$
(D)None of these, the specified changes cannot occur

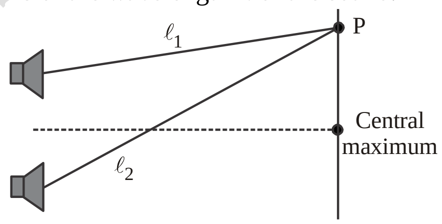
Q.7 In a Young's experiment, the separation between the slits is 0.10mm, the wavelength of light used is 600nm and the interference pattern is observed on a screen 1.0 m away. Find the separation between the successive bright fringes.

(A) 6.6 mm (B) 6.0 mm
(C) 6 m (D) 6 cm.

Q.8 Two light waves are given by,
$E_1 = 2 \sin(100\pi t - kx + 30°)$ and
$E_2 = 3 \cos(200\pi t - k'x + 60°)$. The ratio of intensity of first wave to that of second wave is –

(A) 2/3 (B) 4/9
(C) 1/9 (D) 1/3

Q.9 The two loudspeakers in the drawing are producing identical sound waves. The waves spread out and overlap at the point P. This situation is analogous to Young's double-slit experiment, except that sound waves are being used. What is the difference $\ell_2 - \ell_1$ in the two path lengths if point P is at the third sound intensity minimum from the central sound intensity maximum? Express this difference in terms of the wavelength λ of the sound.

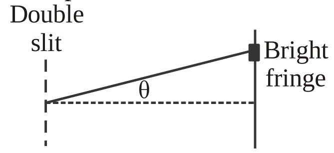


(A) λ/2 (B) λ
(C) 3λ/2 (D) 5λ/2

Q.10 In a Young's double slit experiment the angular width of a fringe formed on a distant screen is 1°. The wavelength of the light used is 6280 Å. What is the distance between the two coherent sources ?

(A) 0.036 mm (B) 0.12 mm
(C) 6mm (D) 4mm

Q.11 In a certain Young's double-slit experiment, a diffraction pattern is formed on a distant screen. The angle that locates a given bright fringe is small, so that the approximation sinθ is valid. By what factor does the angle change if the wavelength λ is doubled and the slit separation d is doubled?

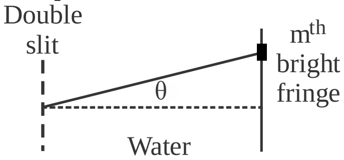


(A) The angle does not change.
(B) The angle increases by a factor of 2.
(C) The angle increases by a factor of 4.
(D) The angle decreases by a factor of 2.

Q.12 The numerical aperture of a microscope is 0.12, and the wavelength of light used is 600 nm. Then its limit of resolution will be nearly –

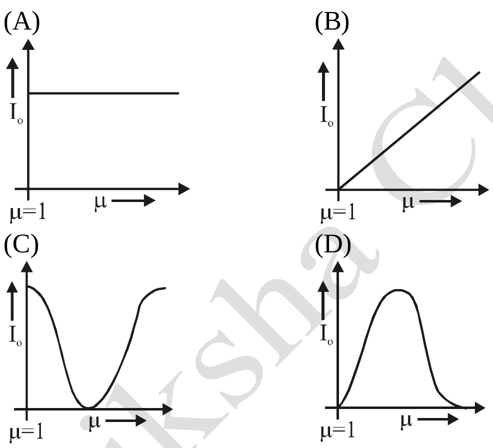
(A) 0.3 μm (B) 1.2 μm
(C) 2.3 μm (D) 3.0 μm

Q.13 Suppose that the apparatus for Young's double-slit experiment is placed under water. Compared to when the apparatus is in a vacuum, how does the wavelength λ and the angle θ change when the apparatus is placed under water?



(A) λ- Does not change, θ- Increases
(B) λ - Increases, θ- Increases
(C) λ - Increases, θ - Decreases
(D) λ - Decreases, θ- Decreases

Q.14 In a YDSE experiment if a slab whose refraction index can be varied is placed in front of one of the slits then the variation of resultant intensity at mid-point of screen with 'μ' will be best represented by (μ ≥ 1). [Assume slits of equal width and there is no absorption by slab; mid point of screen is the point where waves interfere with zero phase difference in absence of slab]



Q.15 A thin oil film of refractive index 1.2 floats on the surface of water (μ=4/3). When a light of wavelength $\lambda = 9.6\times 10^{-7}$ m falls normally on the film from air, then it appears dark when seen normally. The minimum change in its thickness for which it will appear bright in normally reflected light by the same light is :

(A) 10^{-7} m (B) 2×10^{-7} m
(C) 3×10^{-7} m (D) 5×10^{-7} m

Q.16 In a Young's experiment, two coherent sources are placed 0.90 mm apart and the fringes are observed one meter away. If it produces the second dark fringe at a distance of 1mm from the central fringe, the wavelength of monochromatic light used would be –

(A) 60×10^{-4} cm (B) 10×10^{-4} cm
(C) 10×10^{-5} cm (D) 6×10^{-5} cm

Q.17 In Young's experiment for interference of light the slits 0.2 cm. apart are illuminated by yellow light $(\lambda = 5896\ \text{Å})$. What would be the fringe width on a screen placed 1m from the plane of slits. What will be the fringe width if the whole system is immersed in water (μ = 4/3) ?

(A) 0.3 mm, 0.225m (B) 2.3 mm, 0.5 m
(C) 5.3 mm, 2.225m (D) 1.3 mm, 6.25 m

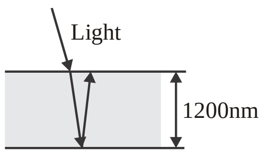
Q.18 In Young's experiment fringe width with is 0.45 mm. When a mica sheet (μ = 1.6) is introduced in the path of waves from one of the slits then the shift of the central fringe is 1.9 mm. What is the thickness of the sheet?

(A) 2.14 μm (B) 4.15 μm
(C) 3.12 μm (D) 7.14 μm

Q.19 The sky is blue because –

(A) most polluting gases and dust particles in the air are bluish in colour and lend their colour to that of the sky.
(B) air molecules absorb red light more efficiently than they do blue light because of their electron orbitals.
(C) tiny particles in the air are more efficient at scattering short wavelength light than they are at scattering long wavelength light.
(D) air molecules absorb blue light more efficiently than they do red light because of their electron orbitals

Q.20 Light of wavelength 600 nm in vacuum is incident nearly perpendicularly on a thin film whose index of refraction is 1.5. The light travels from the top surface of the film to the bottom surface, reflects from the bottom surface, and returns to the top surface, as the figure indicates. How far has the light traveled inside the film? Express your answer in terms of the wavelength λ_{film} of the light within the film.



(A) $2\lambda_{film}$ (B) $3\lambda_{film}$
(C) $4\lambda_{film}$ (D) $6\lambda_{film}$

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

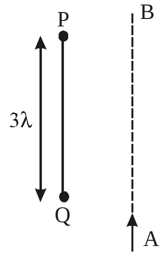
Q.21 In a Young's double slit experiment, 12 fringes are observed to be formed in a certain segment of the screen when light of wavelength 600 nm is used. If the wavelength of light is changed to 400 nm, number of fringes observed in the same segment of the screen is given by

Q.22 If the distance between the first maxima and fifth minima of a double slit pattern is 7mm and the slits are separated by 0.15 mm with the screen 50 cm. from the slits, then the wavelength (in nm) of the light used is

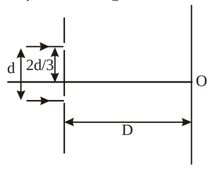
(A) 200 nm (B) 100 nm
(C) 800 nm (D) 600nm

Q.23 In a YDSE : D = 1m, d = 1 mm and λ = 5000 nm. Find the distance of 100th maxima from the central maxima is $(1/\sqrt{X})$. Find the value of X.

Q.24 Two coherent light sources each of wavelength λ are separated by a distance 3λ. The maximum number of minima formed on line AB which runs from $-\infty$ to $+\infty$ is –



Q.25 In the figure shown if a parallel beam of white light is incident on the plane of the slits then the distance of the nearest white spot on the screen from O is (1/X) d. Find the value of X.
(assume d << D, λ << d]



(A) 0 (B) d/2
(C) d/3 (D) d/6


BECOME AN ACE IN JEE & NEET
SHIKSHA CLASSES
Believe & Achieve
JEE | NEET | Previse (8-10)
8625055707 | 8623085707
shikshaclasses.co.in
M-19, MHADA Colony, Khat Road, Bhandara
Learn with Jaiswal sir