Class 12 Physics · Chapter 10: Wave Optics

Worksheet · 20 marks · about 40 minutes · based on NCERT

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1. A beam of light passes from glass into air. The quantity that does not change is its [1]

(a) frequency
(b) wavelength
(c) speed
(d) direction of travel, for oblique incidence

2. Light of frequency 6.0×10^{14} Hz has a wavelength of 400 nm inside a transparent plastic. Taking $c = 3.0 \times 10^{8}$ m s^{-1}, the refractive index of the plastic is [1]

(a) 0.80
(b) 1.33
(c) 1.25
(d) 2.40

3. According to the superposition principle, the resultant displacement at a point where several waves meet is [1]

(a) the vector sum of the displacements due to each wave
(b) the displacement due to the strongest wave alone
(c) the sum of the intensities of the waves
(d) the product of the individual displacements

4. A convex lens forms a real image of a point object. The ray through the centre of the lens covers a shorter geometrical path than a ray through the edge, yet both reach the image together because [1]

(a) the edge ray travels faster in glass than the central ray
(b) the central ray is delayed by reflection at the lens surfaces
(c) light takes no time to cross a thin lens
(d) the central ray spends more of its path in glass, where light travels more slowly

5. Light travels at 2.0×10^{8} m s^{-1} in a certain glass. Taking $c = 3.0 \times 10^{8}$ m s^{-1}, the critical angle for light going from this glass into air is [1]

(a) 48.2°
(b) 41.8°
(c) 33.7°
(d) 19.5°

6. Two coherent sources each produce an intensity I_0 at a point on a screen. Find the resultant intensity at points where the phase difference between the two waves is (i) $\pi/2$, (ii) $5\pi/3$. [2]

7. State Huygens' principle. Using it, describe how the position of a plane wavefront at a time τ later is obtained, and state the direction of the rays. [2]

8. Using the Huygens construction for the refraction of a plane wavefront at a plane surface, show that $\lambda_1/\lambda_2 = v_1/v_2$, and hence that the frequency of the light does not change. State how the wavelength changes when light passes into a denser medium. [2]

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9. In a double-slit experiment the slits are 0.35 mm apart, the screen is 1.25 m away and the light has a wavelength of 560 nm. Find (i) the fringe width, (ii) the distance between the second bright fringe on one side of the centre and the third dark fringe on the other side, (iii) the fringe width when the screen is moved to 1.75 m. [3]

10. Unpolarised light of intensity 32 W m^{-2} falls on a polaroid P_1, and the light from it on a second polaroid P_2. The light emerging from P_2 has intensity 4.0 W m^{-2}. Find (i) the intensity between P_1 and P_2, (ii) the angle between their pass-axes, (iii) the smallest angle through which P_2 must be turned to double the emerging intensity. [3]

11. Light travels at 2.25×10^8 m s^{-1} in a liquid. It meets the plane surface between the liquid and air from inside the liquid. Taking $c = 3.00 \times 10^8$ m s^{-1}, find (i) the refractive index of the liquid, (ii) the critical angle for the liquid–air surface. (iii) Using the Huygens construction, explain why there is no refracted wavefront when the angle of incidence exceeds the critical angle. [3]