CLASS XII – PHYSICS (042)
PRACTICE PAPER – CHAPTER 10: WAVE OPTICS

Academic Session 2026–27

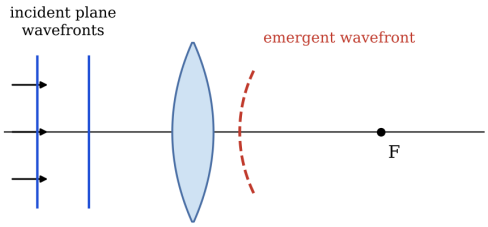
Maximum Marks : 35 **Time Allowed : 1 hour 15 minutes**

General Instructions

(1) There are 18 questions in all. All questions are compulsory.
(2) The question paper has five sections: Section A, B, C, D and E.
(3) Section A (Q.1–9) has seven MCQs and two Assertion–Reasoning questions of 1 mark each. Section B (Q.10–13) has four questions of 2 marks each. Section C (Q.14–16) has three questions of 3 marks each. Section D (Q.17) is one case study based question of 4 marks. Section E (Q.18) is one long answer question of 5 marks.
(4) There is no overall choice. An internal choice is provided in Q.12 (Section B), Q.15 (Section C), Q.17 part (iv) (Section D) and Q.18 (Section E). Attempt only one of the choices in such questions.
(5) Use of calculators is not allowed.
(6) You may use the following values wherever necessary: $c = 3 \times 10^8$ m s^{-1}, 1 nm = 10^{-9} m, refractive index of water = 4/3.

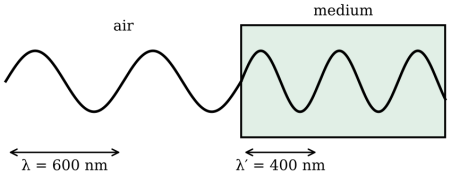
SECTION A (9 × 1 = 9)

1. Plane wavefronts of light are incident on a thin convex lens, as shown. The wavefront that emerges from the lens is **1**



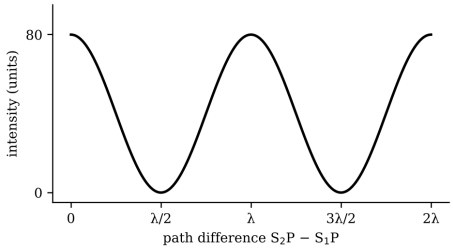
(a) plane, because the speed of light in glass is the same as in air
(b) spherical and converging to the focus F, because the central part of the wavefront is delayed the most
(c) spherical and diverging from the focus F, because the central part of the wavefront is delayed the least
(d) plane but tilted, because the lower part of the wavefront is delayed more

2. A wave of wavelength 600 nm in air enters a medium, in which its wavelength is 400 nm, as shown. The frequency of the wave and its speed in the medium are respectively **1**



(a) 5×10^{14} Hz, 3×10^8 m s^{-1}
(b) 7.5×10^{14} Hz, 2×10^8 m s^{-1}
(c) 5×10^{14} Hz, 2×10^8 m s^{-1}
(d) 7.5×10^{14} Hz, 3×10^8 m s^{-1}

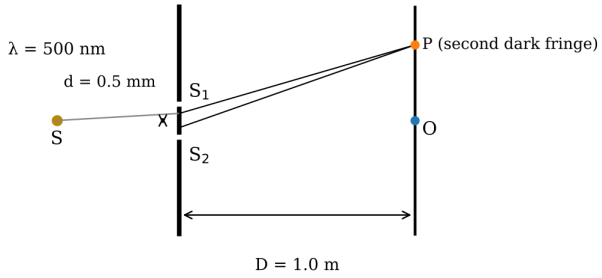
3. The graph shows the intensity of light at a point on the screen when two coherent sources illuminate it, as a function of the path difference between the waves reaching it. The intensity at a point where the path difference is λ/6 is **1**



(a) 20 units
(b) 40 units
(c) 60 units
(d) 80 units

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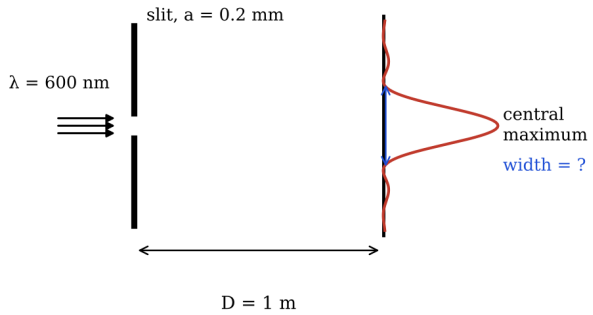
4. In the Young's double-slit arrangement shown, the point P is the second dark fringe from the central bright fringe O. The distance OP is **1**



(a) 1.0 mm
(b) 1.5 mm
(c) 2.0 mm
(d) 2.5 mm

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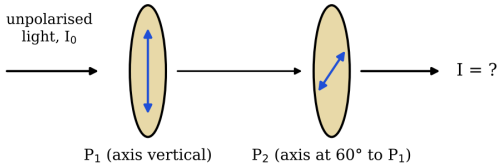
5. A parallel beam of light of wavelength 600 nm falls normally on a single slit of width 0.2 mm, and the pattern is seen on a screen 1 m away, as shown. The width of the central maximum is **1**



(a) 3 mm
(b) 6 mm
(c) 12 mm
(d) 1.2 mm

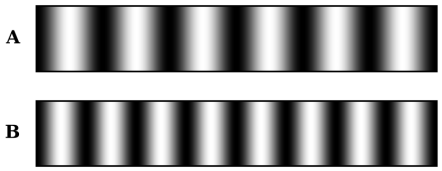
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6. Unpolarised light of intensity I_0 passes through two polaroids P_1 and P_2 whose pass axes make an angle of 60° with each other, as shown. The intensity of the emergent light is **1**



(a) $I_0/2$
(b) $I_0/4$
(c) $I_0/8$
(d) zero

7. The two strips A and B show the interference patterns obtained on the same size of screen in the same Young's double-slit set-up with two different monochromatic lights. Strip B is obtained with light of wavelength 450 nm. The wavelength of the light producing strip A is **1**



(a) 338 nm
(b) 450 nm
(c) 600 nm
(d) 800 nm

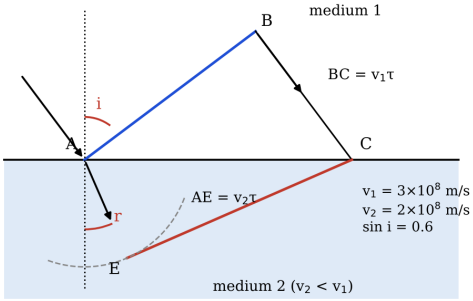
For Questions 8 and 9, a statement of Assertion (A) is followed by a statement of Reason (R). Select the correct answer from the options below.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

8. **Assertion (A):** No interference fringes are observed when two independent sodium lamps illuminate two pinholes placed close together. **1**
Reason (R): Light from two independent sources has no fixed phase relationship, so the intensities of the two simply add up.

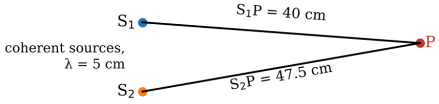
9. **Assertion (A):** Diffraction of light is not noticed in our everyday experience. **1**
Reason (R): The wavelength of light is much larger than the size of the obstacles we commonly meet.

SECTION B (4 × 2 = 8)

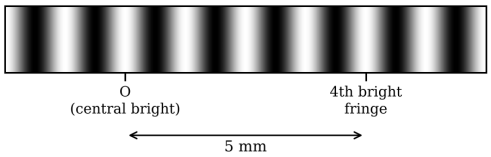
10. A plane wavefront AB in air is incident on the surface of a glass slab, as shown in the Huygens construction. In the time τ taken by the wavefront to travel BC in air, the wave travels AE in the glass. (a) Show that $\sin i / \sin r = v_1/v_2$. (b) If $\sin i = 0.6$, $v_1 = 3 \times 10^8$ m s^{-1} and $v_2 = 2 \times 10^8$ m s^{-1}, find sin r. **2**



11. Two coherent sources S_1 and S_2 emit waves of wavelength 5 cm in phase, as shown. Find the path difference at P and the corresponding phase difference. State whether the interference at P is constructive or destructive and find the resultant intensity there, if each source alone produces intensity I_0 at P. **2**



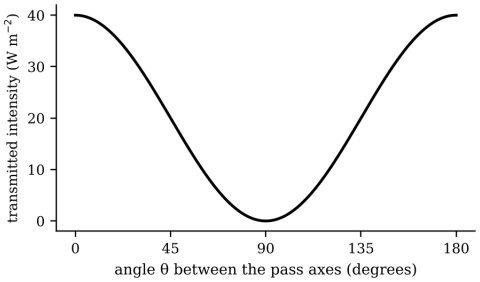
12. **(A)** In a Young's double-slit experiment the slits are 0.4 mm apart and the screen is 1.0 m away. The distance between the central bright fringe O and the fourth bright fringe on the screen is measured to be 5 mm, as shown. Find the wavelength of the light used. **2**



OR

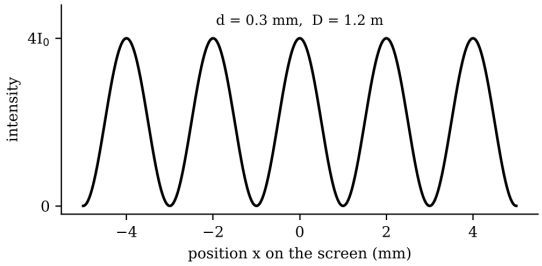
(B) In a Young's double-slit experiment the slit separation is d and the screen is at a distance D. Obtain the expression for the fringe width $\beta = \lambda D/d$.

13. Unpolarised light is incident on a polaroid P_1 and the light emerging from it falls on a second polaroid P_2 which is rotated. The graph shows the intensity of the light transmitted by P_2 as a function of the angle θ between the pass axes. Find (a) the intensity of the unpolarised light incident on P_1, and (b) the angle θ at which the transmitted intensity is 10 W m^{-2}. **2**

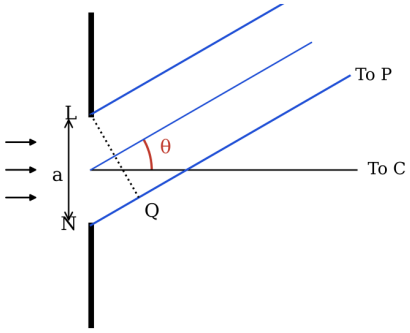


SECTION C (3 × 3 = 9)

14. The graph shows the intensity distribution on the screen in a Young's double-slit experiment in which the slits are 0.3 mm apart and the screen is 1.2 m away. (a) Find the fringe width from the graph. (b) Find the wavelength of the light used. (c) The whole apparatus is now immersed in water (refractive index 4/3). Find the new fringe width. **3**



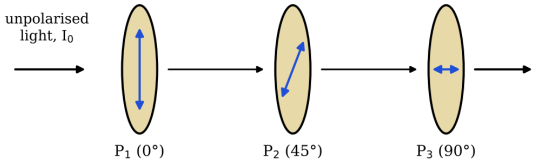
15. **(A)** A parallel beam of monochromatic light of wavelength λ falls normally on a single slit LN of width a, as shown. Using the figure, show that the first minimum of the diffraction pattern occurs at sin θ = λ/a. State how the intensity of the secondary maxima compares with that of the central maximum, and write the expression for the angular width of the central maximum. **3**



OR

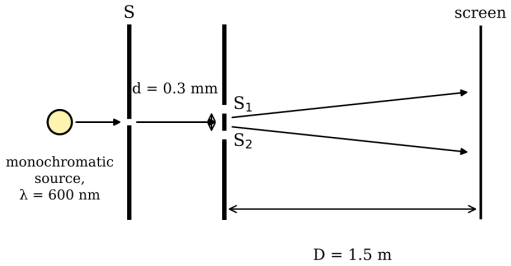
(B) State Huygens' principle. Using it, with a labelled diagram, prove the law of reflection for a plane wave incident on a plane reflecting surface.

16. Unpolarised light of intensity I_0 passes successively through three polaroids P_1, P_2 and P_3 whose pass axes are at 0°, 45° and 90° respectively, as shown. (a) Find the intensity of the light after P_1. (b) Find the intensities after P_2 and after P_3. (c) What would be the intensity transmitted if P_2 were removed? Give a reason. **3**



SECTION D (1 × 4 = 4)

17. **Case Study.** A student sets up Young's double-slit experiment with a monochromatic source of wavelength 600 nm. The slit separation is 0.3 mm and the screen is at a distance of 1.5 m from the slits, as shown. A single slit S in front of the source ensures that S_1 and S_2 are coherent, because the light reaching them comes from the same wavefront. Answer the following: **4**



(i) The fringe width on the screen is

(a) 0.3 mm (b) 3 mm (c) 6 mm (d) 9 mm

(ii) The distance of the third bright fringe from the central maximum is

(a) 3 mm (b) 6 mm (c) 9 mm (d) 12 mm

(iii) If the screen is moved to a distance of 3.0 m, the fringe width becomes

(a) 1.5 mm (b) 3 mm (c) 4.5 mm (d) 6 mm

(iv) If the source is replaced by a blue source of wavelength 450 nm, the fringe width (for D = 1.5 m) becomes

(a) 4.0 mm (b) 2.25 mm (c) 3.0 mm (d) 9 mm

OR

(iv) If the whole apparatus (with the original 600 nm source and D = 1.5 m) is immersed in a liquid of refractive index 1.5, the fringe width becomes

(a) 4.5 mm (b) 3.0 mm (c) 2.0 mm (d) 1.0 mm

SECTION E (1 × 5 = 5)

18. **(A)** State Huygens' principle. With a labelled diagram of the Huygens construction, derive Snell's law of refraction for a plane wave incident at an angle i on a plane surface separating two media in which the speeds of light are v_1 and v_2. (3) **5**

Light of wavelength 600 nm in air enters water of refractive index 4/3. Find the wavelength, frequency and speed of the light in water. (2)

OR

(B) Two coherent sources produce waves of equal amplitude a with a phase difference φ at a point. Obtain the resultant intensity $I = 4I_0 \cos^2(\varphi/2)$ and hence write the conditions, in terms of path difference, for constructive and destructive interference. (3)

In a Young's experiment the intensity at the central maximum is I. Find the intensity at a point on the screen where the path difference is (i) λ/4 and (ii) λ/3. (2)

— End of Question Paper —