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Class 12 Physics Chapterwise PYQs

2026 – 2003 | All CBSE Board Papers

Chapter-wise previous year questions, sorted by marks and year

Chapter 10: Wave Optics

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1-Mark Questions (64 questions · Section A · MCQ)

Q1. Four independent waves are expressed as: (i) $y_1 = A_1 \sin \omega t$ (ii) $y_2 = A_2 \sin 2\omega t$ (iii) $y_3 = A_3 \cos \omega t$ (iv) $y_4 = A_4 \sin(\omega t + \pi/3)$ The interference between two of these waves is possible in:

(A) (i) and (iii) only
(B) (iii) and (iv) only
(C) (i), (iii) and (iv) only
(D) All of them

[2026 • Set 55-1-1]

Q2. The shape of the interference fringes in Young's double-slit experiment, when the distance between the slit and the screen is very large as compared to the slit-separation, is nearly:

(A) straight
(B) parabolic
(C) circular
(D) hyperbolic

[2026 • Set 55-1-1]

Q3. The angular width of interference fringes in Young's double-slit experiment depends on:

(A) distance between the slits and the screen only
(B) wavelength of light used only
(C) both wavelength of light used and the slits separation
(D) slits separation only

[2026 • Set 55-1-2]

Q4. The phenomenon of interference is shown by:
(A) longitudinal mechanical wave only
(B) transverse mechanical wave only
(C) electromagnetic waves only
(D) all these waves

[2026 • Set 55-1-3]

Q5. Assertion (A): Light added to light can produce darkness. Reason (R): When two coherent light waves interfere, there is darkness at position of destructive interference.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false and Reason (R) is also false.

[2026 • Set 55-2-1]

Q6. The phase difference between the two superimposing waves that give rise to a bright spot in a Young's double-slit experiment is (n is an integer):
(A) $2n\pi$
(B) $2n\pi + \frac{\pi}{2}$
(C) $2n\pi + \frac{\pi}{4}$
(D) $2n\pi + \pi$

[2026 • Set 55-3-1]

Q7. Assertion (A): In Young's double-slit experiment, the fringe width for dark and bright fringes is the same. Reason (R): Fringe width is given by $\beta = \frac{\lambda D}{d}$, where symbols have their usual meanings. Select the correct answer from the codes given below:
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Both Assertion (A) and Reason (R) are false.

[2026 • Set 55-5-1]

Q8. What property of light does this interference experiment demonstrate?

(A) Wave nature of light
(B) Particle nature of light
(C) Transverse nature of light
(D) Both wave nature and transverse nature of light

[2026 • Set 55-5-1]

Q9. (a) The wavelength of light used in this experiment is:

(A) $720\,\text{nm}$
(B) $590\,\text{nm}$
(C) $480\,\text{nm}$
(D) $364\,\text{nm}$

[2026 • Set 55-5-1]

Q10. (b) The fringe width in the interference pattern formed on the screen is:

(A) $1.2\,\text{mm}$
(B) $0.2\,\text{mm}$
(C) $4.2\,\text{mm}$
(D) $6.8\,\text{mm}$

[2026 • Set 55-5-1]

Q11. The path difference between the two waves meeting at point P, where there is a minimum in the interference pattern is:

(A) $8.1 \times 10^{-7}\,\text{m}$
(B) $7.2 \times 10^{-7}\,\text{m}$
(C) $6.5 \times 10^{-7}\,\text{m}$
(D) $6.0 \times 10^{-7}\,\text{m}$

[2026 • Set 55-5-1]

Q12. When the experiment is performed in a liquid of refractive index greater than 1, then fringe pattern will:

(A) disappear
(B) become blurred
(C) be widened
(D) be compressed

[2026 • Set 55-5-1]

Q13. Assertion (A): In double slit experiment if one slit is closed, diffraction pattern due to the

other slit will appear on the screen. Reason (R): For interference, at least two waves are required.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Both Assertion (A) and Reason (R) are false.

[2025 • Set 55-4-1]

Q14. Two coherent light waves, each having amplitude 'a', superpose to produce an interference pattern on a screen. The intensity of light as seen on the screen varies between:

(A) 0 and $2a^2$

(B) 0 and $4a^2$

(C) a^2 and $2a^2$

(D) $2a^2$ and $4a^2$

[2025 • Set 55-5-1]

Q15. Two coherent waves, each of intensity I_0, produce interference pattern on a screen. The average intensity of light on the screen is:

(A) zero

(B) I_0

(C) $2I_0$

(D) $4I_0$

[2025 • Set 55-6-1]

Q16. What are the coherent sources of light? Can two independent sodium lamps act like coherent sources? Explain.

[2024 • Set 55-1-1]

Q17. Diffraction and interference are closely related phenomena that occur together. Diffraction is the phenomenon of bending of light around the edges of the obstacle, while interference is the combination of waves that results in a new wave pattern. In order to get interference, there must be at least two waves that are diffracting. So while diffraction can occur without interference, interference cannot occur without diffraction. Two slits of width $2\ \mu$m each in an opaque material are separated by a distance of $6\ \mu$m. Monochromatic light of wavelength 450 nm is incident normally on the slits. One finds a combined interference and diffraction pattern on the screen. The number of peaks of the interference fringes formed within the central peak of the envelope of the diffraction pattern will be:

(A) 2

(B) 3

(C) 4
(D) 6

[2024 • Set 55-3-1]

Q18. The number of peaks of the interference formed if the slit width is doubled while keeping the distance between the slits same will be:

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

[2024 • Set 55-3-1]

Q19. If instead of 450 nm light, another light of wavelength 680 nm is used, number of peaks of the interference formed in the central peak of the envelope of the diffraction pattern will be:

(A) 2
(B) 4
(C) 6
(D) 9

[2024 • Set 55-3-1]

Q20. Consider the diffraction of light by a single slit described in this case study. The first minimum falls at an angle θ equal to:

(A) $\sin^{-1}(0.12)$
(B) $\sin^{-1}(0.225)$
(C) $\sin^{-1}(0.32)$
(D) $\sin^{-1}(0.45)$

[2024 • Set 55-3-1]

Q21. The number of bright fringes formed due to interference on 1 m of screen placed at $\frac{\pi}{3}$ m away from the slits is:

(A) 2
(B) 3
(C) 6
(D) 10

[2024 • Set 55-3-1]

Q22. Assertion (A): In interference and diffraction of light, light energy reduces in one region producing a dark fringe. It increases in another region and produces a bright fringe. Reason (R): This happens because energy is not conserved in the phenomena of interference and diffraction.

(A) If both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) If both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).
(C) If Assertion (A) is true and Reason (R) is false.
(D) If both Assertion (A) and Reason (R) are false.

[2024 • Set 55-4-1]

Q23. A Young's double-slit experimental set up is kept in a medium of refractive index $\left(\frac{3}{2}\right)$. Which maximum in this case will coincide with the 6th maximum obtained if the medium is replaced by air?
(A) 4^{th}
(B) 6^{th}
(C) 8^{th}
(D) 10^{th}

[2024 • Set 55-5-1]

Q24. Assertion (A): In a Young's double-slit experiment, interference pattern is not observed when two coherent sources are infinitely close to each other. Reason (R): The fringe width is proportional to the separation between the two sources.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true but Reason (R) is false.
(D) Both Assertion (A) and Reason (R) are false.

[2024 • Set 55-5-1]

Q25. In a Young's double-slit experiment in air, the fringe width is found to be 0.44 mm. If the entire setup is immersed in water $\left(\mu = \frac{4}{3}\right)$, the fringe width will be:
(A) 0.88 mm
(B) 0.59 mm
(C) 0.33 mm
(D) 0.44 mm

[2024 • Set 55-5-2]

Q26. Assertion (A): The phase difference between any two points on a wavefront is zero. Reason (R): All points on a wavefront are at the same distance from the source and thus oscillate in the same phase.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation

of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false and Reason (R) is also false.

[2023 • Set 55-1-1]

Q27. Assertion (A): In Young's double slit experiment all fringes are of equal width. Reason (R): The fringe width depends upon wavelength of light (λ) used, distance of screen from plane of slits (D) and slits separation (d).

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true and Reason (R) is NOT the correct explanation of Assertion (A).

(C) Assertion (A) is true and Reason (R) is false.

(D) Assertion (A) is false and Reason (R) is also false.

[2023 • Set 55-2-1]

Q28. A beam of light travels from air into a medium. Its speed and wavelength in the medium are 1.5×10^8 m s^{-1} and 230 nm respectively. The wavelength of light in air will be

(A) 230 nm

(B) 345 nm

(C) 460 nm

(D) 690 nm

[2023 • Set 55-2-1]

Q29. In the wave picture of light, the intensity I of light is related to the amplitude A of the wave as:

(A) $I \propto \sqrt{A}$

(B) $I \propto A$

(C) $I \propto A^2$

(D) $I \propto \dfrac{1}{A^2}$

[2023 • Set 55-3-1]

Q30. In a single-slit diffraction experiment, the width of the slit is halved. The width of the central maximum, in the diffraction pattern, will become:

(A) half

(B) twice

(C) four times

(D) one-fourth

[2023 • Set 55-3-1]

Q31. A plane wavefront is incident on a concave mirror of radius of curvature R. The radius of the refracted wavefront will be:

(A) $2R$
(B) R
(C) $\frac{R}{2}$
(D) $\frac{R}{4}$

[2023 • Set 55-4-1]

Q32. In a Young's double-slit experiment, the fringe width is found to be β. If the entire apparatus is immersed in a liquid of refractive index μ, the new fringe width will be:

(A) β
(B) $\mu\beta$
(C) $\frac{\beta}{\mu}$
(D) $\frac{\beta}{\mu^2}$

[2023 • Set 55-4-1]

Q33. According to Huygens principle, the amplitude of secondary wavelets is

(A) equal in both the forward and the backward directions.
(B) maximum in the forward direction and zero in the backward direction.
(C) large in the forward direction and small in the backward direction.
(D) small in the forward direction and large in the backward direction.

[2023 • Set 55-5-1]

Q34. In a Young's double-slit experiment, the screen is moved away from the plane of the slits. What will be its effect on the following? (i) Angular separation of the fringes. (ii) Fringe-width.

(A) Both (i) and (ii) remain constant.
(B) (i) remains constant, but (ii) decreases.
(C) (i) remains constant, but (ii) increases.
(D) Both (i) and (ii) increase.

[2023 • Set 55-5-1]

Q35. In an interference experiment, third bright fringe is obtained at a point on the screen with a light of 700 nm. What should be the wavelength of the light source in order to obtain the fifth bright fringe at the same point?

(A) 420 nm
(B) 750 nm

(C) 630 nm
(D) 500 nm

[2023 • Set 55-5-3]

Q36. In Young's double slit experiment, the path difference between two interfering waves at a point on the screen is $\frac{11\lambda}{2}$, λ being wavelength of the light used. The _____ dark fringe will lie at this point.

OR

If one of the slits in Young's double slit experiment is fully closed, the new pattern has central maximum _____ in angular size.

[2020 • Set 55-2-1]

Q37. Unpolarised light passes from a rarer into a denser medium. If the reflected and the refracted rays are mutually perpendicular, the reflected light is linearly polarised _____ to the plane of incidence.

[2020 • Set 55-2-1]

Q38. Out of red, blue and yellow lights, the scattering of _____ light is maximum.

[2020 • Set 55-2-1]

Q39. An unpolarised light of intensity I_0 is passed through a polaroid. The intensity of a plane polarised light obtained is _____.

[2020 • Set 55-2-2]

Q40. At sunset or sunrise, the scattered coloured light _____ from the sun reaches our eyes.

[2020 • Set 55-2-3]

Q41. The shape of the wavefront originating from a line source is _____.

[2020 • Set 55-3-1]

Q42. In Young's double slit experiment, the separation between the two slits is halved. The new fringe width will be _____ times its initial value.

[2020 • Set 55-3-1]

Q43. In Young's double slit experiment, when the monochromatic source is replaced by a source of white light, the central fringe becomes _____.

[2020 • Set 55-3-2]

Q44. The phase difference between the two points on the same wavefront is _____.

[2020 • Set 55-3-2]

Q45. In Young's double slit experiment, if the monochromatic source of light is replaced by another monochromatic source of shorter wavelength, the value of fringe width will _____.

[2020 • Set 55-3-3]

Q46. Fill in the blank with appropriate answer. Unpolarised light of intensity I_0 is incident on two crossed polaroids. The intensity of light transmitted by the combination will be _____.

[2020 • Set 55-4-1]

Q47. When a wave undergoes reflection at an interface from rarer to denser medium, adhoc change in its phase is:

(A) $\frac{\pi}{2}$
(B) 0
(C) π
(D) $\frac{\pi}{4}$

[2020 • Set 55-4-1]

Q48. Fill in the blank with appropriate answer. In a linearly polarised light, the electric vector oscillates along a direction perpendicular to the aligned molecules of the polaroid, called _____ axis.

[2020 • Set 55-4-2]

Q49. The relationship between Brewster angle θ and the speed of light v in the denser medium is —

(A) $v \tan\theta = c$
(B) $c \tan\theta = v$
(C) $v \sin\theta = c$
(D) $c \sin\theta = v$

[2020 • Set 55-5-1]

Q50. Write the conditions on path difference under which (i) constructive (ii) destructive interference occur in Young's double slit experiment.

[2020 • Set 55-5-1]

Q51. What is the speed of light in a denser medium of polarising angle $30°$?

[2019 • Set 55-1-1]

Q52. When unpolarised light is incident on the interface separating the rarer medium and the denser medium, Brewster angle is found to be $60°$. Determine the refractive index of the denser medium.

[2019 • Set 55-1-2]

Q53. Distinguish between unpolarised and linearly polarised light.

[2019 • Set 55-1-3]

Q54. Why does sun appear red at sunrise and sunset?

[2016]

Q55. Why can't we see clearly through fog? Name the phenomenon responsible for it.

[2016]

Q56. Which of the following waves can be polarized (i) Heat waves (ii) Sound waves? Give reason to support your answer.

[2013]

Q57. When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a decrease in the energy carried by the light wave? Justify your answer.

[2012]

Q58. How does the angular separation between fringes in single-slit diffraction experiment change when the distance of separation between the slit and screen is doubled?

[2012]

Q59. When monochromatic light travels from one medium to another its wavelength changes but frequency remains the same. Explain.

[2011 • Set 55-1-1]

Q60. If the angle between the pass axis of polarizer and the analyser is $45°$, write the ratio of the intensities of original light and the transmitted light after passing through the analyser.

[2009]

Q61. What type of wavefront will emerge from a (i) point source, and (ii) distant light source?

[2009]

Q62. How would the angular separation of interference fringes in Young's double slit experiment change when the distance between the slits and screen is doubled?

[2009]

Q63. How does the fringe width of interference fringes change, when the whole apparatus of Young's experiment is kept in a liquid of refractive index 1.3?

[2008]

Q64. What is the geometrical shape of the wavefront when a plane wave passes through a convex lens?

[2008]

2-Mark Questions (45 questions · Section B · VSA)

Q1. (a) A beam of light consisting of two wavelengths 400 nm and 600 nm is used to illuminate a single slit of width 1 mm. Find the least distance of the point from the central maximum where the dark fringes due to both wavelengths coincide on the screen placed 1.5 m from the slit.

OR

(b) In a Young's double-slit experimental set-up with slit separation 0.6 mm a beam of light consisting of two wavelengths 440 nm and 660 nm is used to obtain interference pattern on a screen kept 1.5 m in front of the slits. Find the least distance of the point from the central maximum where the bright fringes due to both the wavelengths coincide.

[2026 • Set 55-1-1]

Q2. In a Young's double-slit experiment, a beam of light consisting of two wavelengths 500 nm and 600 nm is used. The interference fringes are observed at a screen placed $1{\cdot}8$ m away from the plane of slits (slit separation $0{\cdot}3$ mm). Calculate the least distance from the central maximum where the bright fringes due to both the wavelengths coincide.

[2026 • Set 55-2-1]

Q3. Explain why diffraction of sound is more common in daily experience than that of light.

[2026 • Set 55-3-1]

Q4. In Young's double slit experiment, the central maximum is bright in the interference pattern obtained on a screen. What will happen when:

(a) light waves emitted out of slits S_1 and S_2 have an initial phase difference of π radian?

(b) one of the slits is closed? Justify your answers.

[2026 • Set 55-3-3]

Q5. (a) State Huygens principle. How did Huygens justify the absence of the backwave on a spherical wavefront?

OR

(b) In a single-slit diffraction experiment, light of wavelength λ illuminates the slit of width 'a'. The diffraction pattern is observed on a screen kept at a distance D from the

slits. (i) Depict variation of intensity in the fringe pattern with the angular position of the fringes. (ii) How is the linear width of central maximum affected when separation between the slit and the screen is decreased?

[2026 • Set 55-4-1]

Q6. In a Young's double-slit experiment, two waves each of intensity I superpose each other and produce an interference pattern. Prove that the resultant intensities at maxima and minima are $4I$ and zero respectively.

[2026 • Set 55-5-2]

Q7. When monochromatic light is incident on a surface separating two media, the refracted and reflected light both have the same frequency as the incident frequency but the wavelength of refracted light is different. Explain why.

[2026 • Set 55-5-3]

Q8. (a) In a diffraction experiment, the slit is illuminated by light of wavelength 600 nm. The first minimum of the pattern falls at $\theta = 30°$. Calculate the width of the slit.

OR

(b) In a Young's double-slit experiment, two light waves, each of intensity I_0, interfere at a point, having a path difference $\frac{\lambda}{3}$ on the screen. Find the intensity at this point.

[2025 • Set 55-1-1]

Q9. In a double-slit experiment, 6^{th} dark fringe is observed at a certain point of the screen. A transparent sheet of thickness t and refractive index n is now introduced in the path of one of the two interfering waves to increase its phase by $2\pi(n-1)\,t/\lambda$. The pattern is shifted and 8^{th} bright fringe is observed at the same point. Find the relation for thickness t in terms of n and λ.

[2025 • Set 55-2-1]

Q10. Show the refraction of light wave at a plane interface using Huygens' principle and prove Snell's law.

[2025 • Set 55-2-2]

Q11. In a double slit experiment, it is observed that the angular width of one fringe formed on the screen is $0.2°$. The wavelength of light used in the experiment is 500 nm. Calculate the separation of the two slits.

[2025 • Set 55-2-3]

Q12. Find the angle of diffraction (in degrees) for first secondary maximum of the pattern due to diffraction at a single slit. The width of the slit and wavelength of light used are

0.55 mm and 550 nm, respectively.

[2025 • Set 55-4-1]

Q13. In a double slit experiment, the two slits are 1.5 mm apart. The slits are illuminated by a mixture of lights of wavelengths of 600 nm and 400 nm and the interference pattern is observed on a screen 1.5 m away from the slits. Find the minimum distance of the point from the central maximum at which bright fringes of the interference patterns of the two wavelengths coincide.

[2025 • Set 55-4-2]

Q14. In Young's double slit experiment, the screen is moved 30 cm towards the slits. As a consequence, the fringe width of the pattern changes by 0.09 mm. If the slits separation used is 2 mm, calculate the wavelength of light used in the experiment.

[2025 • Set 55-4-3]

Q15. (a) Find the intensity at a point on the screen in Young's double slit experiment, at which the interfering waves of intensity I_0 each, have a path difference of (i) $\frac{\lambda}{4}$ and (ii) $\frac{\lambda}{3}$.

OR

(b) A point source of light in air is kept at a distance of 12 cm in front of a convex spherical surface of glass of refractive index $1{\cdot}5$ and radius of curvature 30 cm. Find the nature and position of the image formed.

[2025 • Set 55-6-1]

Q16. Write two differences in the patterns of double-slit interference experiment and single-slit diffraction experiment.

[2025 • Set 55-7-1]

Q17. Light waves from two pinholes illuminated by two sodium lamps do not produce interference patterns. Explain why.

[2025 • Set 55-7-1]

Q18. The ratio of the intensities at maxima to minima in Young's double-slit experiment is $25 : 9$. Calculate the ratio of intensities of the interfering waves.

[2025 • Set 55-7-2]

Q19. In a Young's double-slit experiment, the intensity at the central maximum in the interference pattern on the screen is I_0. Find the intensity at a point on the screen where the path difference between the interfering waves is $\frac{\lambda}{3}$.

[2025 • Set 55-7-3]

Q20. State Huygens' principle. A plane wave is incident at an angle i on a reflecting surface.

Construct the corresponding reflected wavefront. Using this diagram, prove that the angle of reflection is equal to the angle of incidence.

[2024 • Set 55-1-1]

Q21. A beam of light consisting of a known wavelength $520\,\text{nm}$ and an unknown wavelength λ, used in Young's double slit experiment produces two interference patterns such that the fourth bright fringe of unknown wavelength coincides with the fifth bright fringe of known wavelength. Find the value of λ.

[2024 • Set 55-1-1]

Q22. (a) Two waves, each of amplitude 'a' and frequency 'ω' emanating from two coherent sources of light superpose at a point. If the phase difference between the two waves is ϕ, obtain an expression for the resultant intensity at that point.

OR

(b) What is the effect on the interference pattern in Young's double-slit experiment when (i) the source slit is moved closer to the plane of the slits, and (ii) the separation between the two slits is increased? Justify your answers.

[2024 • Set 55-2-1]

Q23. Write two points of difference between interference and diffraction of light.

[2024 • Set 55-3-2]

Q24. What is a sustained or stable interference pattern? What are the conditions for obtaining such an interference pattern?

[2024 • Set 55-3-3]

Q25. Using Huygens' principle, draw a ray diagram showing the propagation of a plane wave refracting at a plane surface separating two media. Also verify Snell's law of refraction.

[2023 • Set 55-1-1]

Q26. Two coherent monochromatic light beams of intensities I and $4I$ superpose each other. Find the ratio of maximum and minimum intensities in the resulting beam.

[2023 • Set 55-1-1]

Q27. What happens to the interference pattern when two coherent sources are

(a) infinitely close, and

(b) far apart from each other?

[2023 • Set 55-2-1]

Q28. In a Young's double slit experiment, the separation between the two slits is d and distance

of the screen from the slits is $1000\,d$. If the first minima falls at a distance d from the central maximum, obtain the relation between d and λ.

[2023 • Set 55-2-2]

Q29. (a) State Huygens' principle. How did Huygens explain the absence of the backwave?

OR

(b) Use Huygens' principle to show reflection/refraction of a plane wave by (i) concave mirror, and (ii) a convex lens.

[2023 • Set 55-3-1]

Q30. How would the angular width of central maximum of diffraction pattern be affected when (i) width of the slit is decreased, and (ii) monochromatic light is replaced by polychromatic light? Justify your answers.

[2021]

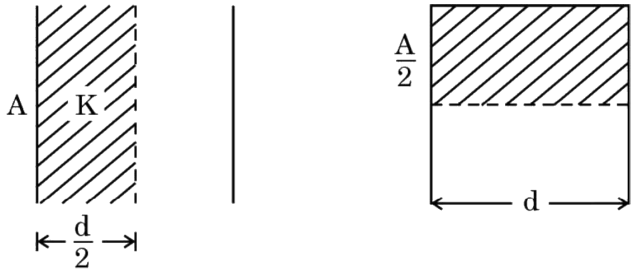
Q31. In interference of light, write the expression for the intensity of resultant wave if I_0 is the intensity of light wave from each slit. Hence, obtain an expression for the intensity of resultant wave if the two sources are (i) incoherent, and (ii) coherent.

[2021]

Q32. Define wavefront of a travelling wave. Using Huygens principle, obtain the law of refraction at a plane interface when light passes from a denser to rarer medium.

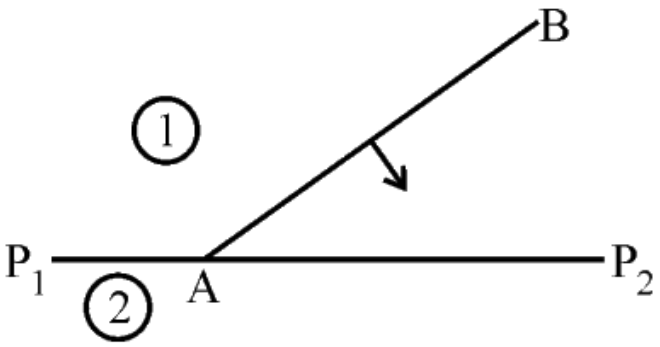
[2020 • Set 55-1-1]

Q33. Light from a sodium lamp (S) passes through two polaroid sheets P_1 and P_2 as shown in fig. What will be the effect on the intensity of the light transmitted (i) by P_1 and (ii) by P_2 on rotating polaroid P_2 about the direction of propagation of light ? Justify your answer in both cases.



(a) (b)

OR Define the term 'wave front of light'. A plane wave front AB propagating from denser medium (1) into a rarer medium (2) is incident on the surface P_1P_2 separating the two media as shown in fig. Using Huygen's principle, draw the secondary wavelets and obtain the refracted wave front in the diagram.



[2020 • Set 55-5-1]

Q34. In a single slit diffraction experiment, the width of the slit is increased. How will the (i) size and (ii) intensity of central bright band be affected ? Justify your answer.

[2020 • Set 55-5-1]

Q35. Explain giving reason, how the resolving power of a compound microscope depends on the

(a) frequency of the incident light.

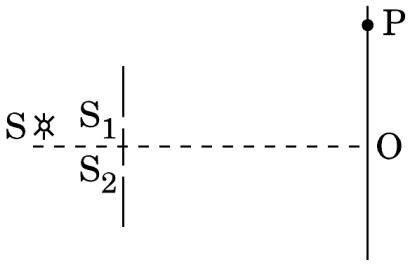
(b) focal length of the objective lens.

[2019 • Set 55-4-1]

Q36. The figure shows a modified Young's double slit experimental set-up. Here $SS_1 - SS_2 = \lambda/4$.

(a) Write the condition for constructive interference.

(b) Obtain an expression for the fringe width.



[2019 • Set 55-4-1]

Q37. Find the intensity at a point on a screen in Young's double slit experiment where the interfering waves of equal intensity have a path difference of (i) $\lambda/4$, and (ii) $\lambda/3$.

[2017]

Q38. Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state two differences between interference and diffraction patterns.

[2017]

Q39. Unpolarised light is passed through a polaroid P_1. When this polarised beam passes through another polaroid P_2 and if the pass axis of P_2 makes angle θ with the pass axis of P_1, then write the expression for the polarised beam passing through P_2. Draw a plot showing the variation of intensity when θ varies from 0 to 2π.

[2017]

Q40. Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state two differences between interference and diffraction patterns.

OR

Unpolarised light is passed through a polaroid P_1. When this polarised beam passes through another polaroid P_2 and if the pass axis of P_2 makes angle θ with the pass axis of P_1, then write the expression for the polarised beam passing through P_2. Draw a plot showing the variation of intensity when θ varies from 0 to 2π.

[2017]

Q41. Find an expression for intensity of transmitted light when a polaroid sheet is rotated between two crossed polaroids. In which position of the polaroid sheet will the transmitted intensity be maximum?

[2015]

Q42. For a single slit of width "a", the first minimum of the interference pattern of a monochromatic light of wavelength λ occurs at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}$, we get a maximum for two narrow slits separated by a distance "a". Explain.

[2014]

Q43. Define the term 'linearly polarised light'. When does the intensity of transmitted light become maximum, when a polaroid sheet is rotated between two crossed polaroids?

[2009]

Q44. How is a wavefront defined? Using Huygens' construction draw a figure showing the propagation of a plane wave refraction at a plane surface separating two media. Hence verify Snell's law of refraction.

[2008]

Q45. How will the angular separation and visibility of the fringes in Young's double slit experiment change when (i) Screen is moved away from the plane of the slits, and (ii) width of the source slit is increased?

[2008]

3-Mark Questions (67 questions · Section C · SA)

Q1. A double slit set-up was initially placed in a tank filled with water and the interference pattern was obtained using a laser light. When water is replaced by a transparent liquid of refractive index $n > n_{\text{water}}$, what will be the effect on the following ?

(a) Speed, frequency and wavelength of the light of laser beam.

(b) The fringe width, shape of interference fringes and shift in the position of central maximum.

[2025 • Set 55-4-1]

Q2. (a) Define 'wavefront' of a light wave. A plane wavefront is refracted from a convex lens. Draw the shape of the refracted wavefront.

(b) A plane wave travelling in a medium is incident on a plane surface separating this medium from a rarer medium. Draw a diagram to show refraction of the wave. Hence, verify Snell's law.

[2025 • Set 55-4-2]

Q3. (a) Write the conditions under which two light waves originating from two coherent sources can interfere each other (i) constructively, and (ii) destructively, in terms of wavelength. Can these be applied for two lights originating from two sodium lamps ? Give reason.

(b) Monochromatic light of green colour is used in Young's double slit experiment and an interference pattern is observed on a screen. If the green light is replaced by red monochromatic light of the same intensity, how will the fringe width of interference pattern be affected ? Justify your answer.

[2025 • Set 55-4-3]

Q4. In Young's double slit experiment, the separation between the two slits is 1.0 mm and the screen is 1.0 m away from the slits. A beam of light consisting of two wavelengths 500 nm and 600 nm is used to obtain interference fringes. Calculate:

(a) the distance between the first maxima for the two wavelengths.

(b) the least distance from the central maximum, where the bright fringes due to both the wavelengths coincide.

[2025 • Set 55-5-1]

Q5. Using the Huygens' principle, briefly describe reflection of a plane wavefront from a reflecting surface. Hence, prove the laws of reflection.

[2025 • Set 55-5-2]

Q6. (a) "You cannot see a person standing on the other side of a boundary wall but can hear him." Explain with reason.

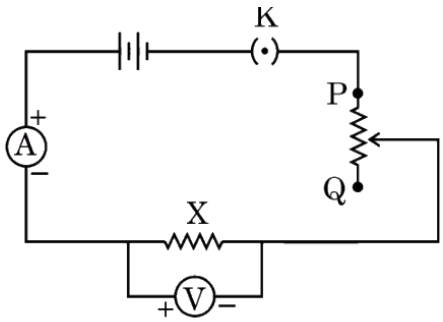
(b) Light of wavelength 750 nm is incident normally on a slit of width 1.5 mm. Diffraction pattern is obtained on a screen 1.0 m away from the slit. Find the distance of the nearest point from the central maxima at which the intensity is zero.

[2025 • Set 55-5-3]

Q7. (a) (i) In diffraction due to a single slit, the phase difference between light waves reaching a point on the screen is $\frac{5\pi}{2}$. Explain whether a bright or a dark fringe will be formed at the point. (ii) What should the width (a) of each slit be to obtain eight maxima of two double-slit patterns (slit separation d) within the central maximum of the single slit pattern? (iii) Draw the plot of intensity distribution in a diffraction pattern due to a single slit.

OR

(b) (i) In a Young's double-slit experiment $SS_1 - SS_2 = \frac{\lambda}{4}$, where S_1 and S_2 are the two slits as shown in the figure. Find the path difference $(S_1P - S_2P)$ for constructive and destructive interference at P.



(ii) What is the effect on the interference fringes in a Young's double-slit experiment, if the monochromatic source S is replaced by a source of white light?

[2023 • Set 55-4-1]

Q8. (a) A plane wave-front propagating in a medium of refractive index 'μ_1' is incident on a plane surface making an angle of incidence (i). It enters into a medium of refractive index μ_2 $(\mu_2 > \mu_1)$. Use Huygen's construction of secondary wavelets to trace the refracted wave-front. Hence verify Snell's law of refraction.

OR

(b) Using Huygen's construction, show how a plane wave is reflected from a surface. Hence verify the law of reflection.

[2023 • Set 55-5-1]

Q9. (i) Monochromatic light is incident on a surface separating two media. The frequency of the light after refraction remains unaffected but its wavelength changes. Why?

(ii) The frequency of an electromagnetic radiation is 1.0×10^{11} Hz. Identify the radiation

and mention its two uses.

[2022 • Set 55-1-1]

Q10. A parallel beam of light of wavelength $600\,\text{nm}$ is incident normally on a slit of width $0.2\,\text{mm}$. If the resulting diffraction pattern is observed on a screen $1\,\text{m}$ away, find the distance of

(i) first minimum, and

(ii) second maximum, from the central maximum.

[2022 • Set 55-1-1]

Q11. Using Huygen's principle, for a plane wavefront incident on a plane reflecting surface, draw the reflected wavefront. Hence prove laws of reflection.

[2022 • Set 55-1-3]

Q12. A plane wavefront of light of wavelength 'λ' is incident normally on a narrow slit of width 'a' and a diffraction pattern is observed on a screen at a distance 'D' from the slit.

(i) Depict the intensity distribution in the pattern observed.

(ii) Obtain the expression for the first maximum from the central maximum.

[2022 • Set 55-2-1]

Q13. Using Huygens' principle, draw a diagram to show the refraction of a plane wavefront incident on a denser medium and hence verify Snell's law of refraction.

[2022 • Set 55-2-1]

Q14. In a Young's double slit experiment using light of wavelength 600 nm, the slit separation is 0.8 mm and the screen is kept 1.6 m from the plane of the slits. Calculate:

(i) the fringe width

(ii) the distance of (a) third minimum and (b) fifth maximum, from the central maximum.

[2022 • Set 55-3-1]

Q15. **(i)** State two conditions for two light sources to be coherent.

(ii) Give two points of difference between an interference pattern due to a double-slit and a diffraction pattern due to a single slit.

[2022 • Set 55-3-1]

Q16. In a diffraction pattern due to a single slit, how will the angular width of central maximum change, if

(i) Orange light is used in place of green light,

(ii) the screen is moved closer to the slit,

(iii) the slit width is decreased? Justify your answer in each case.

[2022 • Set 55-3-1]

Q17. How is the spacing between fringes in a double slit experiment affected if:

(i) the slits separation is increased,

(ii) the colour of light used is changed from red to blue,

(iii) the whole apparatus is submerged in a oil of refractive index 1.2? Justify your answer in each case.

[2022 • Set 55-3-2]

Q18. Monochromatic light of wavelength 600 nm is incident from air on a water surface. The refractive index of water is 1.33. Find the (i) wavelength, (ii) frequency and (iii) speed, of reflected and refracted light.

[2022 • Set 55-3-2]

Q19. A beam of light consisting of two wavelengths 600 nm and 500 nm is used in a Young's double slit experiment. The slit separation is 1.0 mm and the screen is kept 0.60 m away from the plane of the slits. Calculate:

(i) the distance of the second bright fringe from the central maximum for wavelength 500 nm, and

(ii) the least distance from the central maximum where the bright fringes due to both the wavelengths coincide.

[2022 • Set 55-3-3]

Q20. A plane wavefront is propagating from a rarer into a denser medium. Use Huygens principle to show the refracted wavefront and verify Snell's law.

[2022 • Set 55-4-1]

Q21. Briefly explain how bright and dark fringes are formed on the screen in Young's double slit experiment. Hence, derive the expression for the fringe width.

[2022 • Set 55-4-1]

Q22. (a) The interference pattern is not observed in Young's double slit experiment when the two sources S_1 and S_2 are far apart. Explain.

(b) Mention the conditions for the two sources to be coherent.

(c) What is the effect on the interference pattern in a Young's double slit experiment, if the source of wavelength λ is replaced by another source of wavelength 1.5λ, with

the interference pattern still observable?

[2022 • Set 55-4-2]

Q23. Briefly explain how bright and dark fringes are formed on a screen due to the diffraction at a single slit. Hence, explain why the intensity at the bright fringes decreases sharply as their order (n) increases.

[2022 • Set 55-4-3]

Q24. How can you differentiate whether a pattern is produced by a single slit or double slits? Derive the expression for the angular position of (i) bright and (ii) dark fringes produced in a single slit diffraction.

[2022 • Set 55-5-1]

Q25. A slit of width 0.6 mm is illuminated by a beam of light consisting of two wavelengths 600 nm and 480 nm. The diffraction pattern is observed on a screen 1.0 m from the slit. Find:

(i) The distance of the second bright fringe from the central maximum pertaining to light of 600 nm.

(ii) The least distance from the central maximum at which bright fringes due to both the wavelengths coincide.

[2022 • Set 55-5-1]

Q26. How will the interference pattern in Young's double-slit experiment be affected if:

(i) The screen is moved away from the plane of the slits.

(ii) The source slit is moved away from the plane of the slits.

(iii) The phase difference between the light waves emanating from the two slits S_1 and S_2 changes from 0 to π and remains constant.

[2022 • Set 55-5-2]

Q27. Explain the formation of the fringes due to diffraction at a single slit, when path difference of light waves from the ends of the slit on reaching a point on the screen is (i) λ, and (ii) $\frac{\lambda}{2}$. Show the intensity distribution in the fringes due to diffraction at a single slit.

[2021]

Q28. What is the effect on the interference fringes in Young's double slit experiment due to each of the following operations? Justify your answers.

(a) The screen is moved away from the plane of the slits.

(b) The separation between slits is increased.

(c) The source slit is moved closer to the plane of double slit.

[2020 • Set 55-1-1]

Q29. In a single slit diffraction experiment, light of wavelength λ illuminates the slit of width a and the diffraction pattern is observed on a screen.

(a) Show the intensity distribution in the pattern with the angular position θ.

(b) How are the intensity and angular width of central maxima affected when (i) width of slit is increased, and (ii) separation between slit and screen is decreased?

[2020 • Set 55-1-2]

Q30. Give reasons for each of the following:

(a) The intensity of light at some points on the screen in Young's double slit experiment is zero.

(b) The intensity of light transmitted by a polaroid is less than the intensity of the unpolarised light incident on it.

(c) In the single slit diffraction experiment, some coloured fringes around the central white maximum are observed on the screen when one uses a source of white light.

[2020 • Set 55-1-3]

Q31. Two coherent light waves of intensity 5×10^{-2} W m^{-2} each super-impose and produce the interference pattern on a screen. At a point where the path difference between the waves is $\lambda/6$, λ being the wavelength of the wave, find the

(a) phase difference between the waves.

(b) resultant intensity at the point.

(c) resultant intensity in terms of the intensity at the maximum.

[2020 • Set 55-4-1]

Q32. Define the term wavefront. Using Huygens' wave theory, verify the law of reflection.

[2019 • Set 55-1-1]

Q33. Define the term, "refractive index" of a medium. Verify Snell's law of refraction when a plane wavefront is propagating from a denser to a rarer medium.

[2019 • Set 55-1-1]

Q34. (a) Explain how an unpolarised light gets polarised when incident on the interface separating the two transparent media.

(b) Green light is incident at the polarising angle on a certain transparent medium. The

angle of refraction is $30°$. Find (i) polarising angle, and (ii) refractive index of the medium.

[2019 • Set 55-3-1]

Q35. (a) Define a wavefront. Using Huygens' geometrical construction, explain with the help of a diagram how the plane wavefront travels from the instant t_1 to t_2 in air.

(b) A plane wavefront is incident on a convex lens. Explain, with the help of the diagram, the shape of the refracted wavefront formed.

[2019 • Set 55-5-1]

Q36. (a) Good quality sunglasses made of polaroids are preferred over ordinary coloured glasses. Explain why.

(b) How is plane polarized light defined?

(c) A beam of plane polarised light is passed through a polaroid. Show graphically, variation of the intensity of the transmitted light with angle of rotation of the polaroid.

[2019 • Set 55-5-1]

Q37. (a) What do you understand by coherent sources?

(b) Derive the expression for the intensity distribution in the interference pattern on the screen when two harmonic waves having same amplitude (a) and phase difference (ϕ) are superposed on each other. Hence obtain the conditions for constructive and destructive interference.

[2019 • Set 55-5-2]

Q38. Answer the following questions:

(a) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band?

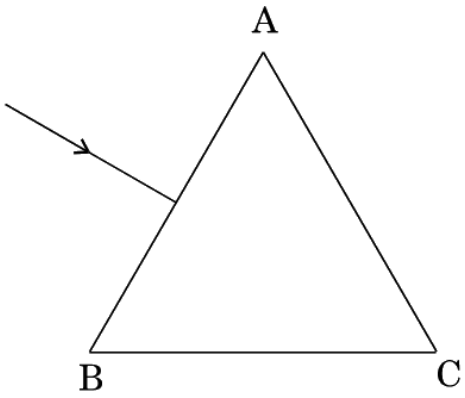
(b) How is the width of the central maximum changed when red light is replaced by blue?

(c) In what way is diffraction from each slit related to the interference pattern in a double slit experiment?

[2019 • Set 55-5-3]

Q39. (a) Show using a proper diagram how unpolarised light can be linearly polarised by reflection from a transparent glass surface.

(b) The figure shows a ray of light falling normally on the face AB of an equilateral glass prism having refractive index $\frac{3}{2}$, placed in water of refractive index $\frac{4}{3}$. Will this ray suffer total internal reflection on striking the face AC ? Justify your answer.



[2018]

Q40. (a) If one of two identical slits producing interference in Young's experiment is covered with glass, so that the light intensity passing through it is reduced to 50%, find the ratio of the maximum and minimum intensity of the fringe in the interference pattern.

(b) What kind of fringes do you expect to observe if white light is used instead of monochromatic light ?

[2018]

Q41. A monochromatic light of wavelength λ is incident normally on a narrow slit of width 'a' to produce a diffraction pattern on the screen placed at a distance D from the slit. With the help of a relevant diagram, deduce the conditions for obtaining maxima and minima on the screen. Use these conditions to show that angular width of central maximum is twice the angular width of secondary maximum.

[2017]

Q42. Draw the intensity distributions for (i) the fringes produced in interference, and (ii) the diffraction bands produced due to single slit. Write two points of difference between the phenomena of interference and diffraction.

[2017]

Q43. (i) State law of Malus.

(ii) Draw a graph showing the variation of intensity (I) of polarised light transmitted by an analyser with angle (θ) between polariser and analyser.

(iii) What is the value of refractive index of a medium of polarising angle $60°$?

[2016]

Q44. Define the term wave front. State Huygen's principle. Consider a plane wave front incident on a thin convex lens. Draw a proper diagram to show how the incident wave front traverses through the lens and after refraction focusses on the focal point of the lens, giving the shape of the emergent wave front.

OR

Explain the following, giving reasons:

(i) When monochromatic light is incident on a surface separating two media, the reflected and refracted light both have the same frequency as the incident frequency.

(ii) When light travels from a rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave?

(iii) In the wave picture of light, intensity of light is determined by the square of the amplitude of the wave. What determines the intensity in the photon picture of light?

[2016]

Q45. (a) In Young's double slit experiment, two slits are 1 mm apart and the screen is placed 1 m away from the slits. Calculate the fringe width when light of wavelength 500 nm is used.

(b) What should be the width of each slit in order to obtain 10 maxima of the double slits pattern within the central maximum of the single slit pattern?

[2016]

Q46. (i) Derive Snell's law on the basis of Huygen's wave theory when light is travelling from a denser to a rarer medium.

(ii) Draw the sketches to differentiate between plane wavefront and spherical wavefront.

[2016]

Q47. Two harmonic waves of monochromatic light $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ are superimposed on each other. Show that maximum intensity in interference pattern is four times the intensity due to each slit. Hence write the conditions for constructive and destructive interference in terms of the phase angle ϕ.

[2016]

Q48. (a) Write the necessary conditions to obtain sustained interference fringes.

(b) In Young's double slit experiment, plot a graph showing the variation of fringe width versus the distance of the screen from the plane of the slits keeping other parameters same. What information can one obtain from the slope of the curve?

(c) What is the effect on the fringe width if the distance between the slits is reduced keeping other parameters same?

[2015]

Q49. Answer the following questions:

(a) In a double slit experiment using light of wavelength 600 nm, the angular width of

the fringe formed on a distant screen is $0.1°$. Find the spacing between the two slits.

(b) Light of wavelength 5000 propagating in air gets partly reflected from the surface of water. How will the wavelengths and frequencies of the reflected and refracted light be affected?

[2015]

Q50. (a) Show, giving a suitable diagram, how unpolarized light can be polarised by reflection.

(b) Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity I_0 is incident on P_1. A third polaroid P_3 is kept in between P_1 and P_2 such that its pass axis makes an angle of $60°$ with that of P_1. Determine the intensity of light transmitted through P_1, P_3 and P_2.

[2014]

Q51. (a) In what way is diffraction from each slit related to the interference pattern in a double slit experiment?

(b) Two wavelengths of sodium light 590 nm and 596 nm are used, in turn, to study the diffraction taking place at a single slit of aperture 2×10^{-4} m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of the first maxima of the diffraction pattern obtained in the two cases.

[2013]

Q52. In Young's double slit experiment, the two slits 0.15 mm apart are illuminated by monochromatic light of wavelength 450 nm. The screen is 1.0 m away from the slits.

(a) Find the distance of the second (i) bright fringe, (ii) dark fringe from the central maximum.

(b) How will the fringe pattern change if the screen is moved away from the slits?

[2012]

Q53. How does an unpolarised light get polarised when passed through a polaroid? Two polaroids are set in crossed positions. A third polaroid is placed between the two making an angle θ with the pass axis of the first polaroid. Write the expression for the intensity of light transmitted from the second polaroid. In what orientations will the transmitted intensity be (i) minimum and (ii) maximum?

[2012]

Q54. (a) Why are coherent sources necessary to produce a sustained interference pattern?

(b) In Young's double slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find

out the intensity of light at a point where path difference is $\lambda/3$.

[2012]

Q55. Define a wavefront. Use Huygens' geometrical construction to show the propagation of a plane wavefront from a rarer medium (1) to a denser medium (2) undergoing refraction. Hence derive Snell's law of refraction.

OR

(a) Use Huygens' geometrical construction to show the behaviour of a plane wavefront (i) passing through a biconvex lens; (ii) reflecting by a concave mirror.

(b) When monochromatic light is incident on a surface separating two media, why does the refracted light have the same frequency as that of the incident light?

[2012]

Q56. Describe Young's double slit experiment to produce interference pattern due to a monochromatic source of light. Deduce the expression for the fringe width.

[2011 • Set 55-1-1]

Q57. Use Huygen's principle to verify the laws of refraction.

[2011 • Set 55-1-1]

Q58. (a) Describe briefly, with the help of suitable diagram, how the transverse nature of light can be demonstrated by the phenomenon of polarization.

(b) When unpolarized light passes from air to a transparent medium, under what condition does the reflected light get polarized?

[2011 • Set 55-1-1]

Q59. The intensity at the central maxima (O) in a Young's double slit experiment is I_0. If the distance OP equals one-third of the fringe width of the pattern, show that the intensity at point P would be $\frac{I_0}{4}$.

[2011 • Set 55-2-1]

Q60. In the experiment on diffraction due to a single slit, show that

(i) the intensity of diffraction fringes decreases as the order (n) increases.

(ii) angular width of the central maximum is twice that of the first order secondary maximum.

[2011 • Set 55-2-1]

Q61. (i) Light passes through two polaroids P_1 and P_2 with pass axis of P_2 making an angle θ

with the pass axis of P_1. For what value of θ is the intensity of emergent light zero?

(ii) A third polaroid is placed between P_1 and P_2 with its pass axis making an angle β with the pass axis of P_1. Find a value of β for which the intensity of light emerging from P_2 is $\frac{I_0}{8}$, where I_0 is the intensity of light on the polaroid P_1.

[2011 • Set 55-2-1]

Q62. What is an unpolarized light? Explain with the help of suitable ray diagram how an unpolarized light can be polarized by reflection from a transparent medium. Write the expression for Brewster angle in terms of the refractive index of denser medium.

[2010]

Q63. In a single slit diffraction experiment, when a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the shadow of the obstacle. Explain why? State two points of difference between the interference pattern obtained in Young's double slit experiment and the diffraction pattern due to a single slit.

[2009]

Q64. In Young's double slit experiment, monochromatic light of wavelength $630\ nm$ illuminates the pair of slits and produces an interference pattern in which two consecutive bright fringes are separated by $8.1\ mm$. Another source of monochromatic light produces the interference pattern in which the two consecutive bright fringes are separated by $7.2\ mm$. Find the wavelength of light from the second source. What is the effect on the interference fringes if the monochromatic source is replaced by a source of white light?

[2009]

Q65. State two conditions to obtain sustained interference of light. In Young's double slit experiment, using light of wavelength 400 nm, interference fringes of width X are obtained. The wavelength of light is increased to 600 nm and the separation between the slits is halved. If one wants the observed fringe width on the screen to be the same in the two cases, find the ratio of the distance between the screen and the plane of the interfering sources in the two arrangements.

[2004]

Q66. State Huygens' principle. For reflection of a plane wave front at a plane reflecting surface, construct the corresponding reflected wave front. Using this diagram, prove that angle of incidence is equal to angle of reflection.

[2003]

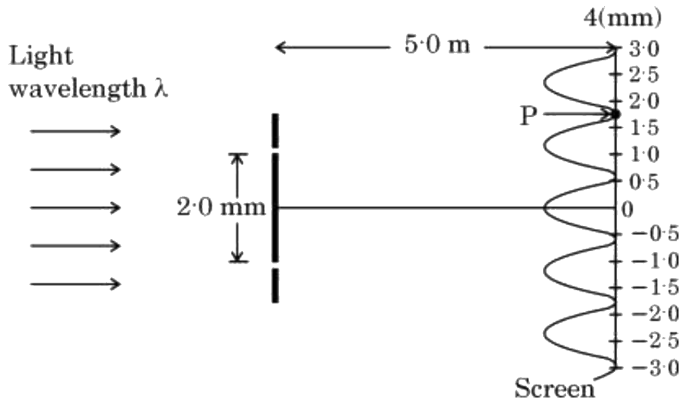
Q67. What is meant by interference of light? In a double slit experiment with monochromatic light, fringes are obtained on a screen placed at some distance from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in fringe width is 3×10^{-5} m. If the

distance between slits is 10^{-3} m, calculate the wavelength of light used.

[2003]

4-Mark Questions (2 questions · Section D · Case Study)

Q1. In a Young's double-slit experiment, the two slits behave as coherent sources. When coherent light waves superpose over each other they create an interference pattern of successive bright and dark regions due to constructive and destructive interference. Two slits 2 mm apart are illuminated by a source of monochromatic light and the interference pattern is observed on a screen 5.0 m away from the slits as shown in the figure.



[2026 • Set 55-5-1]

Q2. Diffraction of light is bending of light around the corners of an object whose size is comparable with the wavelength of light. Diffraction actually defines the limits of ray optics. This limit for optical instruments is set by the wavelength of light. An experimental arrangement is set up to observe the diffraction pattern due to a single slit. Answer the following questions based on the above:

(a) How will the width of central maximum be affected if the wavelength of light is increased?

(b) Under what condition is the first minimum obtained?

(c) Write two points of difference between interference and diffraction patterns.

OR

(c) Two students are separated by a 7 m partition wall in a room 10 m high. If both light and sound waves can bend around obstacles, how is it that the students are unable to see each other even though they can converse easily?

[2023 • Set 55-3-1]

5-Mark Questions (48 questions · Section E · Long Answer)

Q1. (a) What are coherent sources? Why are they necessary for observing stable interference

pattern? Draw a graph showing the variation of intensity of light with the position on the screen in Young's double-slit experiment.

[2026 • Set 55-2-1]

Q2. (b) Find the intensity of light at a point on the screen when two interfering waves of the same intensity (I_0) have a path difference of: (i) $\frac{\lambda}{4}$ and (ii) $\frac{\lambda}{3}$.

[2026 • Set 55-2-1]

Q3. (ii) A beam of coherent light of wavelength 550 nm is incident normal to the plane of a pair of two slits S_1 and S_2 each of width $1{\cdot}2 \times 10^{-6}$ m separated by $1{\cdot}1$ mm. Dark and bright fringes are observed on a screen $2{\cdot}2$ m away from the plane of the slits. Calculate: (I) fringe width. (II) distance of the second dark fringe from the central maximum. (III) what will happen when the entire apparatus is immersed in water.

[2026 • Set 55-3-1]

Q4. (a) (i) A parallel beam of monochromatic light falls normally on a single slit of width $'a'$ and a diffraction pattern is observed on a screen placed at distance D from the slits. Explain: (I) the formation of maxima and minima in the diffraction pattern, and (II) why the maxima go on becoming weaker and weaker with its increasing number (n). (ii) Write any two points of difference between interference pattern due to double-slit and diffraction pattern due to single-slit.

[2026 • Set 55-5-1]

Q5. (a) (i) (1) What are coherent sources? Why are they necessary for observing a sustained interference pattern? (2) Lights from two independent sources are not coherent. Explain. (ii) Two slits 0.1 mm apart are arranged 1.20 m from a screen. Light of wavelength 600 nm from a distant source is incident on the slits. (1) How far apart will adjacent bright interference fringes be on the screen? (2) Find the angular width (in degree) of the first bright fringe.

OR

(b) (i) Define a wavefront. An incident plane wave falls on a convex lens and gets refracted through it. Draw a diagram to show the incident and refracted wavefront. (ii) A beam of light coming from a distant source is refracted by a spherical glass ball (refractive index 1.5) of radius 15 cm. Draw the ray diagram and obtain the position of the final image formed.

[2025 • Set 55-1-1]

Q6. (i) Light consisting of two wavelengths 600 nm and 480 nm is used to obtain interference fringes in a double slit experiment. The screen is placed 1.0 m away from slits which are 1.0 nm apart. (1) Calculate the distance of the third bright fringe on the screen

from the central maximum for wavelength 600 nm. (2) Find the least distance from the central maximum where the bright fringes due to both the wavelengths coincide.

(ii) (1) Draw the variation of intensity with angle of diffraction in single slit diffraction pattern. Write the expression for value of angle corresponding to zero intensity locations. (2) In what way diffraction of light waves differs from diffraction of sound waves?

[2025 • Set 55-2-1]

Q7. (a) (i) Give any two differences between the interference pattern obtained in Young's double-slit experiment and a diffraction pattern due to a single slit. (ii) Draw an intensity distribution graph in case of a double-slit interference pattern. (iii) In Young's double-slit experiment using monochromatic light of wavelength λ, the intensity of light at a point on the screen, where path difference is λ, is K units. Find the intensity of light at a point on the screen where the path difference is $\frac{\lambda}{3}$.

OR

(b) (i) Draw a labelled ray diagram of a compound microscope showing image formation at least distance of distinct vision. Derive an expression for its magnifying power. (ii) A telescope consists of two lenses of focal length 100 cm and 5 cm. Find the magnifying power when the final image is formed at infinity.

[2024 • Set 55-2-1]

Q8. (i) The displacement of two light waves, each of amplitude 'a' and frequency ω, emanating from two coherent sources of light, are given by $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$. ϕ is the phase difference between the two waves. These light waves superpose at a point. Obtain the expression for the resultant intensity at that point.

(ii) In Young's double slit experiment, find the ratio of intensities at two points on a screen when waves emanating from two slits reaching these points have path differences (i) $\frac{\lambda}{6}$ and (ii) $\frac{\lambda}{4}$.

[2024 • Set 55-3-1]

Q9. (i) Differentiate between a wavefront and a ray.

(ii) State Huygen's principle and verify laws of reflection using suitable diagram.

(iii) In Young's double slit experiment, the slits S_1 and S_2 are $3\,\text{mm}$ apart and the screen is placed $1.0\,\text{m}$ away from the slits. It is observed that the fourth bright fringe is at a distance of $5\,\text{mm}$ from the second dark fringe. Find the wavelength of light used.

[2024 • Set 55-4-1]

Q10. (i) A plane light wave propagating from a rarer into a denser medium, is incident at an angle i on the surface separating two media. Using Huygen's principle, draw the

refracted wave and hence verify Snell's law of refraction.

(ii) In a Young's double slit experiment, the slits are separated by 0.30 mm and the screen is kept 1.5 m away. The wavelength of light used is 600 nm. Calculate the distance between the central bright fringe and the 4^{th} dark fringe.

[2024 • Set 55-5-1]

Q11. (i) Discuss briefly diffraction of light from a single slit and draw the shape of the diffraction pattern.

(ii) An object is placed between the pole and the focus of a concave mirror. Using mirror formula, prove mathematically that it produces a virtual and an enlarged image.

[2024 • Set 55-5-1]

Q12. (i) (1) Write two points of difference between an interference pattern and a diffraction pattern. (2) Name any two factors on which the fringe width in a Young's double-slit experiment depends.

(ii) In Young's double-slit experiment, the two slits are separated by a distance equal to 100 times the wavelength of light that passes through the slits. Calculate: (1) the angular separation in radians between the central maximum and the adjacent maximum. (2) the distance between these two maxima on a screen 50 cm from the slits.

[2023 • Set 55-1-1]

Q13. (i) State Huygen's principle. With the help of a diagram, show how a plane wave is reflected from a surface. Hence verify the law of reflection.

(ii) A concave mirror of focal length 12 cm forms a three times magnified virtual image of an object. Find the distance of the object from the mirror.

[2023 • Set 55-2-1]

Q14. The principle of superposition is used to understand the phenomenon of interference of light waves. The principle states that at a particular point, the resultant displacement produced by a number of waves is the vector sum of the displacements produced by each wave. Light waves from two coherent sources produce interference pattern. Thomas Young devised a way to obtain two coherent sources using two identical pinholes (S_1 and S_2) illuminated by a single monochromatic pinhole source S. Using these sources in his experiment known as Young's double slit experiment, Young studied the interference pattern. The pattern consists of alternate bright and dark fringes. The distance between two successive bright or dark fringes depends on the distance between S_1 and S_2, the distance of the screen from the plane of S_1S_2 and the wavelength of light used. I. Consider the following waves:

(i) $y_1 = a \sin \omega t$

(ii) $y_2 = a \sin 2\omega t$

(iii) $y_3 = a \sin(\omega t + \phi)$

(iv) $y_4 = a \sin\left(4\omega t + \frac{\pi}{2}\right)$ Which pair of the waves coming from two sources S_1 and S_2 will produce interference? (A) (i) and (ii) (B) (ii) and (iii) (C) (iii) and (iv) (D) (iv) and (i) II. Two light waves of the same intensity I_0 each, having a path difference of $\lambda/4$, emanating from two coherent sources, meet at a point. The resultant intensity at the point will be (A) Zero (B) I_0 (C) $2I_0$ (D) $4I_0$ III. Vandana performs Young's double slit experiment by using orange, green and red lights successively. If the fringe widths measured in the three cases are ω_1, ω_2 and ω_3 respectively, then which of the following is correct? (A) $\omega_2 > \omega_1 > \omega_3$ (B) $\omega_1 > \omega_2 > \omega_3$ (C) $\omega_2 > \omega_3 > \omega_1$ (D) $\omega_3 > \omega_2 > \omega_1$ IV. In a Young's double slit experiment, the slit separation is 0.8 mm and the interference pattern is obtained on a screen kept 50 cm from the plane of the slits S_1 and S_2. If the first bright fringe is formed 0.4 mm from the central maximum, the wavelength of light used is (A) 480 nm (B) 560 nm (C) 640 nm (D) 680 nm V. Consider the effect on the angular separation of the fringes in a Young's double slit experiment due to the following operations:

(i) the scree...

[2022 • Set 55-1-1]

Q15. The British physicist Thomas Young explained the interference of light using the principle of superposition of waves. He observed the interference pattern on the screen, in his experimental set-up, known now as Young's double slit experiment. The two slits S_1 and S_2 were illuminated by light from a slit S. The interference pattern consists of dark and bright bands of light. Such bands are called fringes. The distance between two consecutive bright and dark fringes is called fringe width.

(a) If the screen is moved closer to the plane of slits S_1 and S_2, then the fringe width: (i) will decrease, but the intensity of bright fringe remains the same. (ii) will increase, but the intensity of bright fringe decreases. (iii) will decrease, but the intensity of bright fringe increases. (iv) and the intensity both remain the same.

(b) What will happen to the pattern on the screen, when the two slits S_1 and S_2 are replaced by two independent but identical sources? (i) The intensity of pattern will increase (ii) The intensity of pattern will decrease (iii) The number of fringes will become double (iv) No pattern will be observed on the screen

(c) Two sources of light are said to be coherent, when both emit light waves of: (i) same amplitude and have a varying phase difference. (ii) same wavelength and a constant phase difference. (iii) different wavelengths and same intensity. (iv) different wavelengths and a constant phase difference.

(d) The fringe width in a Young's double slit experiment is β. If the whole set-up is immersed in a liquid of refractive index 'μ', then the new fringe width will be: (i)

β (ii) $\mu\beta$ (iii) $\frac{\beta}{\mu}$ (iv) $\frac{\beta}{2}$ (e) The total path difference between two waves meeting at points P_1 and P_2 on the screen are $\left(\frac{3\lambda}{2}\right)$ and (2λ) respectively. Then: (i) bright fringes are formed at both points. (ii) dark fringes are formed at both points. (iii) a bright fringe is formed at P_1 and a dark fringe is formed at P_2. (iv) a bright fringe is formed at P_2 and a dark fringe is formed at P_1.

[2022 • Set 55-2-1]

Q16. (a) What is meant by plane polarised light? An unpolarised light is incident at an angle θ on the surface of glass of refractive index μ. If the reflected and refracted rays are perpendicular to each other, then obtain the relationship between μ and θ.

(b) Two polaroids P_1 and P_2 are placed in a crossed position. Unpolarised light of intensity I_0 is incident on P_1. If P_2 is rotated through an angle θ about the direction of propagation of light, keeping P_1 fixed, plot the graph of intensity of light for $0° \leq \theta \leq 360°$ which is (i) transmitted by P_1, and (ii) transmitted by P_2.

OR

(a) Briefly describe the Young's double slit experiment of interference of light. Derive the expression for fringe width in the pattern.

(b) Monochromatic light of wavelength $588\,\text{nm}$ is incident from air to water interface. Find the wavelength and speed of the refracted light. The refractive index of water is $\frac{4}{3}$.

[2020 • Set 55-3-1]

Q17. Describe any two characteristic features which distinguish between interference and diffraction phenomena. Derive the expression for the intensity at a point of the interference pattern in Young's double slit experiment.

[2019 • Set 55-1-1]

Q18. In the diffraction due to a single slit experiment, the aperture of the slit is $3\,\text{mm}$. If monochromatic light of wavelength $620\,\text{nm}$ is incident normally on the slit, calculate the separation between the first order minima and the 3^{rd} order maxima on one side of the screen. The distance between the slit and the screen is $1.5\,\text{m}$.

[2019 • Set 55-1-1]

Q19. Explain, with the help of a diagram, how plane polarized light can be produced by scattering of light from the Sun. Two polaroids P_1 and P_2 are placed with their pass axes perpendicular to each other. Unpolarised light of intensity I is incident on P_1. A third polaroid P_3 is kept between P_1 and P_2 such that its pass axis makes an angle of $45°$ with that of P_1. Calculate the intensity of light transmitted through P_1, P_2 and P_3.

OR

(a) Why cannot the phenomenon of interference be observed by illuminating two pin holes with two sodium lamps?

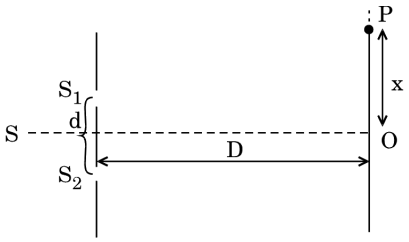
(b) Two monochromatic waves having displacements $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ from two coherent sources interfere to produce an interference pattern. Derive the expression for the resultant intensity and obtain the conditions for constructive and destructive interference.

(c) Two wavelengths of sodium light of $590\,\text{nm}$ and $596\,\text{nm}$ are used in turn to study the diffraction taking place at a single slit of aperture $2 \times 10^{-6}\,\text{m}$. If the distance between the slit and the screen is $1.5\,\text{m}$, calculate the separation between the positions of the second maxima of diffraction pattern obtained in the two cases.

[2019 • Set 55-2-1]

Q20. (a) Can the interference pattern be produced by two independent monochromatic sources of light? Explain.

(b) The intensity at the central maximum (O) in a Young's double slit experimental set-up shown in the figure is I_0. If the distance OP equals one-third of the fringe width of the pattern, show that the intensity at point P, would equal $\frac{I_0}{4}$.



(c) In Young's double slit experiment, the slits are separated by $0.5\,\text{mm}$ and screen is placed $1.0\,\text{m}$ away from the slit. It is found that the 5^{th} bright fringe is at a distance of $4.13\,\text{mm}$ from the 2^{nd} dark fringe. Find the wavelength of light used.

OR

(a) Derive the relation $a\sin\theta = \lambda$ for the first minimum of the diffraction pattern produced due to a single slit of width 'a' using light of wavelength λ.

(b) State with reason, how the linear width of central maximum will be affected if (i) monochromatic yellow light is replaced with red light, and (ii) distance between the slit and the screen is increased.

(c) Using the monochromatic light of same wavelength in the experimental set-up of the diffraction pattern as well as in the interference pattern where the slit separation is $1\,\text{mm}$, 10 interference fringes are found to be within the central maximum of the diffraction pattern. Determine the width of the single slit, if the screen is kept at the

same distance from the slit in the two cases.

[2019 • Set 55-3-1]

Q21. (a) Define a wavefront. Using Huygens' principle, verify the laws of reflection at a plane surface.

(b) In a single slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band ? Explain.

(c) When a tiny circular obstacle is placed in the path of light from a distant source, a bright spot is seen at the centre of the obstacle. Explain why.

[2018]

Q22. (a) Distinguish between unpolarized light and linearly polarized light. How does one get linearly polarised light with the help of a polaroid?

(b) A narrow beam of unpolarised light of intensity I_0 is incident on a polaroid P_1. The light transmitted by it is then incident on a second polaroid P_2 with its pass axis making angle of 60° relative to the pass axis of P_1. Find the intensity of the light transmitted by P_2.

OR

(a) Explain two features to distinguish between the interference pattern in Young's double slit experiment with the diffraction pattern obtained due to a single slit.

(b) A monochromatic light of wavelength $500\ \text{nm}$ is incident normally on a single slit of width $0.2\ \text{mm}$ to produce a diffraction pattern. Find the angular width of the central maximum obtained on the screen. Estimate the number of fringes obtained in Young's double slit experiment with fringe width $0.5\ \text{mm}$, which can be accommodated within the region of total angular spread of the central maximum due to single slit.

[2017]

Q23. (a) Define wavefront. Use Huygens' principle to verify the laws of refraction.

(b) How is linearly polarised light obtained by the process of scattering of light? Find the Brewster angle for air - glass interface, when the refractive index of glass $= 1.5$.

[2017]

Q24. (a) Define wavefront. Use Huygens' principle to verify the laws of refraction.

(b) How is linearly polarised light obtained by the process of scattering of light? Find the Brewster angle for air-glass interface, when the refractive index of glass $= 1.5$.

OR

(a) Draw a ray diagram to show the image formation by a combination of two thin convex lenses in contact. Obtain the expression for the power of this combination in terms of the focal lengths of the lenses.

(b) A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $\frac{3}{4}$th of the angle of prism. Calculate the speed of light in the prism.

[2017]

Q25. (a) Explain why the intensity of light coming out of a polaroid does not change irrespective of the orientation of the pass axis of the polaroid.

(b) State, using a proper diagram, the condition when unpolarized light incident on the boundary between two transparent media produces polarised light. Explain briefly. Hence show that the angle of incidence i_B is related to the refractive index μ by the relation, $\mu = \tan i_B$.

OR

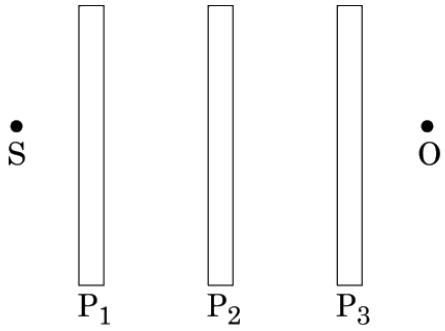
(a) A point object O on the principal axis of a spherical surface of radius of curvature R separating two media of refractive indices n_1 and n_2 forms an image I as shown in the figure. Prove that $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$. Use this expression to derive lens maker's formula. Draw the necessary diagram.

(b) A convex lens is placed over a plane mirror. A pin is now positioned so that there is no parallax between the pin and its image formed by this lens-mirror combination. How will you use this observation to find focal length of the lens? Explain briefly.

[2016]

Q26. (a) Why does unpolarised light from a source show a variation in intensity when viewed through a polaroid which is rotated? Show with the help of a diagram, how unpolarised light from sun gets linearly polarised by scattering.

(b) Three identical polaroid sheets P_1, P_2 and P_3 are oriented so that the pass axis of P_2 and P_3 are inclined at angles of $60°$ and $90°$ respectively with the pass axis of P_1. A monochromatic source S of unpolarized light of intensity I_0 is kept in front of the polaroid sheet P_1 as shown in the figure. Determine the intensities of light as observed by the observer at O, when polaroid P_2 is rotated with respect to P_1 at angles $\theta = 30°$ and $60°$.



[2016]

Q27. (a) Derive an expression for path difference in Young's double slit experiment and obtain the conditions for constructive and destructive interference at a point on the screen.

(b) The intensity at the central maxima in Young's double slit experiment is I_0. Find out the intensity at a point where the path difference is $\frac{\lambda}{6}$, $\frac{\lambda}{4}$ and $\frac{\lambda}{3}$.

[2016]

Q28. When a parallel beam of monochromatic source of light of wavelength λ is incident on a single slit of width a, show how the diffraction pattern is formed at the screen by the interference of the wavelets from the slit. Show that, besides the central maximum at $\theta = 0$, secondary maxima are observed at $\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}$ and the minima at $\theta = \frac{n\lambda}{a}$. Why do secondary maxima get weaker in intensity with increasing n? Explain.

OR

(i) Draw a ray diagram showing the geometry of formation of image of a point object situated on the principal axis and on the convex side of a spherical surface of radius of curvature R. Taking the rays as incident from a rarer medium of refractive index n_1 to a denser medium of refractive index n_2, derive the relation $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$, where symbols have their usual meaning.

(ii) Explain briefly how the focal length of a convex lens changes with increase in wavelength of incident light.

(iii) What happens to the focal length of convex lens when it is immersed in water? Refractive index of the material of lens is greater than that of water.

[2016]

Q29. (a) Use Huygens' principle to show the propagation of a plane wavefront from a denser medium to a rarer medium. Hence find the ratio of the speeds of wavefronts in the two media.

(b) (i) Why does an unpolarised light incident on a polaroid get linearly polarised? (ii) Derive the expression of Brewster's law when unpolarised light passing from a

rarer to a denser medium gets polarised on reflection at the interface.

[2015]

Q30. (a) Using Huygens's construction of secondary wavelets explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a monochromatic beam of light is incident normally.

(b) Show that the angular width of the first diffraction fringe is half that of the central fringe.

(c) Explain why the maxima at $\theta = \left(n + \frac{1}{2}\right)\frac{\lambda}{a}$ become weaker and weaker with increasing n.

[2015]

Q31. (a) **(i)** 'Two independent monochromatic sources of light cannot produce a sustained interference pattern'. Give reason. (ii) Light waves each of amplitude "a" and frequency "ω", emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ where ϕ is the phase difference between the two, obtain the expression for the resultant intensity at the point.

(b) In Young's double slit experiment, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path difference is λ, is K units. Find out the intensity of light at a point where path difference is $\lambda/3$.

OR

(a) How does one demonstrate, using a suitable diagram, that unpolarised light when passed through a Polaroid gets polarised ?

(b) A beam of unpolarised light is incident on a glass-air interface. Show, using a suitable ray diagram, that light reflected from the interface is totally polarised, when $\mu = \tan i_B$, where μ is the refractive index of glass with respect to air and i_B is the Brewster's angle.

[2014]

Q32. (a) In Young's double slit experiment, describe briefly how bright and dark fringes are obtained on the screen kept in front of a double slit. Hence obtain the expression for the fringe width.

(b) The ratio of the intensities at minima to the maxima in the Young's double slit experiment is 9 : 25. Find the ratio of the widths of the two slits.

OR

(a) Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence obtain the conditions for the angular width of secondary maxima and secondary minima.

(b) Two wavelengths of sodium light of 590 nm and 596 nm are used in turn to study the diffraction taking place at a single slit of aperture 2×10^{-6} m. The distance between the slit and the screen is 1.5 m. Calculate the separation between the positions of first maxima of the diffraction pattern obtained in the two cases.

[2014]

Q33. (a) In Young's double slit experiment, derive the condition for (i) constructive interference and (ii) destructive interference at a point on the screen.

(b) A beam of light consisting of two wavelengths, $800\,\text{nm}$ and $600\,\text{nm}$ is used to obtain the interference fringes in a Young's double slit experiment on a screen placed $1.4\,\text{m}$ away. If the two slits are separated by $0.28\,\text{mm}$, calculate the least distance from the central bright maximum where the bright fringes of the two wavelengths coincide.

OR

(a) How does an unpolarized light incident on a polaroid get polarized? Describe briefly, with the help of a necessary diagram, the polarization of light by reflection from a transparent medium.

(b) Two polaroids 'A' and 'B' are kept in crossed position. How should a third polaroid 'C' be placed between them so that the intensity of polarized light transmitted by polaroid B reduces to $\frac{1}{8}$th of the intensity of unpolarized light incident on A?

[2012]

Q34. Use Huygens's principle to explain the formation of diffraction pattern due to a single slit illuminated by a monochromatic source of light. When the width of the slit is made double the original width, how would this affect the size and intensity of the central diffraction band?

[2012]

Q35. (a) What is the effect on the interference fringes in a Young's double slit experiment when (i) the separation between the two slits is decreased? (ii) the width of the source slit is increased? (iii) the monochromatic source is replaced by a source of white light? Justify your answer in each case.

(b) The intensity at the central maxima in Young's double slit experimental set-up is I_0. Show that the intensity at a point where the path difference is $\lambda/3$ is $I_0/4$.

OR

(a) Obtain the conditions for the bright and dark fringes in diffraction pattern due to a single narrow slit illuminated by a monochromatic source. Explain clearly why the secondary maxima go on becoming weaker with increasing n.

(b) When the width of the slit is made double, how would this affect the size and intensity of the central diffraction band? Justify.

[2012]

Q36. State the importance of coherent sources in the phenomenon of interference. In Young's double slit experiment to produce interference pattern, obtain the conditions for constructive and destructive interference. Hence deduce the expression for the fringe width. How does the fringe width get affected, if the entire experimental apparatus of Young is immersed in water?

[2011]

Q37. (a) State Huygens' principle. Using this principle explain how a diffraction pattern is obtained on a screen due to a narrow slit on which a narrow beam coming from a monochromatic source of light is incident normally.

(b) Show that the angular width of the first diffraction fringe is half of that of the central fringe.

(c) If a monochromatic source of light is replaced by white light, what change would you observe in the diffraction pattern?

[2011]

Q38. (i) A plane wavefront approaches a plane surface separating two media. If medium 'one' is optically denser and medium 'two' is optically rarer, using Huygens' principle, explain and show how a refracted wavefront is constructed.

(ii) Hence verify Snell's law.

(iii) When a light wave travels from a rarer to a denser medium, the speed decreases. Does it imply reduction in its energy? Explain.

[2011 • Set 55-2-1]

Q39. State Huygens's principle. Show, with the help of a suitable diagram, how this principle is used to obtain the diffraction pattern by a single slit. Draw a plot of intensity distribution and explain clearly why the secondary maxima become weaker with increasing order (n) of the secondary maxima.

[2010]

Q40. (a) What is plane polarised light? Two polaroids are placed at $90°$ to each other and the transmitted intensity is zero. What happens when one more polaroid is placed between these two, bisecting the angle between them? How will the intensity of

transmitted light vary on further rotating the third polaroid?

(b) If a light beam shows no intensity variation when transmitted through a polaroid which is rotated, does it mean that the light is unpolarised? Explain briefly.

[2008]

Q41. What are coherent sources? Why are coherent sources required to produce interference of light? Give an example of interference of light in everyday life. In Young's double slit experiment, the two slits are 0.03 cm apart and the screen is placed at a distance of 1.5 m away from the slits. The distance between the central bright fringe and fourth bright fringe is 1 cm. Calculate the wavelength of light used.

[2007]

Q42. State the condition under which the phenomenon of diffraction of light takes place. Derive an expression for the width of central maximum due to diffraction of light at a single slit. A slit of width 'a' is illuminated by a monochromatic light of wavelength 700 nm at normal incidence. Calculate the value of 'a' for position of

(i) first minimum at an angle of diffraction of 30°.

(ii) first maximum at an angle of diffraction of 30°.

[2007]

Q43. State the essential condition for diffraction of light to take place. Use Huygen's principle to explain diffraction of light due to a narrow single slit and the formation of a pattern of fringes obtained on the screen. Sketch the pattern of fringes formed due to diffraction at a single slit showing variation of intensity with angle θ.

[2007]

Q44. What are coherent sources of light? Why are coherent sources required to obtain sustained interference pattern? State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit.

[2007]

Q45. What is interference of light? Write two essential conditions for sustained interference pattern to be produced on the screen. Draw a graph showing the variation of intensity versus the position on the screen in Young's experiment when (a) both the slits are opened and (b) one of the slits is closed. What is the effect on the interference pattern in Young's double slit experiment when:

(i) screen is moved closer to the plane of slits?

(ii) separation between two slits is increased. Explain your answer in each case.

[2006]

Q46. What is diffraction of light? Draw a graph showing the variation of intensity with angle in a single slit diffraction experiment. Write one feature which distinguishes the observed pattern from the double slit interference pattern. How would the diffraction pattern of a single slit be affected when:

(i) the width of the slit is decreased?

(ii) the monochromatic source of light is replaced by a source of white light?

[2006]

Q47. (a) How is a wavefront different from a ray? Draw the geometrical shape of the wavefronts when (i) light diverges from a point source, and (ii) light emerges out of a convex lens when a point source is placed at its focus.

(b) State Huygens' principle. With the help of a suitable diagram, prove Snell's law of refraction using Huygens' principle.

[2005]

Q48. (a) In Young's double slit experiment, deduce the conditions for (i) constructive, and (ii) destructive interference at a point on the screen. Draw a graph showing variation of the resultant intensity in the interference pattern against position x on the screen.

(b) Compare and contrast the pattern which is seen with two coherently illuminated narrow slits in Young's experiment with that seen for a coherently illuminated single slit producing diffraction.

[2005]