

CLASS 12

PHYSICS

EXTRA QUESTIONS

Class 12 Physics Chapter 10 Wave Optics – Extra Questions with Answers

These extra practice questions for Class 12 Physics Chapter 10 – Wave Optics go beyond the NCERT textbook exercises to reinforce Huygens' principle, wavefronts, and Young's double-slit interference. Useful for board exam revision and quick concept checks.

Contents

Very Short Answer Type Questions (1 Mark)

Short Answer Type Questions (2–3 Marks)

Higher Order Thinking Skills (HOTS)

These extra practice questions for **Class 12 Physics Chapter 10 – Wave Optics** go beyond the NCERT textbook exercises to reinforce Huygens' principle, wavefronts, and Young's double-slit interference. Useful for board exam revision and quick concept checks.

Very Short Answer Type Questions (1 Mark)

Q1. State Huygens' principle.

Ans: Every point on a given wavefront acts as a source of new secondary spherical wavelets that spread out with the speed of the wave in that medium; the surface tangent to (the envelope of) all these secondary wavelets at any later instant gives the new wavefront.

Q2. What is a wavefront?

Ans: A wavefront is the locus of all points in a medium that are in the same phase of vibration at a given instant — every point on it has travelled the same distance from the source and so oscillates in step.

Q3. Why does the frequency of light remain unchanged when it passes from one medium into another, while its speed and wavelength change?

Ans: Frequency is determined by the source that produces the light, not by the medium it travels through, so it stays fixed. Speed changes because different media transmit light at different speeds ($v=c/n$), and since $v=v\lambda$ with v fixed, wavelength must change to compensate.

Q4. What is the condition on path difference for two coherent waves to produce a bright fringe (constructive interference)?

Ans: The path difference between the two waves must be a whole number of wavelengths: path difference $=n\lambda$, where $n=0, \pm 1, \pm 2, \dots$

Short Answer Type Questions (2–3 Marks)

Q5. Derive the relation for fringe width in Young's double-slit experiment.

Ans: For two slits separated by d , screen at distance D , the path difference for a point at distance y from the centre is approximately yd/D (for $D \gg d$). Bright fringes occur where this equals $n\lambda$, giving $y_n = n\lambda D/d$. The fringe width (spacing between consecutive bright or dark fringes) is $\beta = y_{n+1} - y_n = \lambda D/d$.

Q6. Two coherent sources are needed to observe a stable interference pattern. Why can't two independent light bulbs produce visible interference fringes?

Ans: A stable interference pattern requires the two sources to maintain a constant phase relationship over time. Two independent bulbs emit light from vast numbers of independently-radiating atoms, so the phase difference between them fluctuates randomly and extremely rapidly (faster than any detector can follow); the pattern that would form at one instant is completely different a fraction of a second later, so the fringes wash out into a uniform average illumination.

Q7. Using Huygens' principle, explain qualitatively why a wavefront bends (refracts) towards the normal when it enters a denser medium.

Ans: When a wavefront strikes the boundary at an angle, one edge of the wavefront enters the denser medium first and slows down (since speed is lower in a denser medium) while the rest of the wavefront is still travelling at the higher speed in the rarer medium. This difference in speed along the wavefront causes it to pivot, tilting the wavefront — and hence the ray direction, which is perpendicular to it — towards the normal.

Higher Order Thinking Skills (HOTS)

Q8. In a double-slit experiment, if the entire setup (slits, screen, and the medium between them) is immersed in water instead of air, how does the fringe width change? Explain using the fringe-width formula.

Ans: Fringe width $\beta = \lambda D/d$, and the wavelength inside a medium of refractive index n is $\lambda_{\text{medium}} = \lambda_{\text{air}}/n$. Since water has $n \approx 1.33 > 1$, the wavelength (and hence the fringe width) **decreases by a factor of $1/1.33 \approx 0.75$** compared to air — the fringes become more closely spaced when the experiment is performed underwater.

Q9. Why is monochromatic (single-wavelength) light generally preferred over white light for a clean, easily-observable double-slit interference pattern?

Ans: Each wavelength in white light produces its own set of bright and dark fringes at slightly different positions (since fringe spacing $\beta = \lambda D/d$ depends on λ). With white light, these overlapping patterns for different colours quickly get out of step away from the centre, smearing the fringes into a blur of colour after just a few fringes (only the central fringe, where all colours coincide, stays white and sharp) — monochromatic light avoids this smearing entirely, giving a clean, sharply-defined fringe pattern extending far from the centre.

Continue Practising — NCERT Solutions for Class 12 Physics:

[Chapter 1: Electric Charges and Fields](#) | [Chapter 2: Electrostatic Potential and Capacitance](#) | [Chapter 3: Current Electricity](#) | [Chapter 4: Moving Charges and Magnetism](#) | [Chapter 5: Magnetism and Matter](#) | [Chapter 6: Electromagnetic Induction](#) | [Chapter 7: Alternating Current](#) | [Chapter 8: Electromagnetic Waves](#) | [Chapter 9: Ray Optics and Optical Instruments](#) | [Chapter 10: Wave Optics](#)

Recommended: Buy the Printed NCERT Class 12 Physics Book

Contains Amazon affiliate links.

If you'd like a printed copy alongside the PDF, here's a verified option:

NCERT Physics Textbook Part 1 for Class 12 (2025-26 Edition)

4.4 out of 5 stars (159 ratings) · Rs. 155

Buy on Amazon →

Price and availability may change on Amazon. As an Amazon Associate, ncertbooks.org earns from qualifying purchases.

© NCERTBooks.org — your one-stop source for Class 1 to 12 NCERT Books, Solutions, Extra Questions, Revision Notes, Formulas Handbooks and more. Visit ncertbooks.org for the latest chapters as they are published.