

8 Superposition — Part 1 — Answers

Answers

8.1 Constructive interference; resulting amplitude = $3 + 3 = 6$ mm.

8.2 Destructive — a path difference of 1.5λ is an odd number of half-wavelengths, so the waves arrive out of step and cancel.

8.3 Nodes are half a wavelength apart, so $\lambda = 2 \times 0.40 = 0.80$ m.

8.4 $x = \frac{\lambda D}{a} = \frac{(6.0 \times 10^{-7})(2.0)}{0.50 \times 10^{-3}} = 2.4 \times 10^{-3}$ m (2.4 mm).

8.5 The two beams must be coherent — a steady, matching phase — to give a fixed pattern. Splitting light from one source guarantees this; two separate lamps have randomly changing phases, so any pattern washes out.

8.6 The spacing *increases*. In $x = \lambda D/a$, a smaller slit separation a is divided into the top, so x gets larger — the fringes spread further apart.