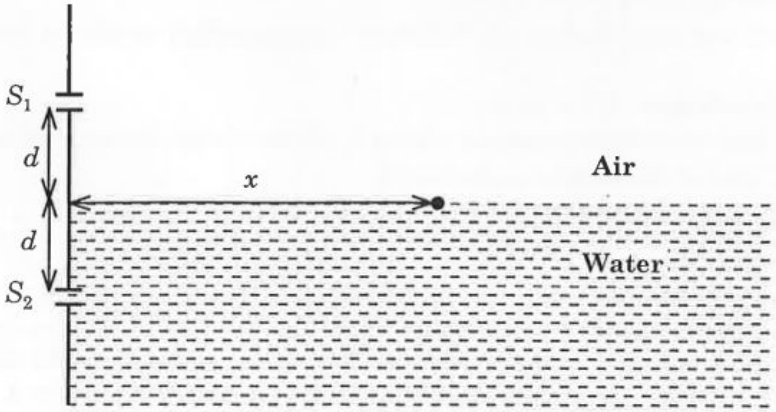
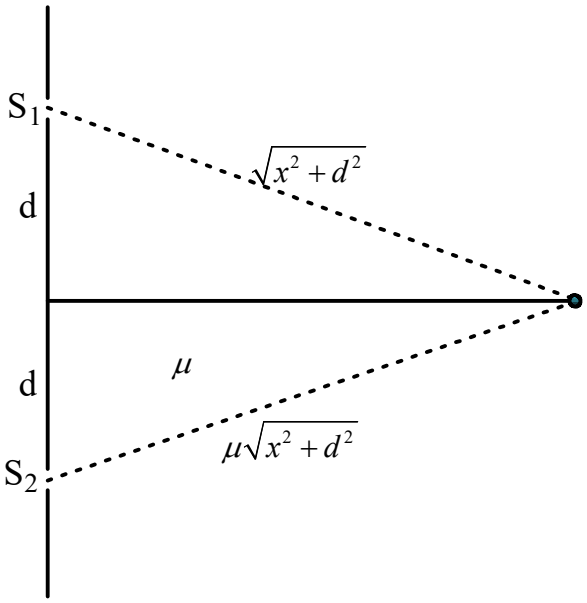
A Young's double slit interference arrangement with slits S_1 and S_2 is immersed in water (refractive index = 4/3) as shown in the figure. The positions of maxima on the surface of water are given by $x^2 = p^2m^2\lambda^2 - d^2$, where λ is the wavelength of light in air (refractive index = 1), $2d$ is the separation between the slits and m is an integer. The value of p is



Note: p is a single digit integer ranging from 0 to 9, both 0 & 9 inclusive.

Solution



Path Difference = $\mu\sqrt{x^2+d^2} - \sqrt{x^2+d^2} = n\lambda$

$\therefore \sqrt{x^2+d^2}\left(\frac{4}{3}-1\right) = n\lambda$

$\therefore x^2 + d^2 = 9n^2\lambda^2$

$\therefore x^2 = 9n^2\lambda^2 - d^2$

So, $p^2 = 9$

$\therefore p = 3$ (-3 is rejected as p is non-negative)

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