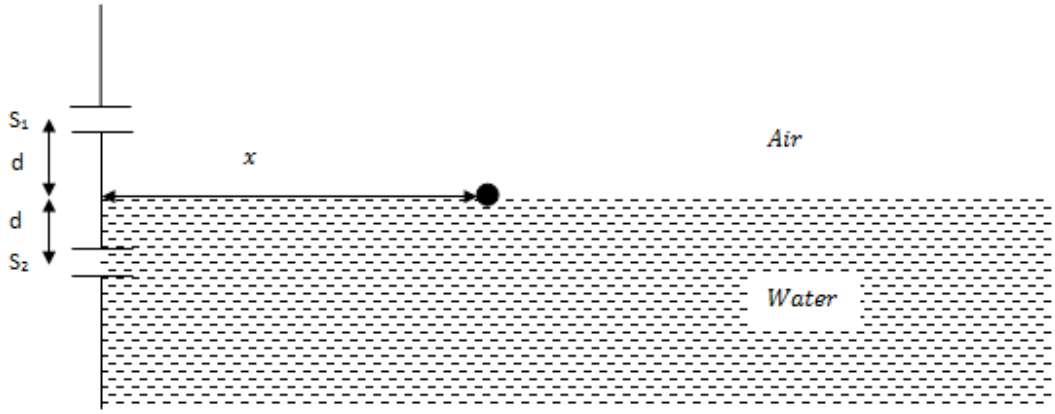
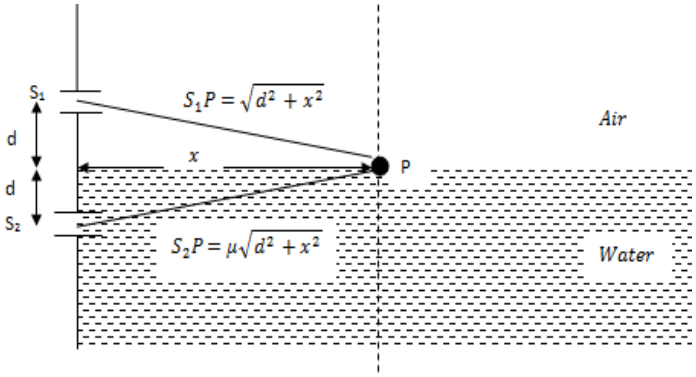
7. A Young's double slit interference arrangement with slits S_1 and S_2 is immersed in water (refractive index = 4/3) as shown in the figure. The positions of maxima on the surface of water are given by $x^2 = p^2m^2\lambda^2 - d^2$, where λ is the wavelength of light in air (refractive index = 1),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



Answer:



Let at P maxima occurs though Geometrically S_1P and S_2P are equal but because of medium change optical path from water i.e. $S_2P=\mu S_2P$

Now condition of maxima is path difference =Integral multiple of λ.

$$S_2P - S_1P = m\lambda$$

$$or\ \mu\sqrt{d^2 + x^2} - \sqrt{d^2 + x^2} = m\lambda$$

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

$$or\ d^2 + x^2 = 9m^2\lambda^2$$

$$or\ x^2 = 9m^2\lambda^2 - d^2$$

Comparing with $x^2 = p^2m^2\lambda^2 - d^2$

$$P = 3$$

Answer: 3