Answer on Question #38003, Physics, Nuclear Physics

Question:

In Young's double slit experiment when violet light of wavelength 4358Å is used,84 fringes are formed in the field of view.When another Sodium light of particular wavelength is used,62 fringes are formed in the same field of view.The wavelength of the sodium light is: a)6893Å b)5904 Å c)5523Å d)6429Å.

Solution:

It's known that the wavelength is inversely proportional to the number of a fringe $n > 0$ and length $L$from the screen with slits to the viewing screen:

$$\lambda = \frac{xd}{nL},$$

where x is a distance from a central fringe and d is a distance between slits. So, in the first experiment we have $\lambda_1 = 4358\ \text{Å}$ and $n_1 = 84$. If in the second experiment one obtains $n_2 = 62$ fringes, one can write a proportion

$$\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1} \Rightarrow \lambda_2 = \frac{\lambda_1 n_1}{n_2} = 5904\ \text{Å}.$$

Answer: b) 5904 Å.