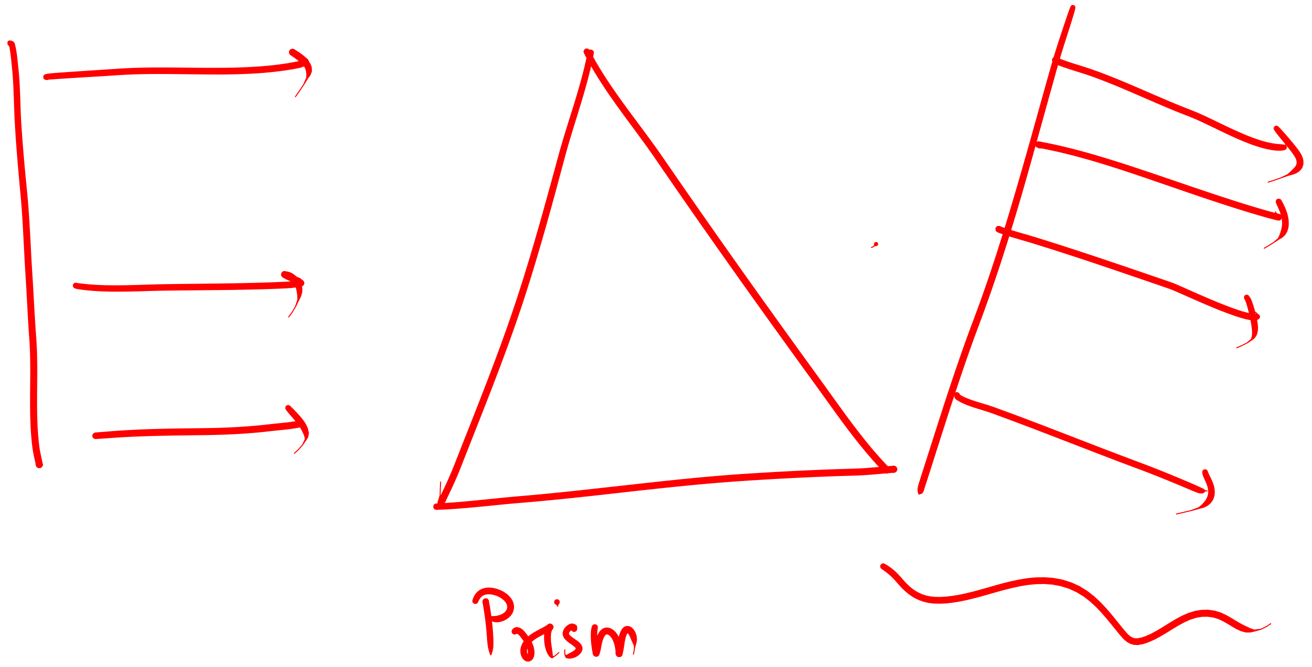
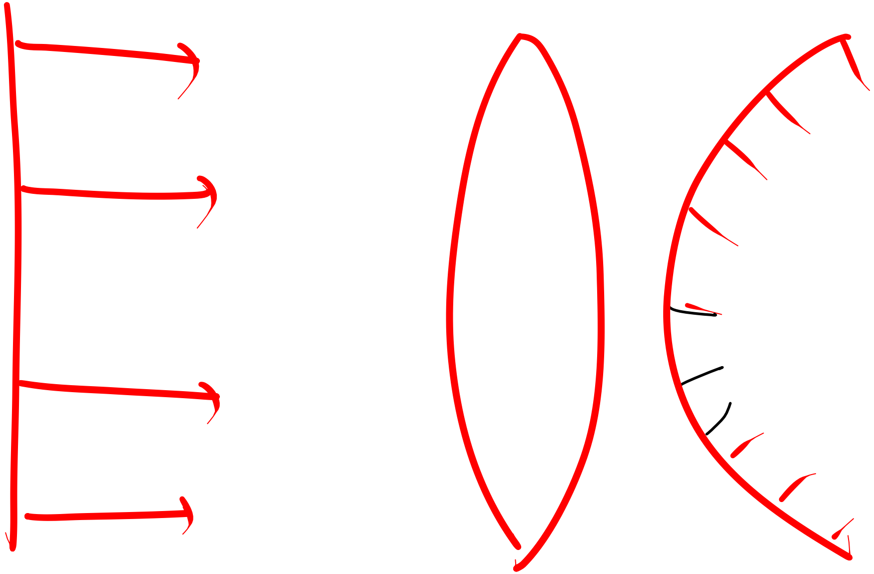
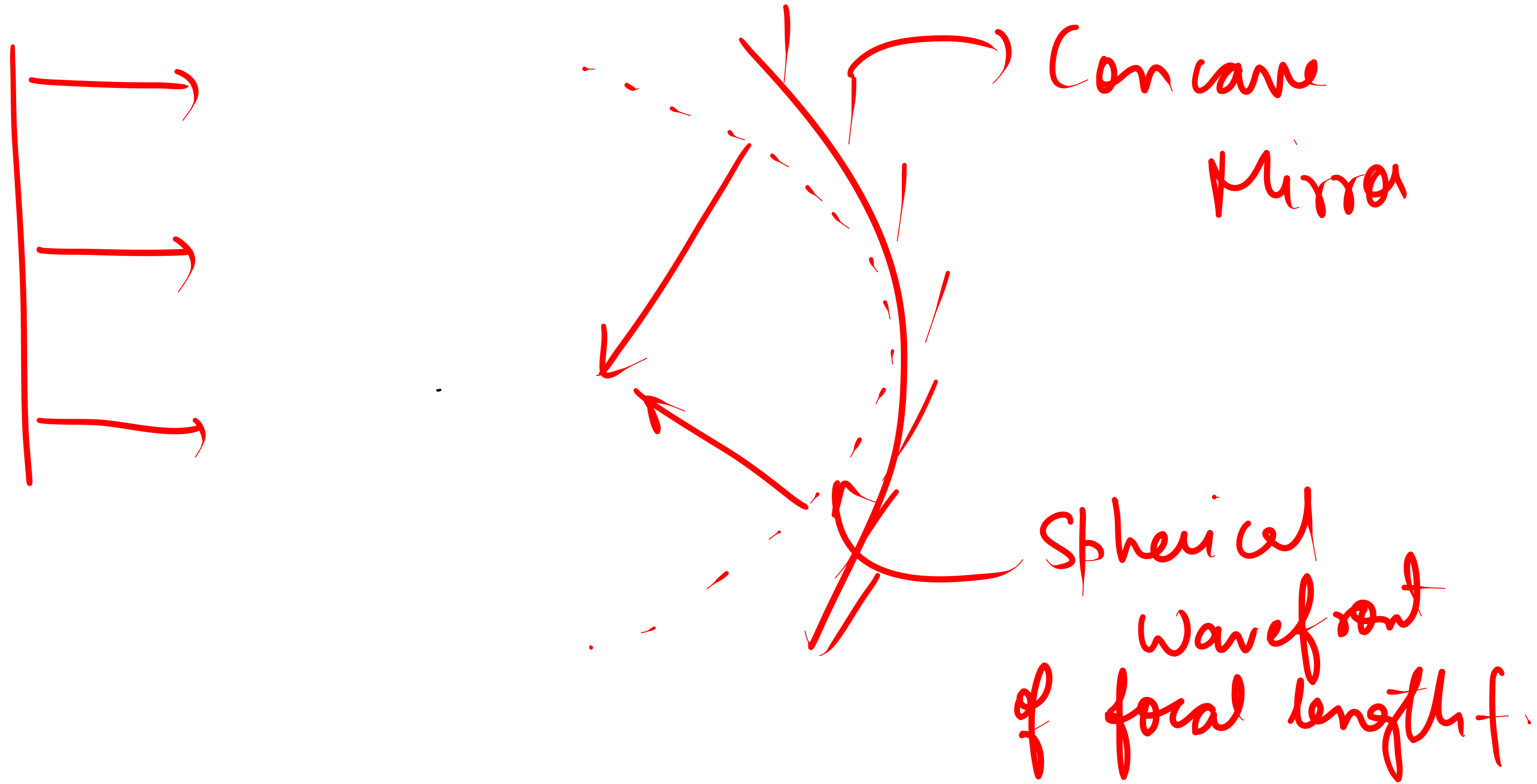
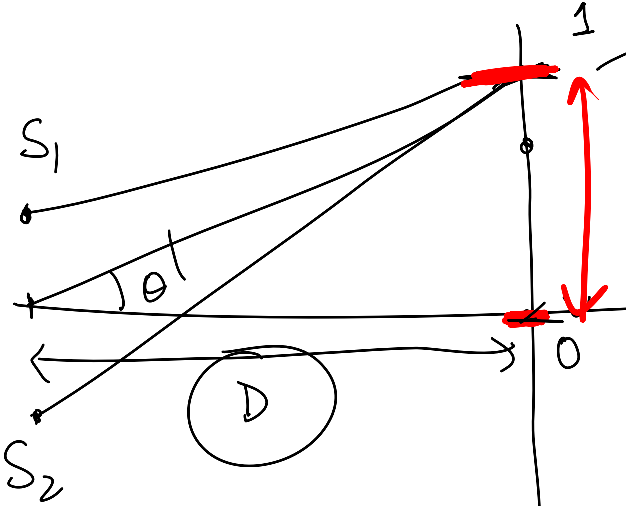

Prism



Spherical Wavefront of Radius R.


Concave Mirror
Spherical wavefront of focal length f.

Young Double Slit Experiment.



→ Bright fringe

Fringe Width

$$y = \frac{\lambda D}{d}.$$

θ ~ very small

$\tan\theta \sim \theta$.

Angular fringe is referred to as the length between two consecutive bright fringes.

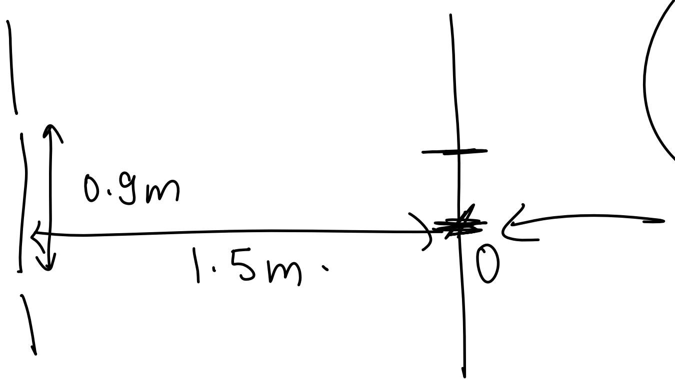
$$\theta = \frac{\frac{\lambda D}{d}}{D} = \frac{\lambda}{d}.$$

$$\beta = \frac{\lambda}{d}.$$

Ques In a Young double slit experiment, the slits are separated by .9 mm and the screen is placed 1.5 m. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.9 cm. $\lambda =$

Ans. 1st $\rightarrow \frac{\lambda D}{d}$

$$\frac{4\lambda D}{d} = 1.9$$



Bright fright

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$$\frac{4 \times \lambda \times D}{d} = 1.9$$

$$\begin{array}{r} 19 \\ 9 \\ \hline 1 \end{array} \quad 8$$

$$\frac{4 \times \lambda \times 1.5}{0.9 \times 10^{-3} \times 10} = \frac{1.9 \times 10^{-2}}{10}.$$

$$\lambda = \frac{0.9 \times 10^{-2} \times 19 \times 10^{-1}}{4 \times 15 \times 10} = \frac{171}{60} \times 10^{-4}\ m.$$

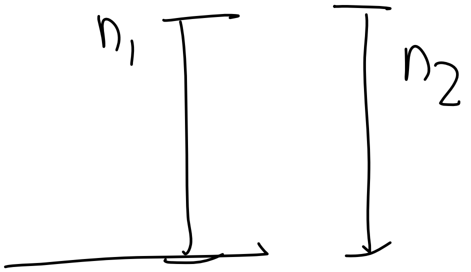
Ques A beam of light consisting of two wavelengths 650nm, 520 nm, is used to obtain interference fringes in YDSE. a) Find the distance of the third bright fringe on the screen from the central maxima for $\lambda = 650\,nm$.

b) What is the least distance from the central maxima where the bright fringe due to both the wavelengths coincide.

$\lambda_1 = 650\,nm$, $\lambda_2 = 520\,nm$

nth bright fringe $= \frac{n\lambda D}{d} \Rightarrow \frac{3 \times 650 \times 10^{-9} \times D}{d}$

b) n_1 n_2



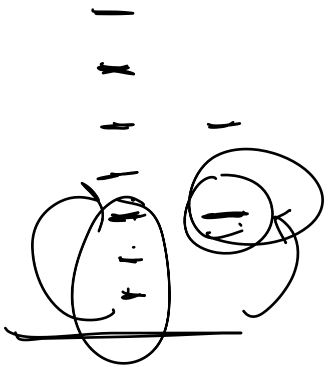
$$\frac{n_1 \lambda_1 D}{d} = \frac{n_2 \lambda_2 D}{d}$$

$n_1 \times \lambda_1 = n_2 \lambda_2 \Rightarrow n_1 \times 650 = n_2 \times 520$

$$\frac{n_1}{n_2} = \frac{52}{65}.$$

Wavelength 1 → 52 → coincide with the 65th of the wavelength of second.

Ques In YDSE, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path diff. λ is K units. What is the intensity of light at a point where path difference is $\lambda/3$.



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$\Delta x \rightarrow K = 4I_0^2 \cos^2 \frac{\phi}{2}$

$\Delta x \rightarrow \lambda$

$\Delta\phi = K\Delta x = \frac{2\pi}{\lambda} \times \lambda \Rightarrow 4I_0^2 \cos^2 \frac{2\pi}{2}$ (π = 180°)

$K \rightarrow 4I_0^2$

$\Delta x = \frac{\lambda}{3} \longrightarrow K'$

$\Delta\phi = K\Delta x \longrightarrow K' = 4I_0^2 \cos^2 \frac{\phi}{2}$, $\phi = \frac{2\pi}{3}$

$= \frac{2\pi}{\lambda} \times \frac{\lambda}{3}$

$\cos\frac{\pi}{3} = \frac{1}{2}$

$= 4I_0^2 \cos^2\left(\frac{2\pi}{3 \times 2}\right)$

$K' = 4I_0^2 \left(\frac{1}{2}\right)^2 = \frac{K}{4}$

Interference pattern: (Effect on Angular Width).

a) Screen is moved away from the plane of the slits, $\beta \to$ same

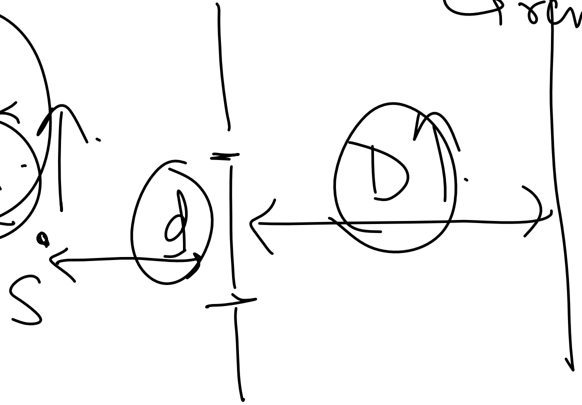
b) the separation between the two slits is increased. $\beta \downarrow$

c) the source slit is moved closer to the double slit

↳ remains same.

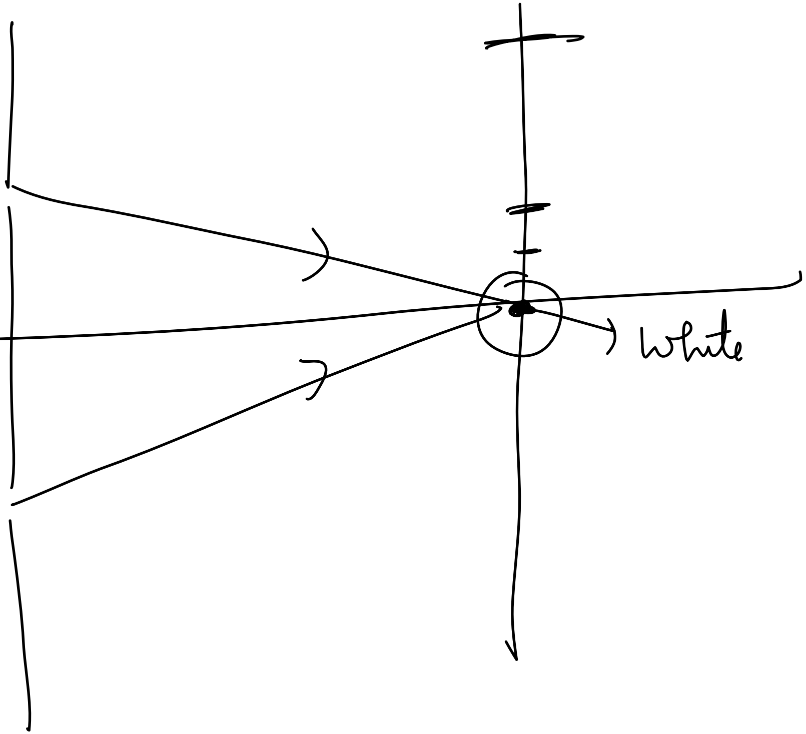
Angular Width remains same.

$\beta = \frac{\lambda D}{d}$



White light:

$$y_v = \frac{\lambda D}{d}$$



Violet → $\lambda_V = 700\,nm$

Red → $\lambda_R = 400\,nm$

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Ques

$\beta = 0.2^\circ$

$D = 1m$, $\lambda = 600nm$

$\beta = \frac{\lambda D}{d}$

$0.2 = \frac{600 \times 10^{-9}}{d}$

$\beta' \longrightarrow$ Entire Apparatus (water).

$\frac{\beta}{\beta'} =$

$\frac{n_1 = c/v_1}{n_2 = c/v_2} \Rightarrow \frac{4/3}{1} = \frac{v_2}{v_1}$

$\frac{4}{3} = \frac{f_2 \lambda_2}{f_1 \lambda_1}$

$\frac{4}{3} = \frac{\lambda_2}{600} =$

200 $\Rightarrow$ 800 nm

$$\frac{\beta_1}{\beta_2} = \frac{3\cancel{600} \times \cancel{10^{-9}}}{4\cancel{800} \times \cancel{10^{-9}}}$$

$$\frac{0.2}{\beta_2} = \frac{3}{4}$$

$$\beta_2 = \frac{0.8}{3} \Rightarrow 0.26^{\circ}$$