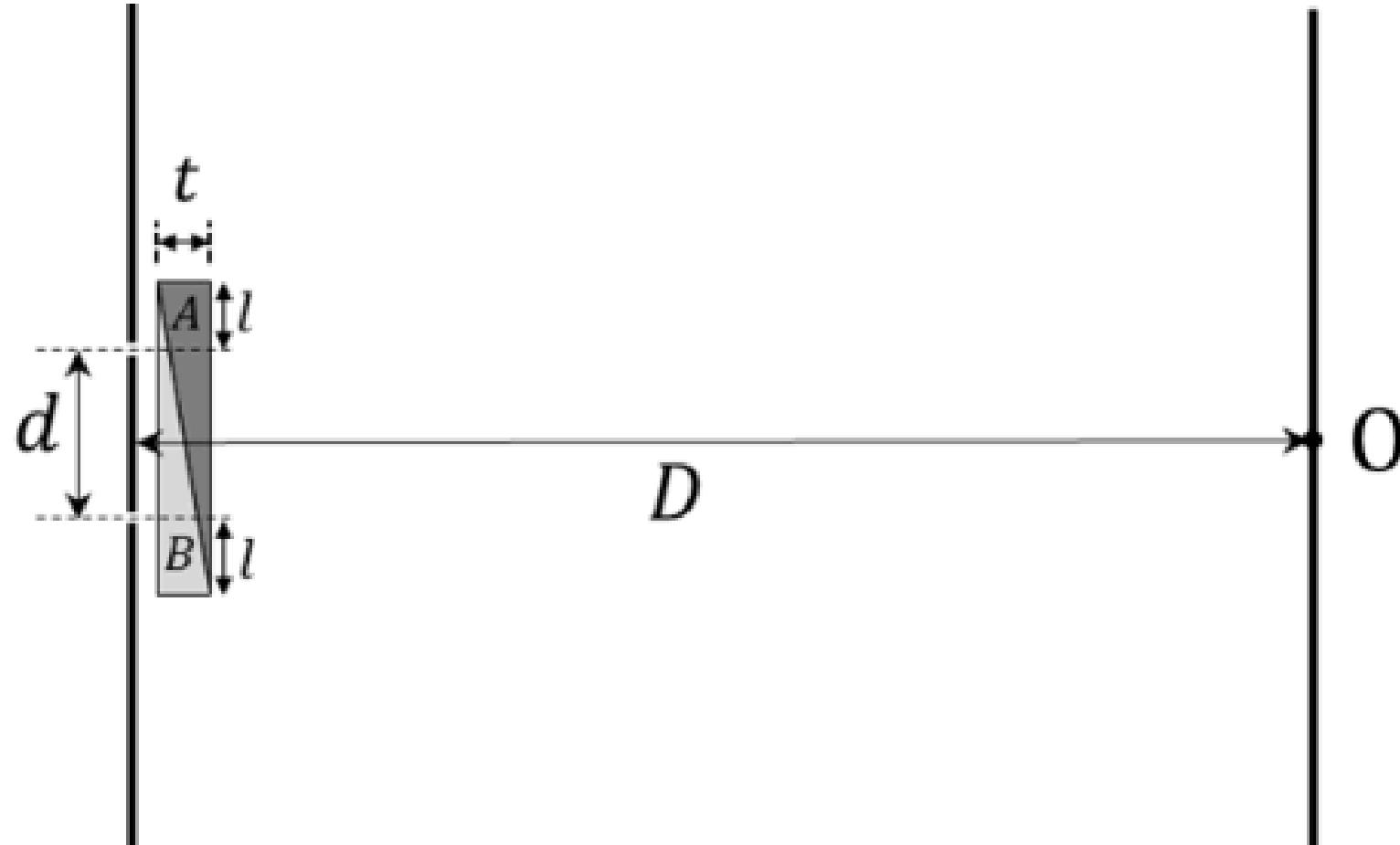


JEE Advanced 2025 Physics Problem:

In a Young's double slit experiment, a combination of two glass wedges A and B, having refractive indices 1.7 and 1.5, respectively, are placed in front of the slits, as shown in the figure. The separation between the slits is $d = 2 \text{ mm}$ and the shortest distance between the slits and the screen is $D = 2 \text{ m}$. Thickness of the combination of the wedges is $t = 12 \mu\text{m}$. The value of l as shown in the figure is 1 mm. Neglect any refraction effect at the slanted interface of the wedges. Due to the combination of the wedges, the central maximum shifts (in mm) with respect to O by ____.



CORRECT ANSWER: 1.2



OpenAI o3:

The additional optical path introduced is only due to the different refractive indices, because each slit's beam traverses the *same physical thickness t* of glass.

Wrong assumption

Optical path difference

$$\begin{aligned}\Delta &= (n_A - n_B) t \\ &= (1.7 - 1.5) \times 12 \mu\text{m} \\ &= 0.2 \times 12 \times 10^{-3} \text{ mm} \\ &= 2.4 \times 10^{-3} \text{ mm} = 2.4 \mu\text{m}\end{aligned}$$

Wrong formula usage

For the central maximum to re-appear, the geometrical path difference at the new point must cancel this:

$$dy / D = \Delta \Rightarrow y = D \Delta / d$$

Given: $D = 2 \text{ m} = 2000 \text{ mm}$; $d = 2 \text{ mm}$

$$\begin{aligned}y &= 2000 \text{ mm} \times 2.4 \mu\text{m} / 2 \text{ mm} \\ &= 2000 \times 2.4 \times 10^{-3} \text{ mm} / 2 \\ &= 2.4 \text{ mm}\end{aligned}$$

So the central maximum shifts by \boxed{2.4}

Wrong answer