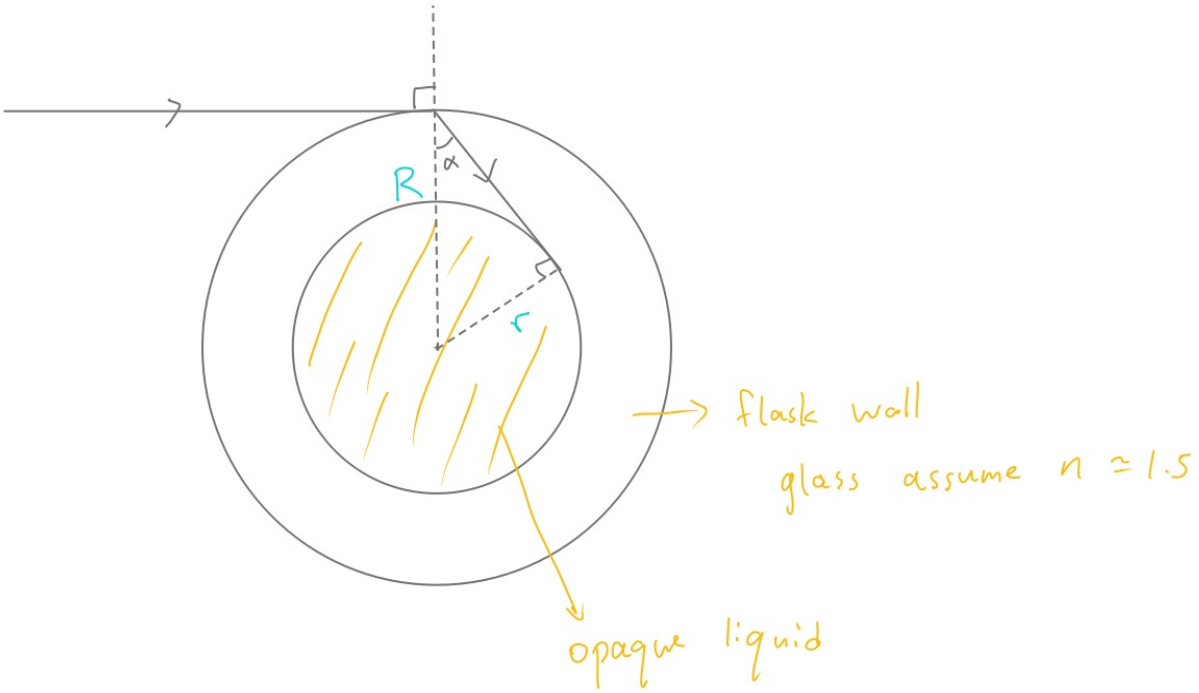
黑板

BPhO Round 2 2021 Q1 (e)



For $1 = \sin(90°) = n \sin\alpha = \frac{nr}{R}$

$\Rightarrow \quad \frac{r}{R} = \frac{1}{n}$

We have $R = 10\,cm \quad \Rightarrow \quad r = \frac{10}{1.5} = 6.67\,cm$

(critical value)

If opaque liquid blocks all incident light

$\Rightarrow$ the flask appears black

This requires $\Rightarrow \quad r \geq 6.67\,cm$

Flask Volume $\geq \frac{4}{3}\pi (6.67\,cm)^3 = 1243\,cm^3$

$> 1000\,cm^3$

$= 1\,L$

$= 1L$

$\Rightarrow$ can hold 1L of water.