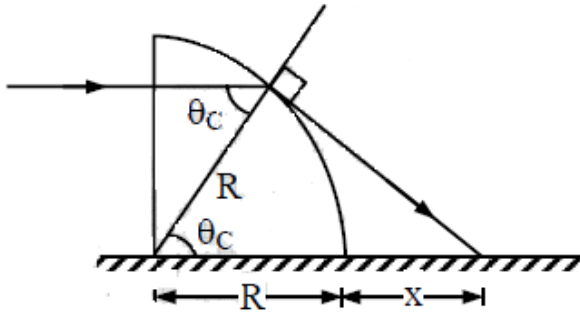a glass prism in the shape of a quarter-cylinder lies on a horizontal table. a uniform, horizontal light beam falls on its vertical plane surface, as shown in the figure. if the radius of the cylinder is R=5cm and the refractive index of the glass is n=1.5,where , on the table beyond the cylinder, will a path of light be found?

Solution

Referring to the ray diagram, we have, $\sin \theta c = \frac{1}{n}$ and

$\cos \theta c = \frac{R}{R+x}$, $\cos \theta c = \sqrt{1 - (\sin \theta c)^2} = \sqrt{1 - \frac{1}{n^2}} = \sqrt{1 - \frac{1}{1.5^2}} = 0.745$

giving $x = R\left(\frac{1}{0.745} - 1\right) = 5\left(\frac{1}{0.745} - 1\right) = 1.71 \; cm.$

Now consider the lower part of the cylinder as a planoconvex lens to get $f = 2R = 10 \; cm.$
Thus the path of light will be found between 1.71 cm and 10 cm beyond the cylinder.

Answer: between 1.71 cm and 10 cm beyond the cylinder.