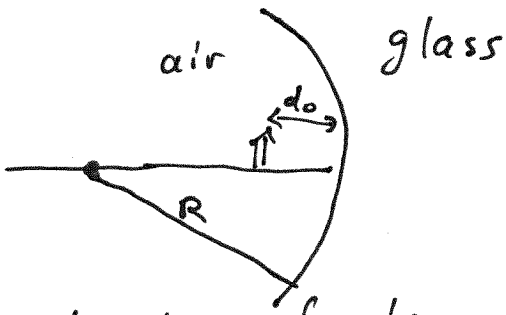
Ch.2 Prob. 48

$d_o = 5.0\,cm$

$R = 20\,cm$



Where is the image due to refraction.

For a single surface the ~~image~~ Image can be predicted by

$$\frac{n_1}{d_o} + \frac{n_2}{d_i} = \frac{n_2 - n_1}{R}$$

Now

$d_o = 5.0\,cm$

$n_1 = 1.000$

$n_2 = n_{glass} = 1.5$

$R = -20\,cm$ (This is a ~~positive~~ negative value because the surface is concave.

Solving for d_i gives

$$\frac{n_2}{d_i} = \frac{n_2 - n_1}{R} - \frac{n_1}{d_o} = \frac{1.5 - 1.0}{-20} - \frac{1.0}{5.0}$$

$$\frac{n_2}{d_i} = \frac{0.5}{-20} - \frac{1}{5} = -0.225\,\frac{1}{cm}$$

$$n_2 = -0.225\,(d_i)$$

$$d_i = \frac{n_2}{-0.225} = \frac{1.5}{-0.225} = \boxed{-6.67\,cm}$$

The negative means the image is virtual and falls on the object side of the surface.

Magnification $m = \dfrac{-n_1 d_i}{n_2 d_o} = \dfrac{-1.00\,(-6.67\,cm)}{1.50\,(5.00\,cm)} = \boxed{0.889}$