Answer on Question #47617-Physics-Optics

Determine distance and height of the image formed when an object of height $h_1 = 20cm$ and a distance of $s_1 = 20cm$ is placed in front of a concave surface with $n_2 = 1.45$ that has a $r = 7.20cm$ radius. (We use $n_1 = 1.00029$ for air)?

Solution

Use the equation for refraction at a single surface to relate the image and object distances:

$$\frac{n_1}{s_1} + \frac{n_2}{s_2} = \frac{n_2 - n_1}{r}.$$

Solving for s_2 yields:

$$s_2 = \frac{n_2}{\frac{n_2 - n_1}{r} - \frac{n_1}{s_1}} = \frac{1.45}{\frac{1.45 - 1.00029}{-0.072} - \frac{1.00029}{0.2}} = -13\ cm.$$

where the minus sign tells us that the image is 13 cm in front of the surface and is virtual.
Find the magnification:

$$M = -\frac{s_2}{s_1} = -\frac{(-13\ cm)}{20cm} = 0.65.$$

The height of the image is

$$h_2 = Mh_1 = 0.65 \cdot 20cm = 13\ cm.$$