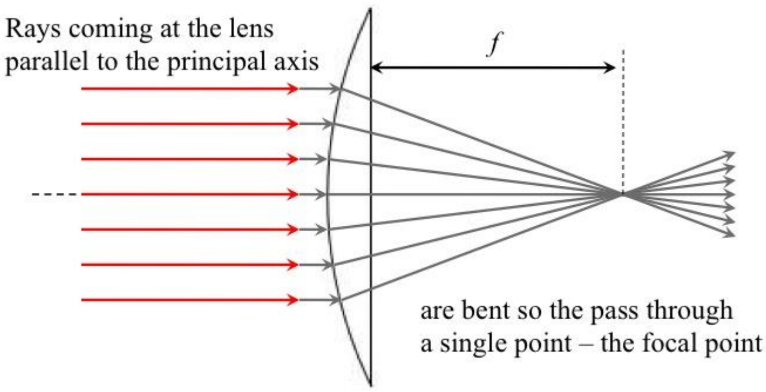
Answer on Question #57428, Physics / Optics

A planoconvex lens is made of refractive index 1.5 . The radius of curvature of its spherical surface is 40cm . At what distance from the lens will a parallel beam of light will get focussed ? Draw a neat diagram to show the image formation from the lens. What will be the nature and power of a combination of two such lenses kept with their (a) - plane surfaces in contact. (b) - spherical surfaces in contact

Solution:

Light rays passing through the lens parallel to the principal axis are focused to a single point. This is called the focal point. The distance from the centre of the lens to the focal point is called the focal length.



The power 1/f is given by

$$\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

The radii of curvature here are measured according to the Cartesian sign convention.

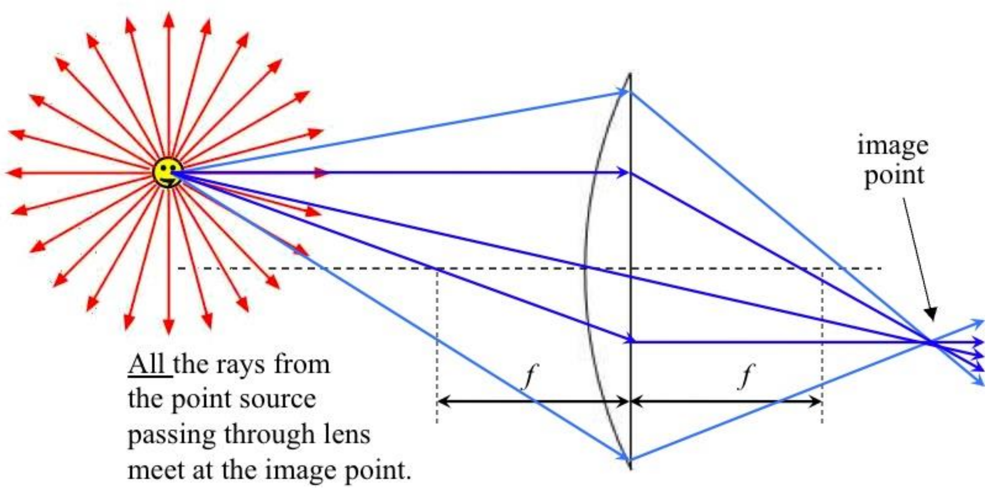
In our case,

$$R_1 = 40\ cm, \;\; R_2 = \infty$$

Thus, the focal length is

$$f = \frac{R_1}{n-1} = \frac{40}{1.5-1} = 80 \text{ cm}$$

A parallel beam of light will be focused at 80 cm from the lens.



(a)

For a double convex lens the radius R_1 is positive since it is measured from the front surface and extends right to the center of curvature. The radius R_2 is negative since it extends left from the second surface.

$$\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right] = (1.5-1)\left[\frac{1}{0.40} + \frac{1}{0.40}\right] = 2.5\ \mathrm{D}$$

$1/f > 0$ and this lens will be converging.

(b)

When spherical surfaces in contact the combined focal length f of the lenses is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{0.8} + \frac{1}{0.8} = 2.5\ \mathrm{D}$$

$1/f > 0$ and this lens will be converging.