Review of Thin Lens Optics

Thin lenses (an approximation that works for low powered lenses with curvatures that are relatively flat) can be thought of as two spherical refracting surfaces separated by an index of refraction that is greater than the surrounding medium.

For each surface:

$$F = \frac{n' - n}{r}$$

Example

What is the approximate (nominal) power of a spectacle lens with the following parameters: radius of front surface is 22.22 cm, radius of back surface is 15.38cm, index of refraction is 1.50?

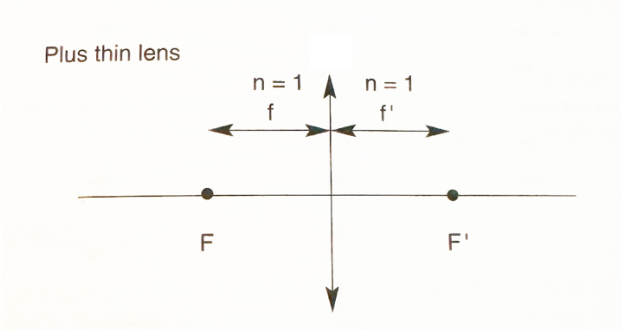
F1 = (1.50 – 1.00) / 0.2222m = +2.25D

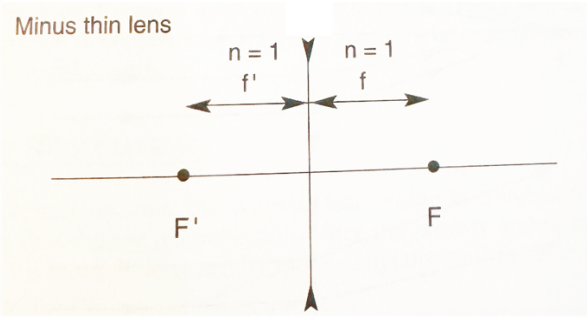
F2 = (1.00 – 1.50) / 0.1538m = -3.25D

F_A = -1.00D

Locating primary and secondary focal points is very simple since we can ignore the lens thickness.

$$F = \frac{1}{f} \qquad F' = \frac{1}{f'}$$





Systems of Thin Lenses

Thin lenses may be combined to form an optical system. When this occurs the image from the first lens serves as the object of the second lens.

Example

Where is image located for an optical system that consists of 2 lenses the first is +6.00D and the second is -8.00D. The lenses are separated by 15cm, and the object is 50cm to the left of the first lens?

We can locate the image for each lens using

L' = L + F

Lens 1 L' = 1/-0.50m + (+6.00D) L' = -2.00D + (+6.00D) L' = +4.00D l' = +25cm

Lens 2. L' = 1/+0.10m + (-8.00D). L' = +10.00D + (-8.00D). L' = +2.00D l' = +50cm

The Equivalent Power of the system can be determined with the formula:

$$F_E = F1 + F2 - dF1F2$$

where d is the distance between the 2 lenses