

Answer on Question #41799, Physics, Optics

An astronomical telescope has a length of 105cm, and its magnification is 6 determine the power of objective and eye piece?

Solution:

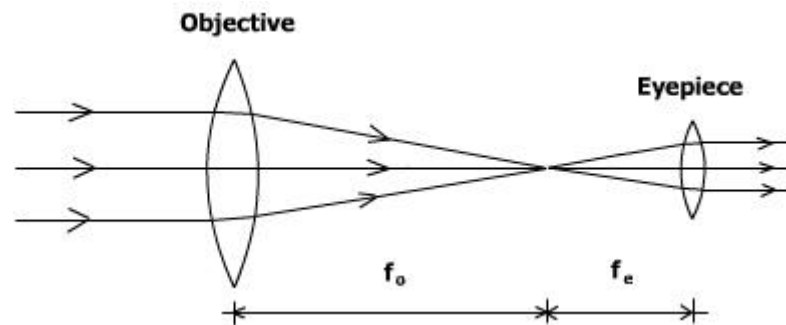
Given:

$$L = 105 \text{ cm,}$$

$$M = 6,$$

$$f_o = ?,$$

$$f_e = ?$$



Focal length of objective = f_o

Focal length of eyepiece = f_e

When the final image is at infinity, then magnification is

$$M = \frac{f_o}{f_e} = 6$$

and length of the telescope is

$$L = f_o + f_e = 105 \text{ cm}$$

Thus, from first equation

$$f_o = 6f_e$$

From second equation

$$6f_e + f_e = 105$$

$$7f_e = 105$$

$$f_e = \frac{105}{7} = 15 \text{ cm}$$

$$f_o = 6 \cdot 15 = 90 \text{ cm}$$

The power of a lens is defined as the reciprocal of its focal length in meters.

Thus, the powers of objective and eye piece are

$$P_o = \frac{1}{f_o} = \frac{1}{0.9} = 1.11 \text{ diopters}$$

$$P_e = \frac{1}{f_e} = \frac{1}{0.15} = 6.67 \text{ diopters}$$

Answer. $P_o = 1.11$ diopters, $P_e = 6.67$ diopters.