

WS24 Microscope and Telescope

The microscope and refractive telescope are surprisingly similar devices. For both the microscope and telescope, the eye piece is designed to act as a simple magnifier. Furthermore, the exit pupil of the device needs to match that of the eye.

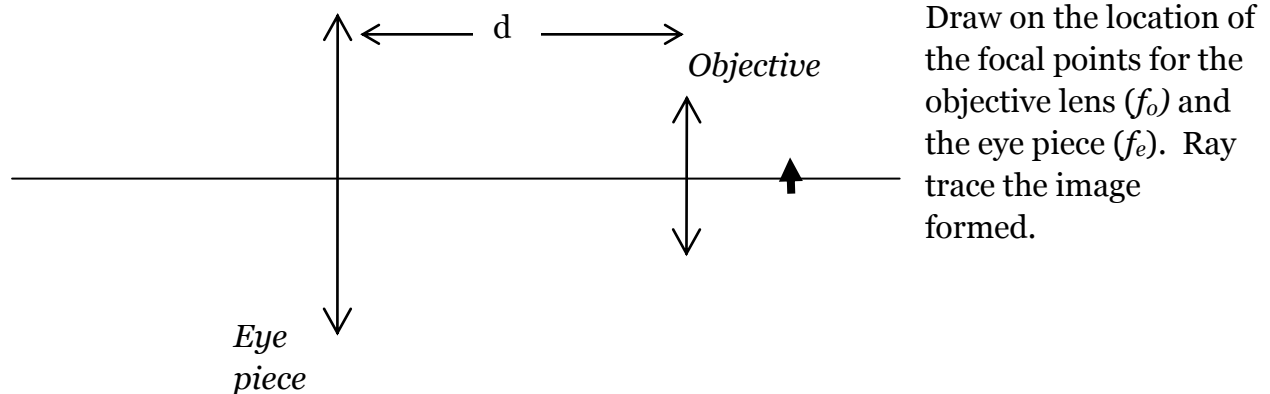
Considering the eye piece as a magnifier: where should the image from the first lens (objective in the case of a microscope) be set to form?

What kind of image is formed by the objective?

Where should the object be located with respect to the objective lens?

When using a microscope, where should the objective lens be placed with respect to the object? What does this imply about the focal length of the objective?

How should the focal points of the objective and eye piece be situated with respect to each other?



Draw on the location of the focal points for the objective lens (f_o) and the eye piece (f_e). Ray trace the image formed.

How is the final image oriented with respect to the object?

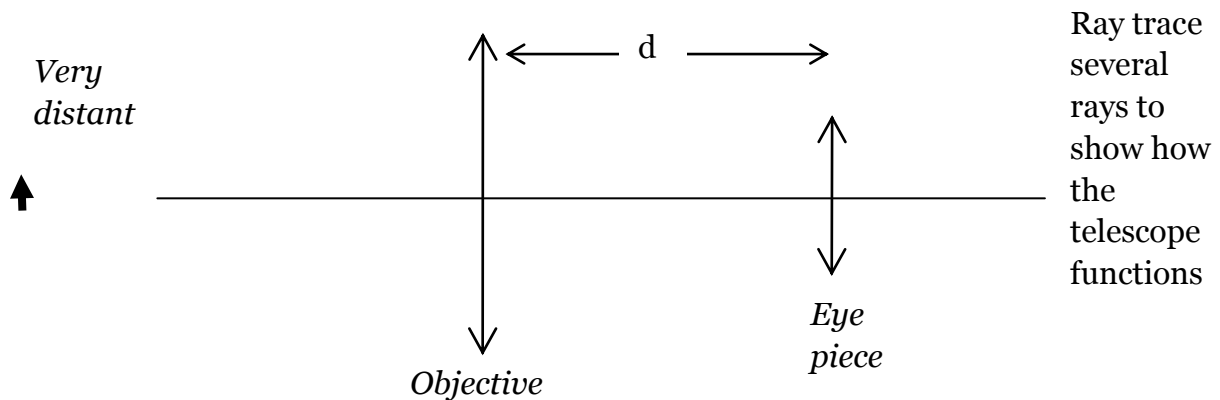
A telescope has a couple of different requirements from a microscope. First, it must magnify a distant object rather than a near object. Second, it must collect a lot of light since we are looking at distant objects.

Given these two requirements, what do you think must happen to the size of the first lens?

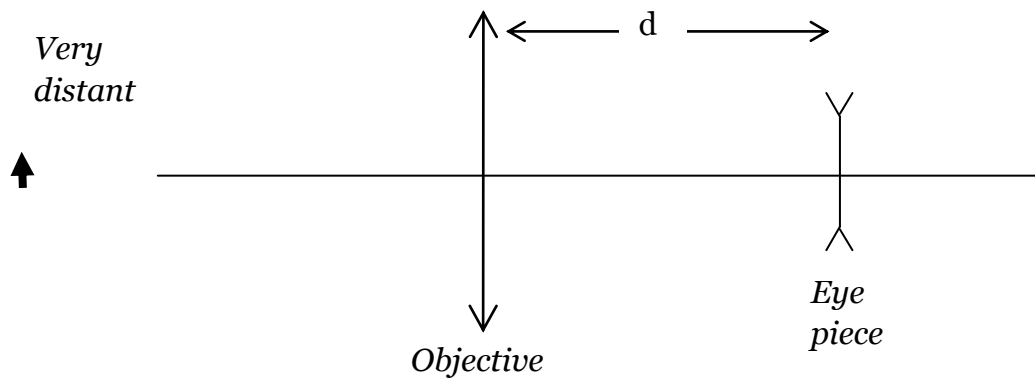
What impact does the size have on its focal length?

Given that the eye piece is again a simple magnifier, where should the image form?

Where should you locate the focal points of the lenses? Explain

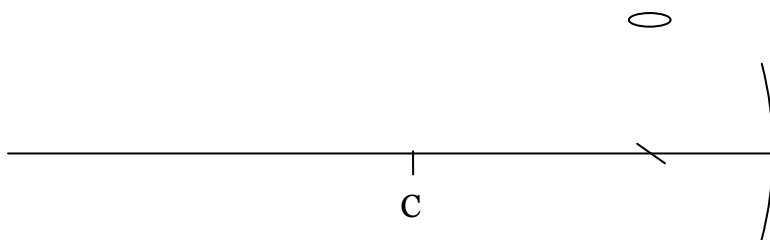


Suppose you replaced the converging eye piece with a diverging lens, could this work? Explain.



What problems are there with using a lens in an imaging system? How could these be corrected?

A common reflective mirror configuration is as shown:



Where are the focal points located?

Is this configuration greatly different from the refractive configurations?