Percent Transmission of Light

No glass lens is perfectly transparent, that is, the lens does not transmit 100% of the light that strikes it through the lens. Consider the two lenses in a telescope, the objective lens and the eyepiece lens. If the objective lens transmits 96% of the light, and the eyepiece lens transmits 97%, what percent of light from a distant source reaches your eye?

1. Read and Understand

What information are you given?

Transmission of objective lens = 96%
Transmission of eyepiece lens = 97%

2. Plan and Solve

What unknown are you trying to calculate?

Percent of light transmitted through two-lens system = ?

What formula contains the given quantity and the unknown?

Transmitted light = Incident light $\times$ Percent transmission

Substitute the known values and solve.

For light passing through two lenses, multiply the incident light by the percent transmission of each lens. Assume the amount of incident is unity, or 1.

Transmitted light = Incident light $\times$ Percent transmission$_{\text{objective}}$ $\times$ Percent transmission$_{\text{eyepiece}}$

Transmitted light = $1 \times 0.96 \times 0.97$

Transmitted light = 0.93 or 93% of the light passes through the two-lens system

3. Look Back and Check

Is your answer reasonable?

Yes, it makes sense that the amount of light that passes through is less than the percent transmission value for each lens.

Math Practice

On a separate sheet of paper, solve the following problems.

1. The diaphragm of a digital camera limits the lens opening to allow only 50% of the incident light to enter the lens. If the percent transmission of the multi-lens optical system used in the camera is 88%, what percent of the total incident light makes its way to the electronic sensor?

2. Light passing through one side of a binocular passes through an objective lens, two prisms, and an eyepiece lens. The objective lens, prism 1, prism 2, and eyepiece lens have percent transmission of 98%, 95%, 95%, and 94%, respectively. What percent of the light from an object makes it to your eyes?