2.710

Quiz 1

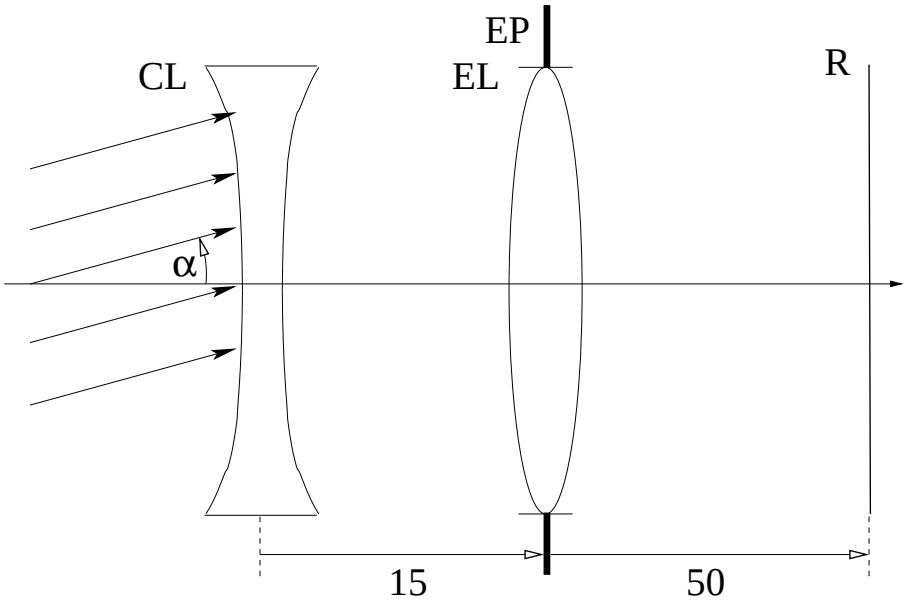
50 min

8:05–8:55am EST

9:05–9:55pm SST

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

2.710 Optics **Spring '09**
QUIZ 1 Wednesday, March 9th, 2009



distances shown in mm (not to scale)

CL=corrective lens; **EL**=eye lens; **EP**=eye pupil; **R**=retina

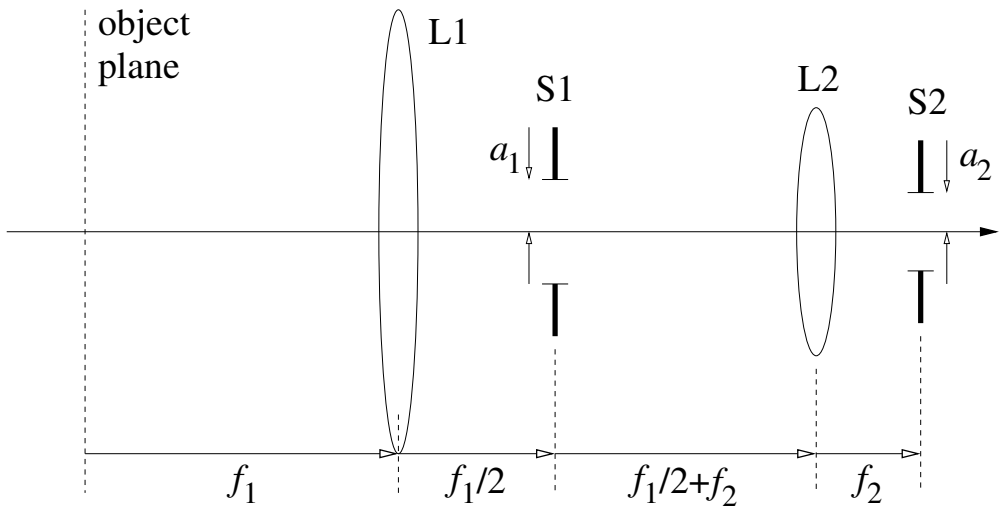
1. **Eye correction** The schematic above is a grossly simplified model of a person's eye who suffers from myopia. The unaccommodated focal length of EL is f_e = 45mm, whereas the distance from EL to R is longer, as shown. The purpose of this problem is to study the corrective action of CL for objects at infinity. We model both CL and EL as thin lenses.

   a) (15%) First consider an on–axis object, *i.e.* $\alpha = 0$. Calculate CL's focal length f_c such that the combination of CL and EL focus properly on R.

   b) (15%) Locate the 2nd Principal Plane and the Effective Focal Length of the combination of CL and EL.

   c) (15%) Now consider an off–axis object, *i.e.* $\alpha \neq 0$. Which elevation on R is the image formed at?

   d) (15%) Does this person's EP appear smaller or larger than its natural size when viewed through CL by an observer? By how much?



2. Aperture and field stops in a telescope with finite conjugates For the telescope configuration shown above, where lenses L1 and L2 have focal lengths f_1, f_2, respectively, the object plane and two stops S1 and S2 of half–sizes a_1, a_2, respectively, are at the locations shown,

a) (10%) identify the Aperture Stop and the Field Stop, and trace the Chief Ray and Marginal Ray for a sample off-axis point object of your choice;

b) (10%) locate the Entrance Pupil, Exit Pupil, Entrance Window, and Exit Window;

c) (10%) calculate the Numerical Aperture and Field of View; and

d) (10%) critique whether stops S1, S2 are optimally located and, if not, suggest better location(s).

GOOD LUCK!

2.71 / 2.710 Optics
Spring 2009