Homework 9.

Image produced by a two-lens system.

Last time we discussed the images produced by a two-lens system. We considered 3 examples which illustrate ho we can use the properties of thin lenses to build the final image.

1. The first lens produces a real image real image at a large distance from the second lens (here "large" means "larger than the focal distance of the second lens"), Figure 1:

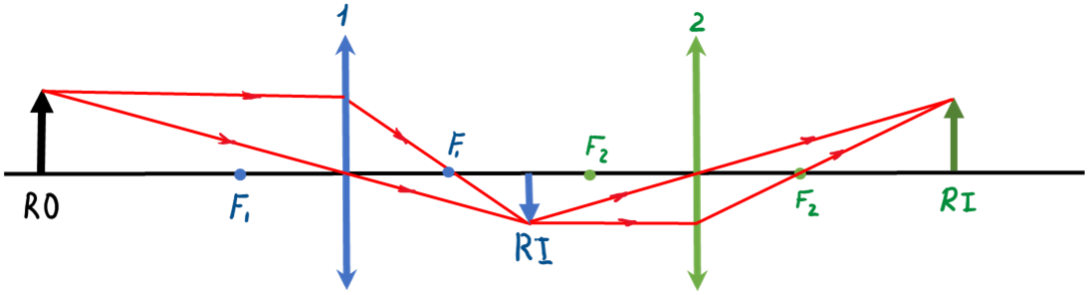


Figure 1.

Here RO means "real object, RI means "real image.

2. The distance between the image from the first lens and the second lens is less than the focal distance of the second lens, Figure 2:

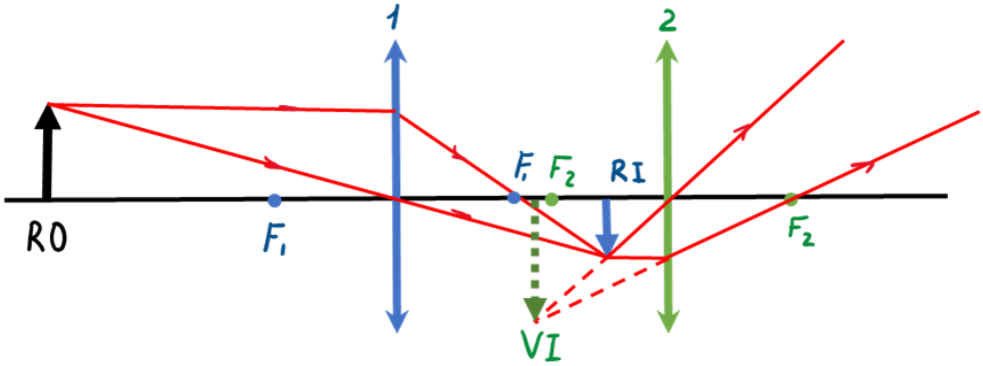


Figure 2.

In this case the final image is a virtual one.

3. The image from the first lens is behind the second lens. We have discussed this example previously (Figure 3):

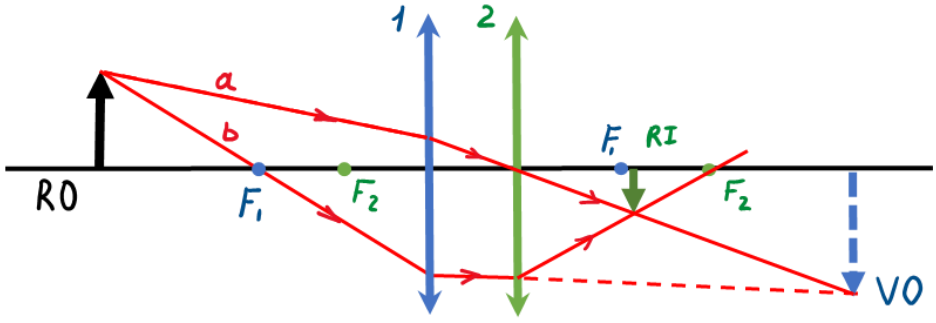


Figure 3.

In this case we use the concept of the virtual object (VO).

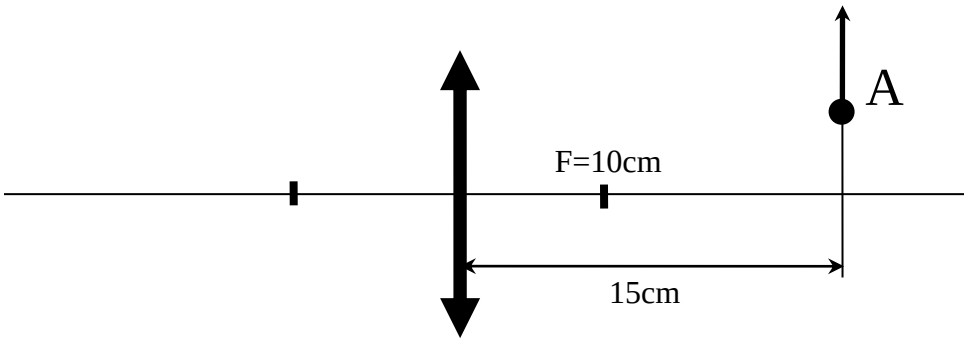
Of course, these 3 examples do not cover all possible arrangements. For example, we did not discuss the situations where the image, created by the first lens is a virtual one. But these examples contain all the necessary concepts we can use to consider all possible optical configurations.

Problems:

1. Consider the optical configuration similar to that in Figure 1, but the distance between the object and the first lens now is less than the focal distance of the first lens. Build the image, produced by the two-lens system.

2. Imagine that a small particle of dust stack to the objective of your photo camera (or there is a small scratch on the lens). Describe how it will affect the quality of the picture. Explain your answer.

3. The point A in the Figure moves up at the speed of 2cm/s (see figure). Focal distance of the lens is 10cm. Find a velocity of the image of the point A.



4. Distance between the object and the lens is *n* times smaller than the focal distance of the lens. Find the magnification. (Assume that only *n* is known).

5. Two lenses with the optical powers D_1=4dioptres (dpt) and D_2=5dpt are placed on the same optical axis and separated by the distance of 0.9m. Find the position of the image if the object is placed 0.5m before the first lens. (Just to remind: optical power is the inverse focal distance of a lens; 1 dioptre = 1/m).