

Pre-Lab: Lens and Telescope

An ordinary magnifying glass consists of a curved glass or lens. The type of lens inside a magnifying glass is called a converging lens or convex lens because light rays that strike the lens parallel to the optical axis will converge at a single point in space called the focal point.

As you can see from Fig. 1, this type of lens is thicker in the middle than the sides. The point in space where these light rays meet, in the diagram called F, is called the Focal Point. Convex lenses have two focal points, one on either side of the lens.

If we wish to find where the image of an object placed to the left of a convex lens will appear, we use what is called the Ray Tracing Method. Ray tracing Method involves the following

1. Rays traveling parallel to the optical axis when they hit the lens they bend and pass through the Focal Point.
2. Rays traveling such that they hit the middle of the lens "C" in Fig. 1 continue to travel without deviating.

1) For the diagram below, use a ruler and ray tracing to construct the image of the object. Start with the head "H" and draw two rays, one traveling parallel to the optical axis and one going through the the center of the lens. Where these two rays meet will be the image of "H". Do the same for the tail "T". Finally connect the Images of "H" and "T" to construct the image.

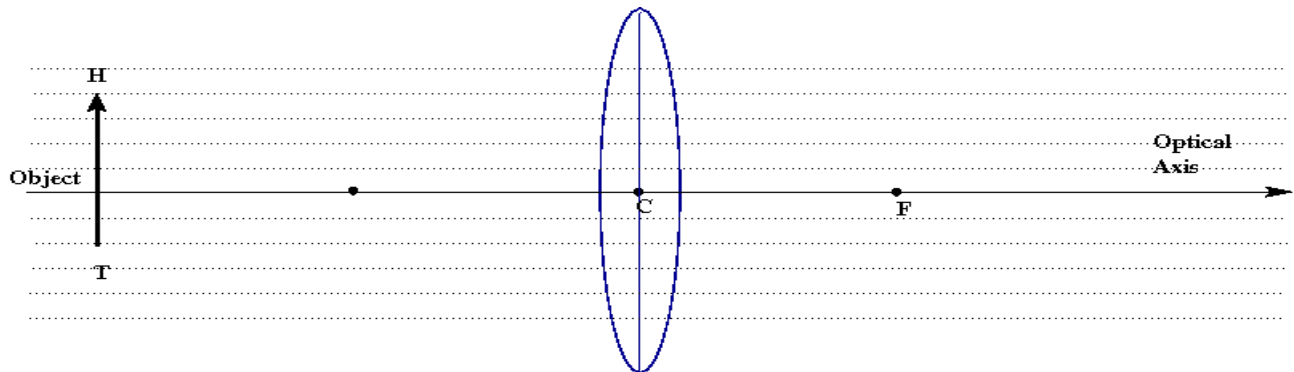


Fig. 1

2) For the diagram below, use ray tracing to construct the image of the object. Start with the head "H" and draw two ray lines, one traveling parallel to the optical axis and one going through the the center of the lens.

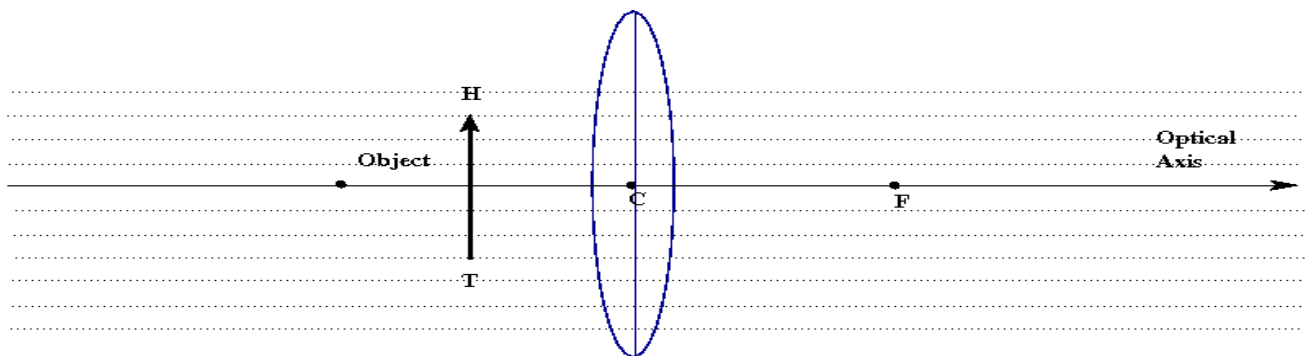


Fig. 2

You will find out that the two rays originating from "H" do not converge. The two rays from "T" do not converge either. Where is the image? It appears that the two diverging rays, if traced backward they will intersect on the left side of the lens indicating the image will be on the same side as the lens. Trace the two diverging rays originating from "H" backward. They intersect to the left of the lens where the image of "H" is located. Do the same for "T". Notice that the image is larger than the object. This is how a magnifying glass works! Instead of seeing the object when you look through the lens, you see the larger image.

Suppose you have two lenses and you want to find the image formed by the combined lenses. How would you proceed? The way to obtain the image is as follows:

1. Find the image of the object 1 formed by lens 1.
2. The image formed by lens 1 will be used as the object 2 for lens 2
3. Get the image of object 2 by lens 2. This will be the final image.

3) In the diagram below there is an object on the left of Lens 1. Then use ray tracing to make an image between the two lenses. Now use this image as the object for Lens 2, and draw its image.

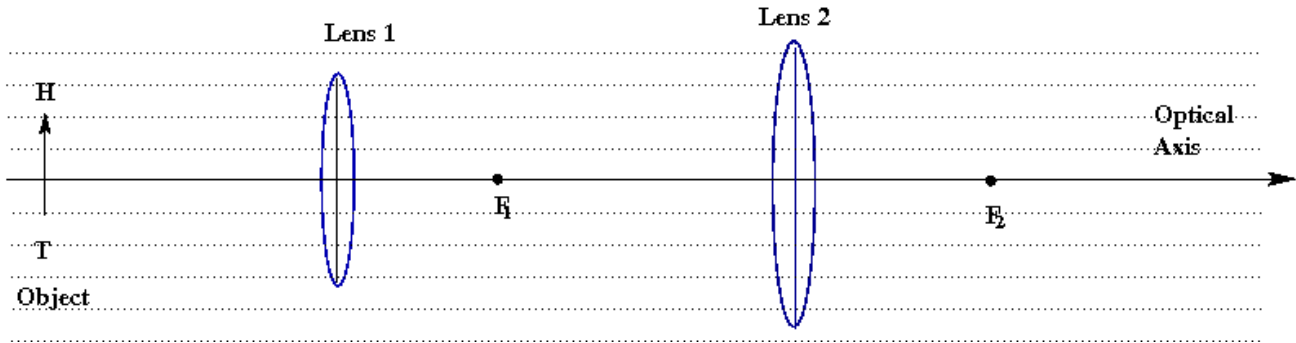


Fig. 3