

## **Mini-Lab: To ruin a camera and build a hopelessly inadequate telescope**

**IMPORTANT:** While you are working on the camera you are required to take precautions two precautions:

1. PROTECT YOUR EYES by wearing goggles. It is quite possible for a small piece of plastic or metal to fly out of the camera at high speed. This could cause a painful, possibly dangerous injury if it were to enter your eye. Wear goggles at all times while you or anyone else near you is dissecting the camera.

2. Protect the desk top by using a piece of cardboard.

1. Examine the camera. Describe the approximate size and appearance of the camera, any controls and any other external features.

2. Look through the viewfinder.

- Look at something very close and describe the image (is it inverted or erect? Is it larger or smaller?)
- Look at something which is far away. Describe the image (is it inverted or erect? Is it larger or smaller?)
- Note that the viewfinder actually consists of two lenses. The lens at the front of the camera will be called the objective lens. The lens which is close to your eye will be called the eye lens. You will need this information later in the experiment.
- Look at something fairly distant by looking through the view finder in the **OPPOSITE** direction. Is the image which you see larger or smaller? Estimate approximately how many times.

3. As carefully as possible, open the camera. You should pay particular attention to the view finder lens and the main plastic lens which brings light rays to a focus on the film. Keep the view finder (it may be in one or two pieces) and the main lens (which, though small, is of fairly high quality.) You will need these later.

4. Examine the mechanical aspects of the camera:

- Describe the shutter mechanism. What must happen in order for light to be admitted to the film?
- Measure the diameter of the aperture (opening) through which the light must pass on its way to the film.
- Take a strip of paper and see if you can make it follow the film path. You may need to trim the film to get it to pass through the slot. How wide is the film?
- Carefully remove the back of the camera and describe the film path. Note the small gear which pulls the film along. Measure the slot. How wide is the film, including the area where the gear engages the film to move it?
- Measure as carefully as you can the distance light must travel from the lens to the film.

5. Return to the viewfinder. As we said before, the viewfinder is actually made up of TWO lenses, the objective lens and the eye lens. the two lenses and for each lens look at a distant object and a near object.

- For the objective lens, describe how a distant object looks (inverted or erect, larger, or smaller)? Does the lens appear to be concave or convex?
- For the eye lens, describe how a distant object looks (inverted or erect, larger, or smaller)? Does the lens appear to be concave or convex?
- Refer back to your observations in step 2. Does the combination of lenses as they are used in a viewfinder act as converging (convex) or diverging (concave)?

6. Take the main plastic camera lens.

- What is its diameter?
- Knowing that this lens must make a real image on the film, what kind of lens would you expect it to be? (Concave or convex)?
- Determine the focal length of the main plastic lens by focusing a distant object on a piece of paper.

7. Take a laboratory lens (diameter = 3.75 cm)

- Determine the focal length of the lab lens.
- Using the lab lens as the objective and the main plastic lens from the camera as the eye lens, construct a telescope.
- View some object which is reasonably far away (at the opposite end of the room) and estimate the magnification of this pair of lenses.