OPTICS LAB #2

OBJECT: To understand character of thin spherical lenses

EQUIPMENT: Optics bench

Optics box

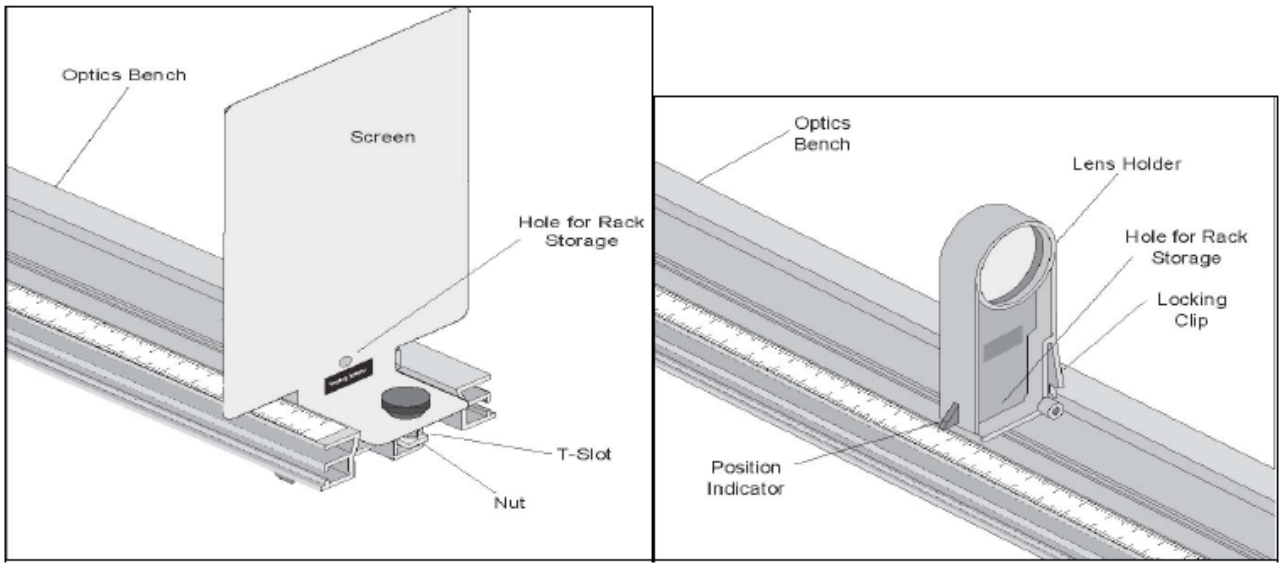
Metal Screen

Since you will be working in a dark room, it will be very efficient if you have a flashlight with you.

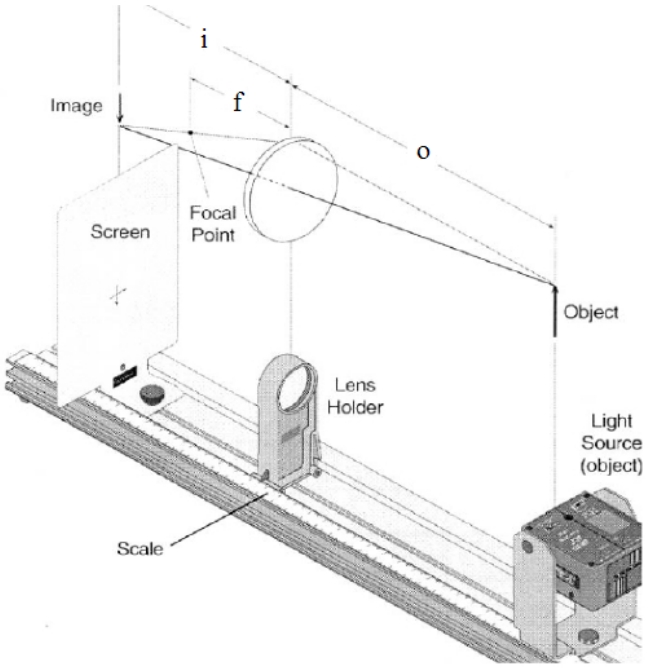
GENERAL DIRECTIONS

A. Focal length of a single lens

Method 1 – When "o" is infinity



1. Place the metal screen at 0 cm mark on the optics bench.
2. Place Lens A (100mm) on the optics bench.
3. Bring the optics bench outside and adjust Lens A until a sharp image of a long distance object is formed on the screen.
4. Record the distance between the screen and the lens.
5. Repeat the procedure with Lens B (200mm).
6. Draw a large and accurate ray diagram for this set up



Method 2 – Using the lens equation

1. Measure "o" and "i" to calculate "f" and "m"
2. Measure the sizes of object and image within the accuracy of 0.1 mm to calculate the magnification.
3. Calculate % errors of "f" and "m".
4. Repeat the procedure with the second lens
5. On the conclusion, discuss if it is possible to obtain a non-inverted image with a converging spherical lens.

6. Draw a large and accurate ray diagram for this set up.

Method 3 – Using symmetry

1. Using the same set up as Method 2 move the lens back and forth to find two positions for which the image on the screen is in focus.
2. Move the screen f few centimeters closer to the object and again observe that a focused image is obtained for two different lens positions.
3. Continue to move the screen closer to the object until “o” and “i” are equal. Record the values.
4. Calculate % error.
5. Repeat the procedure with the second lens.
6. Draw a large and accurate ray diagram for this set up (to show why “o” = “i” = “2f”.)

B1. Combination of two lenses – two convex lenses

1. Collect data necessary for un-mounted lens and calculate its focal length (Use the method you think is most accurate used in A. On the conclusion, discuss why the method was used.).
2. Place the lens onto Lens A and hold in place with a small piece of masking tape.
3. Repeat the method 2,1, 2,2, and 2,3.
4. Calculate the theoretical focal length of combined lens and compare it with the result using the other method.
5. Calculate % error.

B2. Combination of two lenses – convex and concave lens

1. Place the un-mounted lens used in B1 onto the concave lens C (- 150 mm).
2. Repeat the method used for “two convex lenses” to find f_{eq}.
3. Calculate the focal length of concave lens C and compare it with the printed value.
4. Calculate % error.