

6. CONCAVE LENS USING CONVEX LENS- FOCAL LENGTH

AIM:

To find the focal length of a given concave lens using a convex lens.

APPARATUS REQUIRED:

Light source, Concave Lens, Convex lens, Lens stand(2), Screen, Meter Scale.

THEORY:

A Concave lens always forms only a virtual, erect image and hence cannot find its focal length by direct method. So, we use an indirect method to find its focal length, by using a convex lens of known focal length.

The focal length of a concave lens can be calculated using the formula,

$$\frac{1}{f} = \frac{1}{u} - \frac{1}{v}$$
$$f = \frac{uv}{u-v}$$

Where, u – Object distance from the lens (in cm)

v – Image distance from the lens (in cm)

F – focal length of the convex lens (in cm)

According to sign convention, u, v and f are negative. The negative value of the ' f ' shows that concave lens is a diverging lens.

PROCEDURE:

1. Find the rough focal length of the given convex lens by distant-object method. Note it down.
2. Mount the given lenses in the lens holders.
3. Place the convex lens from the object (Wire gauze of the light source) at a distance of $u = 1.5f$ cm. Get the image by adjusting the screen.
4. Note the position of the screen for reference.

5. Now place the concave lens in between the convex lens and the first position of the screen , such that $u=8$ cm from the screen.The image on the screen is blurred.
6. This distance between the concave lens and the blurred image is taken as object distance(u).
7. Move the screen backward till we get a clear image. The distance of the concave lens to this second position of the screen is taken as image distance(v).
8. Record the observations.
9. Repeat the experiment by increasing the values of u in steps of 2cm.
10. Note down the corresponding image distance and find the focal length from each set using the equation $f = \frac{uv}{u-v}$.
11. Find the mean f .

PRECAUTIONS:

1. The source, the lenses and the screen should all lie on the same straight line.
2. The uprights should be rigid and vertical.
3. The focal length of the given convex lens should be less than focal length of the concave lens given.

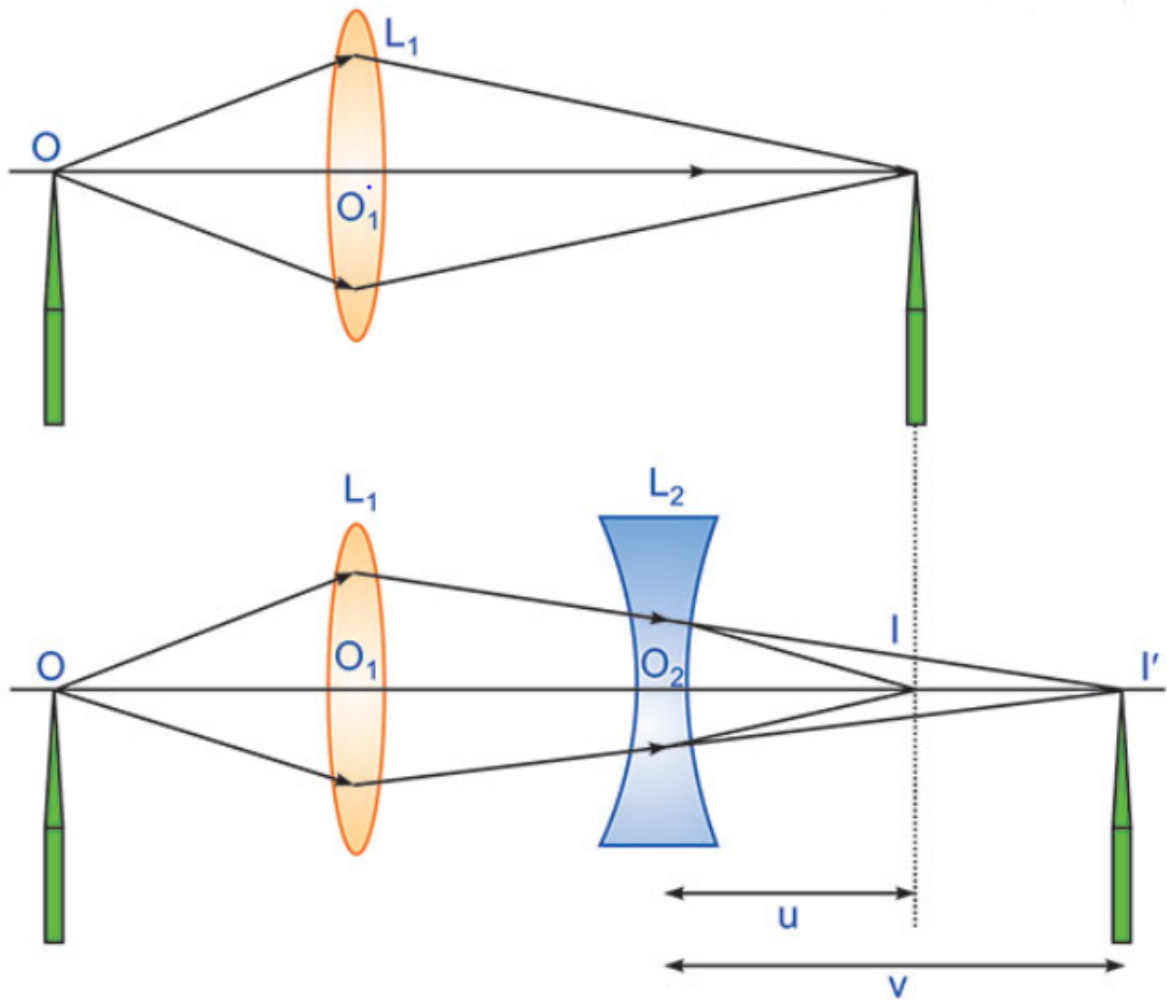
SOURCES OF ERROR:

1. The source, the lenses and the screen may not be in the same straight line.
2. The parallax removal may not be perfect.
3. Lenses might be having spherical/chromatic aberrations.
4. The lens might not be clean.

RESULT:

The focal length of the given concave lens using the convex lens =.....cm

RAY DIAGRAM:



L_1 ----- Convex lens

L_2 ----- Concave lens

u -- Object distance (Distance of L_2 from first image (I))

v -- Image distance (Distance of L_2 from second image (I'))

OBSERVATIONS & TABULATIONS:

Rough focal length of the convex lens, $f = \dots\dots\dots\text{cm}$ (by distant object method)

Sl.No	Object distance u (cm)	Image distance v (cm)	$f = \frac{uv}{u-v}$ (cm)
1.			
2.			
3.			
4.			
5.			

Mean Focal length, $f = \dots\dots\dots\text{cm}$