EXP. No. (6)

The focal length of convex lens by graphical method

The aim of experiment

Determination the focal length of the convex lens by graphical method

Theory:-

Focal length :-Is the distance between center of the lens and the focal point of the lens. This point produce from the meeting of parallel rays of light .
A lens is a transparent curved surface that is used to refract light. It is usually made from glass. There are two different types of lenses.

Convex lenses :- They are thick at the middle. The rays of light that pass through the lens are brought closer together (light converging). The image formed by a convex lens is real and inverted and can be bigger or smaller than the object as shown in Figure 1.

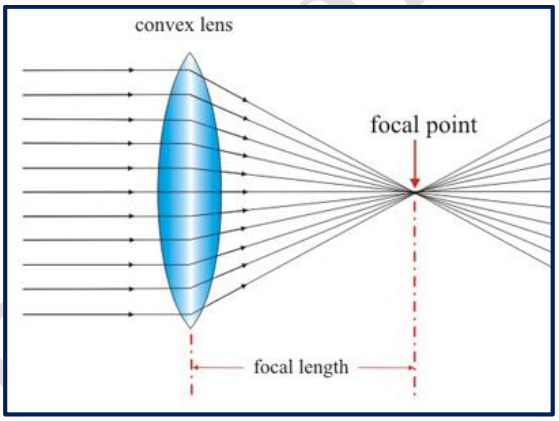

Figure 1: Convex lenses

Concave lenses:- They are thin in the middle and thicker at the edges. A concave lens is also called a diverging lens. A concave lens will disperse light and make an image that is always virtual, upright and smaller than the object as shown in Figure 2.

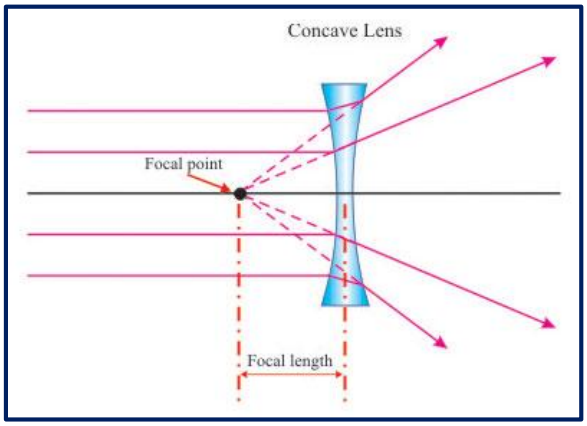

Figure 2: Concave lenses

The lenses are used in making of medical glasses to treat the vision defects

Long sight:-

A person who has a long sight vision can focus clearly on distant objects but cannot focus on near objects. This is because the eyeball is too short. Light from near objects is focused at a point behind the retina resulting in a blurred image. This defect can be corrected by wearing a convex (converging) lens.

Short sight :-

A person sees near objects clearly while distant object is formed in front of the retina
This may be caused due to elongated eyeball or excessive curvature of the cornea .
This defect can be corrected by using a concave (diverging) lens.
It's known that there is length formula used to determine the focal length of the lens:

$$\frac{1}{F} = \frac{1}{U} + \frac{1}{V}$$

which stated the relationship between the object distant (u/cm) , image distant (v/cm) and the focal length of spherical convex lens (F/cm).
Where:
U= the distance of an object from the lens
V= the distance between the lens and the image
F= the focal length of the convex lens

Apparatus :-

Convex lens , Meter scale , Source of light (lamp) ,White screen , Object , Two holders for lens and object .

Methodology:-

First obtained a rough value for the focal length of the lens by focusing the image of the window panes on the screen

1-Place the object pin between the lamp and the lens .

2-Move the lens away from the object slowly to the place where the sharpest image is formed on the screen , record the distance between the object and lens and the distance between lens and the screen .

3-Increase the distance of the object (3cm) and move the lens until the sharp image formed on the screen record the distance of object and image .

4-Repeat step 3 at least 5 times, every time you should change the position of the screen and move the lens until the formation of the sharp image.

5-Record the readings as in the table below:

Distance of object from lens U cm	**Distance of image from lens V cm**	**1/U cm^{-1}**	**1/V cm^{-1}**
. .			

6. Plot a graph of 1/U cm^{-1} against 1/V cm^{-1}

Calculation:-

From the graph the intercept of both axes represent $\frac{1}{F_1}$, $\frac{1}{F_2}$

The focal length of lens is $F = \frac{F_1+F_2}{2}$

Medical application:-

1-To diagnose and treat eye defects such as long sight and short sight.

2-To diagnose and treat the Astigmatism.

3-It is used in medical and biological devices like microscope, endoscope.