ACTIVITY NO.1
REFRACTIVE INDEX OF CONVEX LENS USING SPHEROMETER AND AUTO COLLIMATION METHOD

Aim: To determine refractive index of the material of given convex lens.

Apparatus: A spherometer, a double convex lens, a plane mirror, an index pin, a retort stand, a metre scale.

Diagram:

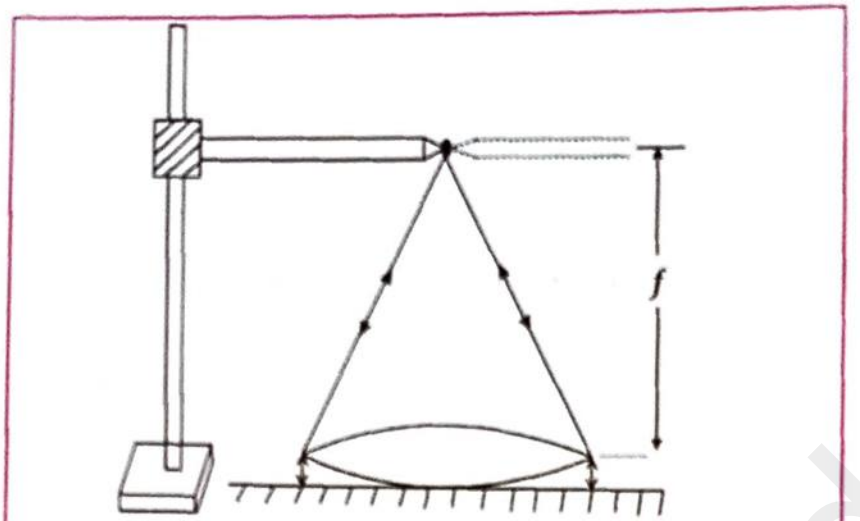

Fig. Auto Collimation

Formula: For a lens,

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

Where, f = focal length of the lens

n = Refractive index of material of the lens

R_1 and R_2 = Radii of curvature of the lens.

According to Cartesian sign convention, R_1 & f are positive and R_2 is negative for a convex lens.

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$ ...numerically.

Procedure:

1. Determine the radii of curvature R_1 & R_2 of both the surfaces of the given double convex lens. (Use the values which have been determined in spherometer experiment)
2. Keep the lens on the plane mirror.
3. Hold the pin horizontal in the retort stand holder and adjust its position so that its tip is along the principal axis of the lens.
4. Look from above the pin and adjust the position of the pin either by raising or lowering it so that it coincides with its own inverted image formed by reflection in the mirror, without parallax. (You will have to lower down the object pin if image appears thinner than the object pin and raise the object pin if the image appears thicker than the object pin). This method is called auto collimation method.
5. Record the distance of the tip of the pin from the centre of the lens. This distance is focal length of the lens f.
6. Calculate refractive index of the material of the lens.

Observations:

R_1 = ...10..... cm. R_2 = ...12..... cm. f = ..30.2..... cm.

Calculations:

$$n = 1 + \frac{(R_1 R_2)}{f(R_1 + R_2)} = 1 + \frac{(10 \times 12)}{f(10+12)} = 1 + \frac{120}{f22} = \frac{22f + 120}{22f}$$

$$= 1 + \frac{120}{30.2 \times 22} = 1 + \frac{120}{664.4} = 1 + 0.1806$$

$$\boxed{n = 1.1806}$$

Result:

Refractive index of material of the lens, n = ...

Precaution:

Use the same lens which we have used in spherometer experiment.

FOR NOTES

The sufractive indices of them concave x lenses are determined by unmeasured of them local the test lens is used as a collecting them which to determine the focal length.

Remark and sign of teacher: .....