Experiment 2

Find the Refractive Index of a Liquid by Using a Convex Lens and Plane Mirror

Aim

Find the Refractive Index of a Liquid by Using a Convex Lens and Plane Mirror

Materials Required

Convex lens, liquid, plane mirror, retort stand with clamp and pin, spherometer, meter rule

Theory

Let us consider f_1 and f_2 to be the focal length of the glass convex lens and liquid lens respectively and let F be the focal length of their combination, then

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

From the lens maker's formula

We have,

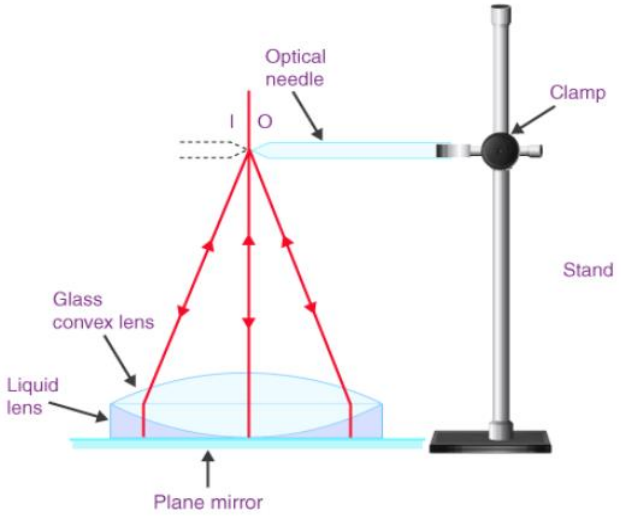
$$\frac{1}{f_2} = (n-1)[\frac{1}{R_1} - \frac{1}{R_2}]$$

Simplifying further, we get

$$\frac{1}{f_2} = \frac{(n-1)}{R}$$

Inserting values of f_2, n can be calculated.

Diagram



Procedure

1- Place the plane mirror on the horizontal base of the iron stand.
2- Place the convex lens on the plane mirror, and its focus is found by locating the position of the pin where it coincides with its own image. By measuring from this point to the lens, its focal length (f1) is found.
3- The lens is now removed, and a few drops of liquid are placed on the mirror. On placing the convex lens on the liquid, a combination of a convex (glass) and a Plano-concave (liquid) lens results.
4- The focal length (f) of the combination is found as above, and the

   focal length (f2) of the liquid lens calculated from f and f1 (equ. (1))

5- The radius of curvature (r) of the lens surface in contact with the liquid is now obtained by a spherometer , or by boys, method.
6- Calculate the refractive index of liquid from equation (2).

Calculations

$$\frac{1}{f_2} = \frac{1}{F} - \frac{1}{f_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$n = 1 + \frac{R}{f_2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Question

Q1: What is the Refractive Index of a medium?

Q2: What are the laws of reflection?

Q3: Can the refractive index of a medium be less than or equal to 1?