Refractive Index

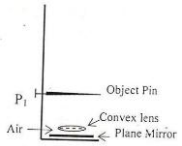
Purpose:

1. To determine the refractive index of water using a concave mirror.

Apparatus: 1. Plane mirror. 2. Stand. 3. Convex lens. 4. Water. 5. spherometer.

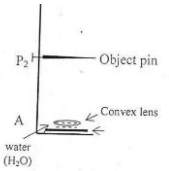
Method:

1. Place the ,plane mirror on the base of the stand and put the convex lens above the mirror. See Fig. A:



2. Measure its distance (P_1A) this value is represented focal length of glass (F_1). When we get the best image of object pin.

3. Put a drop or two drops of water between the plan mirror and the convex lens.



4. Adjust the position (AP_2) of the object pin when we get the best image of pin.

5. Measure the distance (AP_2) this value represented the focal length of complex lens (F) a combination of two lens convex and the concave lens of water.

6. By spherometer we can measure the curvature height (h).

Calculation:

F = Focal length of complex lens.

F_1 = Focal length of class lens.

F_2 = Focal length of water lens.

From the relation:

$$\frac{1}{F} = \frac{1}{F_1} + \frac{1}{F_2}$$

$$\therefore F_2 = \frac{F_1 \times F}{F_1 - F}$$

* To find the curvature radius (R) use the equation:

$$R = \frac{a^2}{6h}$$

Where:

a = The distance between spherometer legs.

h = curvature height.

* To calculate the refractive index use the relation:

$$n = 1 + \frac{R}{F_2}$$

Where: n= refractive index.

Medical Applications:

The eye has two major focusing components: the cornea, which is the clear transparent bump on the front of the eye that does about two- thirds of the focusing, and the lens, which does the fine focusing. The cornea is a fixed focus element; the lens is variable in shape and has the ability to focus objects at various distances.

The cornea focusing by bending (refracting) the light rays. The amount of bending depends on the curvatures of its surface and the speed of light in the lens compared with that in the surrounding material (relative index of refraction). The indexes of refraction of the cornea and other transparent parts of the eye are given in table (1).

Table (1): The indexes of Refraction of the cornea and other optical parts of the eye

Part of the eye	Index of refraction
Cornea	1.37
Aqueous humor	1.33
Lens cover	1.38
Lens center	1.41
Vitreous humor	1.33

When the cornea is under water it loses most of its focusing power because the index of refraction of the water (1.33) is close to that of the cornea (1.37). (Fish have a similar problem out of water). Divers keep air around the cornea by wearing a face mask. The index of refraction is nearly constant for all corneas, but the curvature varies considerably from one person to another and is responsible for most of our defective vision.