

Experiment 4

Air cell apparatus for determining the refractive index of a liquid by the critical angle method

Aim

determining the refractive index of a liquid by the critical angle method

Theory

When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal. As the angle of incidence increases, the refracted ray bends further and gets closer to the surface. If the angle of incidence angle is such that the angle of refraction makes 90° to the surface normal, then the incident angle is called the critical angle.

The **Critical angle** is defined as the angle of incidence that provides an angle of refraction of 90 degrees.



Conditions for Determination of Critical Angle

There are two necessary conditions for determining the critical angle.

1. The ray of light must be traveling from a denser medium to a rarer medium, i.e., from a medium of higher refractive index to a medium of lower refractive index.
2. The angle of refraction must be 90° so that Snell's law of refraction can be used to determine the critical angle.

Procedure

The measurement of the refractive index can be done through the air cell method, air cell **comprising wooden stand with rotatable clip, graduated scale, air cell, and glass box. This technique involves using two glass plates that have a narrow air gap between them.**

**Method:**

- The air cell is immersed in a liquid under test.
- A beam of monochromatic light is directed onto the air cell and then observed through the cell from the opposite side at **E**.
- The cell is then rotated on one side until light is suddenly cut off and the angular position **θ_1** is noted
- The cell is again rotated in the opposite direction until light is suddenly cut off and the angular position **θ_2** is noted
- The refractive index of the liquid can then be calculated from

$$n = 1/\sin\theta \quad \text{where } \theta = (\theta_1 + \theta_2)/2$$

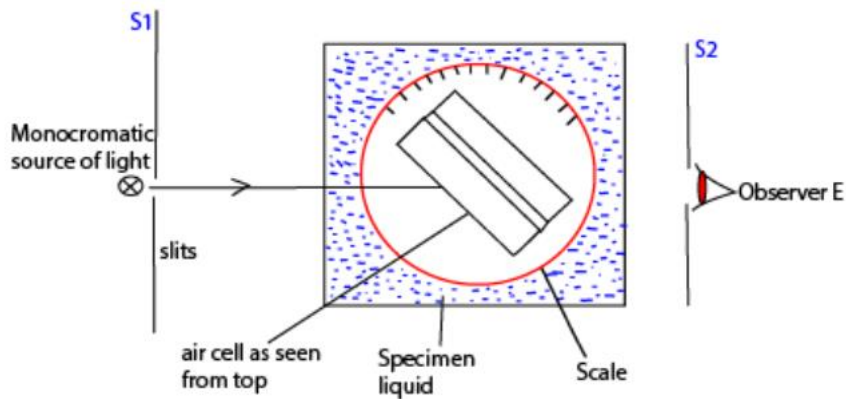


Table of Reading

θ_1	θ_2	θ_{av}	n

Question:

- 1- What the Laws of Refraction?
- 2- Defined critical angle and what conditions for determinant.