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Continued ....

(i) i = angle of incidence in medium 1

(ii) μ_1 = refractive index of medium 1 (it is a dimensionless constant)

(iii) r = angle of refraction in medium 2

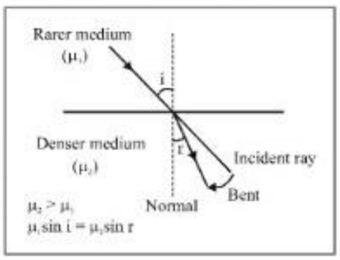
(iv) μ_2 = refractive index of medium 2

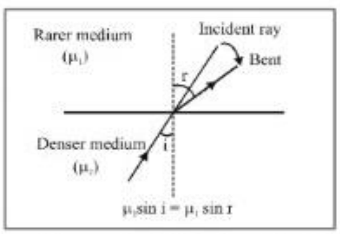
(v) If $\mu_1 = \mu_2$, then r = i. The light beam does not bend

(vi) If $\mu_1 > \mu_2$, then r > i. Refraction bends the light away from normal

(vii) If $\mu_1 < \mu_2$, then r < i. Refraction bends the light towards the normal

A medium having greater refractive index is called denser medium while the other medium is called rarer medium.





The three conditions required to find the unit vector along the refracted ray = r (provided we are given the unit vector along the incident ray = u, and the normal unit vector shown in the figure, from medium–1 towards medium–2) are

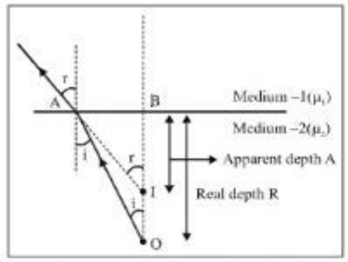
1. |r| = 1
2. Snell's law
3. u, n and r are coplanar ⇒ STP = 0 = r . (u × n)

Note

cos i = (u . n) ; cos r = (r . n)

5.3 Single Refraction from a Plane Surface Real and Apparent Depth

When an object placed in a medium is seen from another medium, its apparent position is different from the actual position. Consider the following figure.



We shall derive the expression for small angles (or you can say that the object is being seen from top). By Snell's law,

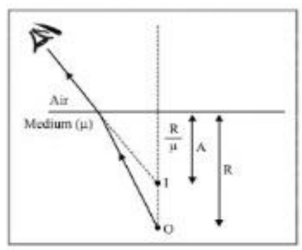
$\mu_2 \times \sin i = \mu_1 \times \sin r$ or, $\mu_2 \times i = \mu_1 \times r$

$$i = \frac{AB}{R},\ r = \frac{AB}{A} \Rightarrow \mu_2 \times \frac{AB}{R} = \mu_1 \times \frac{AB}{A} \Rightarrow \boxed{\frac{\mu_2}{R} = \frac{\mu_1}{A}}$$

The following possibilities may arise.

(i) When observer is in air and the object is in a medium of refractive index μ.

You have, $\frac{\mu}{R} = \frac{1}{A} \Rightarrow A = \frac{R}{\mu}$



(ii) When observer is in a medium of refractive index μ and the object is in air, you have

$$\frac{1}{R} = \frac{\mu}{A} \Rightarrow A = \mu R$$