Refractive Index.

→ Light passes more slowly through a Substance than through a vacuum.

→ If light passes through a denser substance, speed of light is reduced & shorter wavelength.

→ Refraction: Light enters the denser substance at an angle, one part of the wave slows down more quicly as it passes the interface, and this produces a bending of the wave toward the interface. This phenomenon is called as refraction.

→ If light enters a less dense substance, it is refracted away from the interface rather than toward it.

→ The relative value of this effect bet^{n} 2 substances is given by refractive index, n

$$n = \frac{\sin i}{\sin r}.$$

$$n = \frac{\text{velocity of Light in } 1^{st} \text{ Substance (Air/vacuum)}}{\text{Velocity of Light in Second substance (material)}}.$$

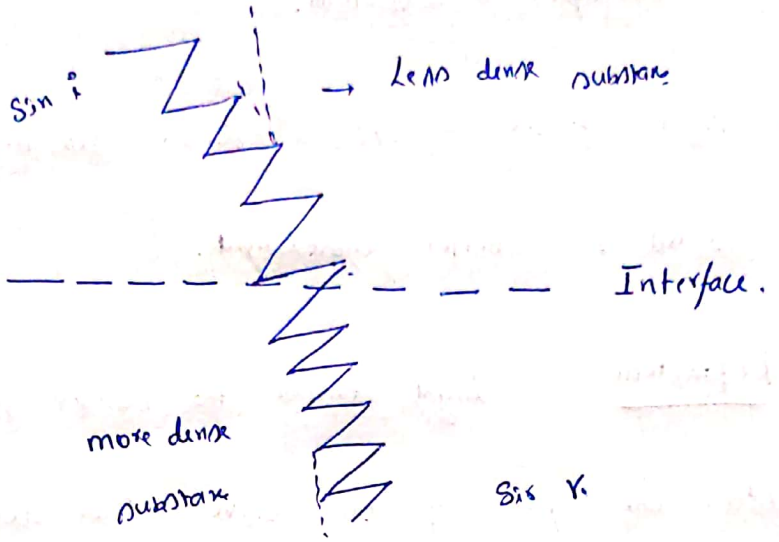
i → Angle of Incident ray of Light.

r → " " refracted ray of Light.

→ $n > 1$, $\rho_{material} > \rho_{Air}$.

→ Reference sample ($n = 1$); Air (or) Vacuum. ($n = 1$)

(0.03% difference)



→ n value varies ∝ λ, Temp.

eg: n_D^{20} → ref. Index using the D-line emission of Sodium at 589 nm. (λ).

At temp 20°c.

→ Pressure should be const.

App:

→ Identification of substance.

→ To measure its purity.

→ To determine the concentration of one substance dissolved in another.

Instrument: Abbe's Refractometer.

→ Molar Refraction, R_m → It is related to both the refractive index & the molecular properties of a compound being tested.

$$R_m = \frac{n^2 - 1}{n^2 + 2} \left(\frac{M}{\rho}\right).$$

→ M → mol.wt ; ρ → density of the compound.

R_m → used to predicted from the structural features of the molecule.

→ In a compound → Each constituent atom (or) group contributes a specific value.

Ex: Acetone. $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$.

3 - carbons → 7.254.

6 - Hydrogens → 6.6.

Carbonyl oxygen → 2.21.

Total R_m = 16.1 cm^3/mol. (Additive property).

→ R_m value is distinguish bet" structurally diff". compounds such as Keto & Enol tautomers.

→ Light Incident upon a molecule induces vibrating dipoles, and the greater the refractive index at a particular wavelength, the greater is the dipolar induction.

→ The Interaction of light photons & polarizable electrons of a dielectric causes a reduction in the velocity of light.

→ polarization of light ∝ D.E.

→ The ref. index for light of long wavelength, n_∞, is related to D.E. of non-polar molecule.

$$\epsilon = n_\infty^2.$$

→ molar polarization $P_\lambda \cong$ molar refraction R_m.

$$P_i = \left(\frac{n_\infty^2 - 1}{n_\infty^2 + 2}\right)\frac{M}{\rho} = \frac{4}{3}\pi \cdot N\alpha_p.$$

α_p → polarizability of non-polar molecule.