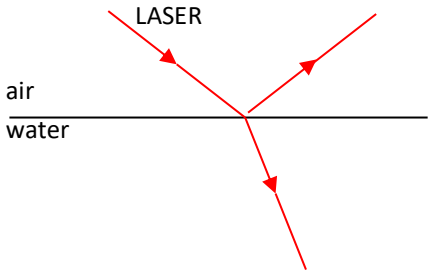
Refraction of light

Light crossing borders



Note: ***L****ight* ***A****mplified by* ***S****timulated* ***E****mission of* ***R****adiation*

At the interface between 2 media, a light beam splits. One part is reflected, while the other crosses the separating surface and changes direction. This is known as refraction of the light beam:

<u>Refraction</u> is the change in direction that a light ray undergoes when it crosses the surface separating 2 transparent media with different refractive indices.

Refraction index

For radiation of a given wavelength λ, any transparent, homogeneous medium is characterized by a unitless number called the refractive index n.

$$n = \frac{c}{v}$$

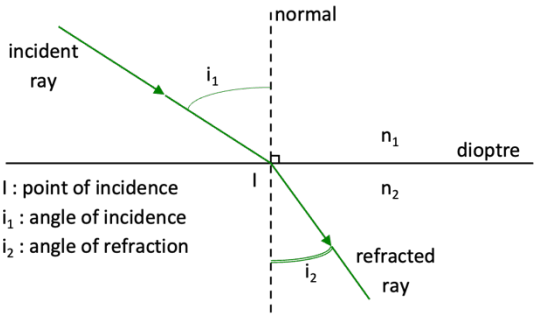
with c the celerity of light (speed of light in vacuum, c = 3.00x10^8 m.s^{-1}) and v the speed of light in the medium travelled in.

Ex: $\lambda = 590$ *nm (Reference)* $n_{air} = 1$; $n_{water} = 1.33$

Note: *n is always greater than 1*

Laws of refraction

1. VOCABULARY



2. SNELL'S FIRST LAW FOR REFRACTION

The incident and refracted rays propagate in the same plane, called the plane of incidence.

3. SNELL'S SECOND LAW FOR REFRACTION

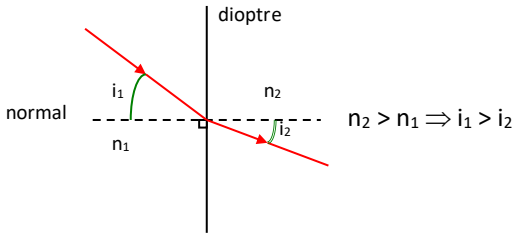
$$n_1 \sin i_1 = n_2 \sin i_2$$

4. SOME NOTES.

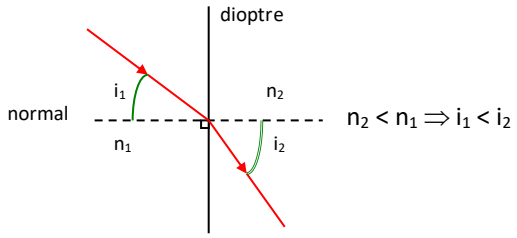
(i) Incident and refracted rays always lie on opposite sides of the normal.

(ii) An incident beam arriving at right angles to the dioptre is not deflected.

(iii) If $n_1 < n_2$, the ray « comes closer » to the normal after having crossed the dioptre.



(iv) If $n_1 > n_2$, the ray « moves away » of the normal after having crossed the dioptre.



When the angle of incidence become too important, the refracted ray doesn't exist anymore: there is total reflection.

The smallest angle of incidence for which the refracted ray disappears can be determined:

$$i_{1_{lim}} = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

5. REFRACTION AND PRISM.

The entrance face of the prism causes a 1st deflection of the incident light. Radiation is separated a 1st time. As the light passes through the exit face, it is deflected again.