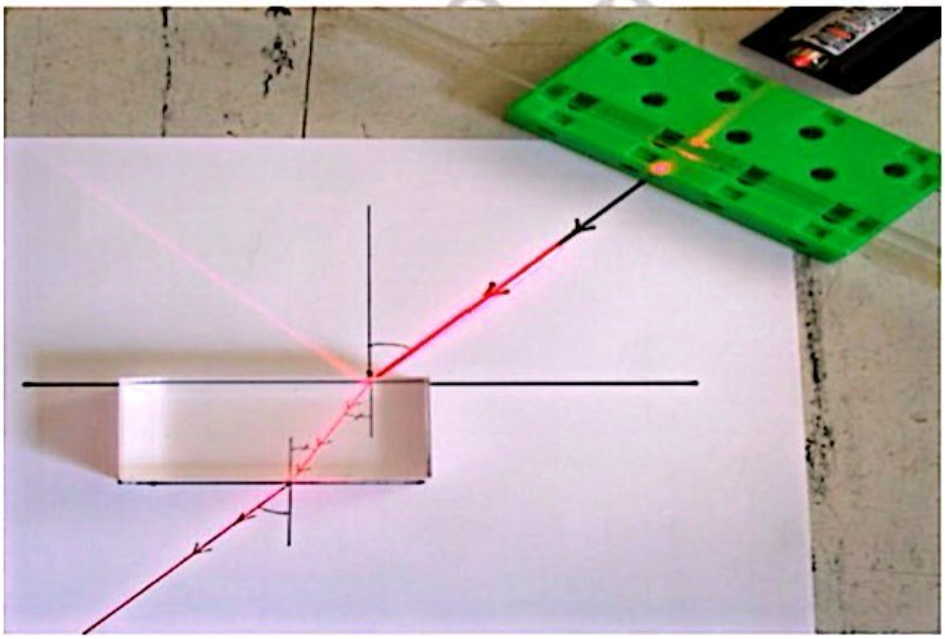
Medical physics laboratory

2nd semester

EXPERIMENT

Studying The Reflection & Refraction using Laser Beam (glass)



Studying The Reflection & Refraction using Laser Beam (glass)

Purpose:

1- Applying and realizing Snell's law and recognizing the phenomenon of refraction.

2- Measurement of the refractive index of glass

Apparatus:

1. Transparent body- glass .
2. Angle measuring device.
3. Wires to connect the laser.
4. Laser.
5. A circular wooden base where the corners are written on it.

Theory:

When light travelling through air encounters a different material, part of the light energy is reflected back into the air and part of it is transmitted into the glass, experiencing an abrupt change in direction at the glass surface (Figure 1). This change in direction of the transmitted light is refraction. Directions of the light rays are specified with respect to a line drawn normal to the glass surface (called the normal line). Figure 1 shows an incident light ray, and the resulting reflected and refracted rays.

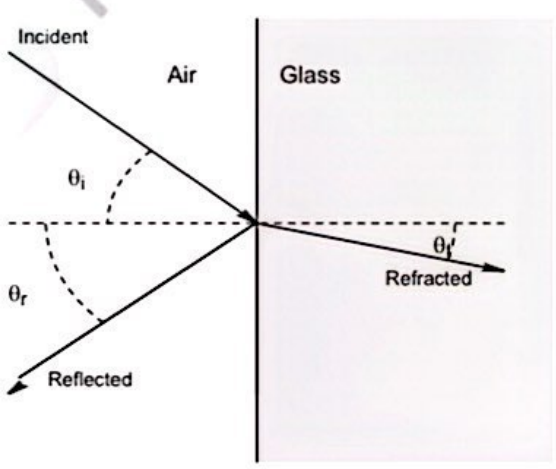


Figure 1

Here, θ_i is the angle of incidence, θ_r is the angle of reflection, and θ_t is the angle of refraction. Note that all angles are measured from the normal line.

Law of reflection. The law of reflection states the angle of incidence is equal to the angle of reflection. Thus

Law of refraction.

- The law of reflection states that: (i) the angle of incidence equals the angle of reflection; (ii) the reflected ray is on the opposite side of the normal from the incident ray; (iii) the incident ray, surface normal, and reflected ray all lie in the same plane.
- The law of refraction states that: (i) the sine of the angle of incidence and the the sine of the angle of refraction are in constant ratio to each other; (ii) the refracted ray lies on the opposite side of the normal from the incident

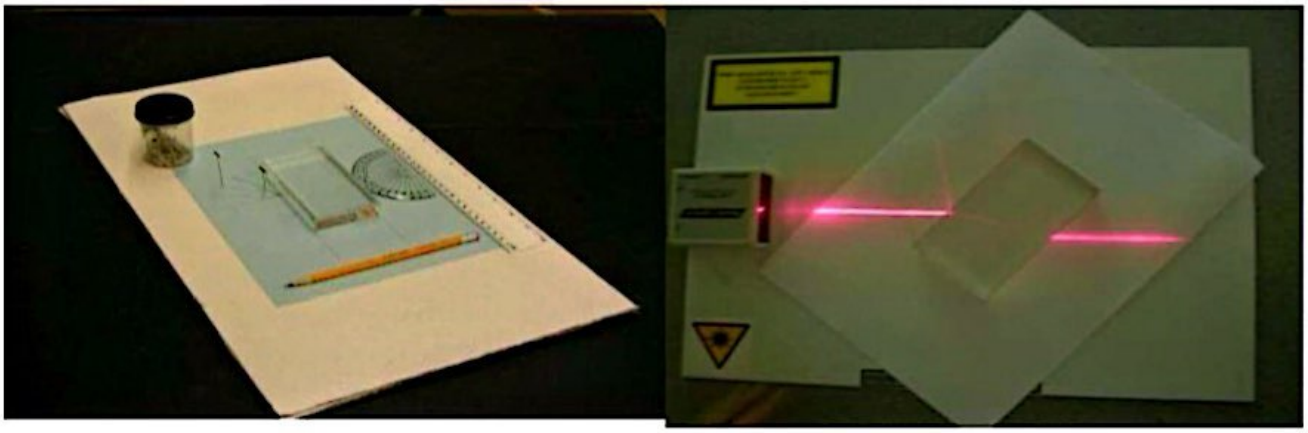
Snell's law relates the angle of incidence to the angle of refraction. Snell's law is stated as

$$n_1 \sin\theta_i = n_2 \sin\theta_2$$
or
$$n_1 \sin\theta_i = n_2 \sin\theta_t$$

Here, n_1 and n_2 refer to the indices of refraction of the two materials or in other words their optical densities. The index of refraction in air is

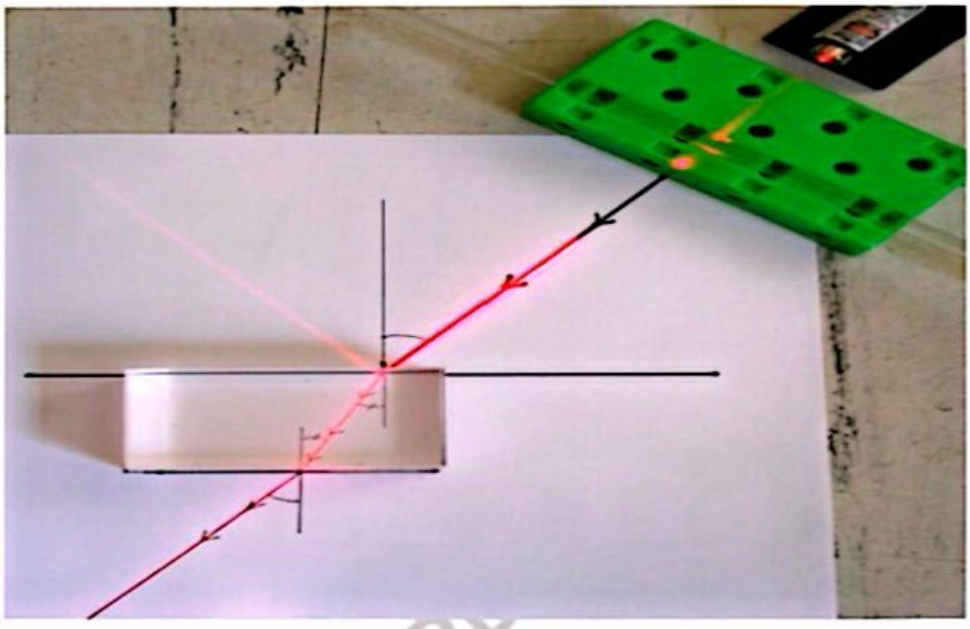
$$n_{air} = 1.00.$$

In this lab your light will start in air so you will know n_1. During the lab you will attempt to measure the angles (θ_i and θ_t) and use these to determine the index of refraction of the given material (n_2).



Experimental Details:-

If we put the transparent body - the glass body on the wooden goniometer so that the base of the glass body was on the base of the wooden device and also the yellow line was perpendicular to the surface (i.e. the surface of the cylinder) and then I turned on / projected the laser (beam) where there were degrees of light For every light there was a number, so I used light No. 4 and we observed the ray. The angle at which the ray falls is the angle of incidence, and when it is refracted, it indicates the angle of refraction. When measuring, I recorded the angles in a table.



Readings & Results:

The table in which the angles are recorded:-

Angle of incidence θ_1	the angle of refraction θ_2	the index of refraction n_2
Average n_2 =		

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

where:

n_1=n_{air} = 1.00.

Discussion: -

1- Total internal reflection observed at angle: _____

2- Calculated critical angle: ___

3- What is the medical applications of this experiment ?