Refractive index

Objective:

The objective of this experiment is to use Snell's law to determine the index of refraction.

Theory

While the speed of light is constant in a vacuum, the speed of light in air and in transparent solids is somewhat less. The ratio of the speed of light in a vacuum (c) to the speed of light in a solid (v) is called the index of refraction (n) of the solid

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

- **_n_** is the index of refraction
- **_c_** is the speed of light in a vacuum
- **_v_** is the speed of light in the media (e.g. water, olive oil, etc.)

When a beam of light travels between substances with different indices of refraction such as from air (n = 1.00026) into glass (n = 1.52), the change in wave velocity which occurs is accompanied by a change in the direction of the beam. This is the principle of refraction.
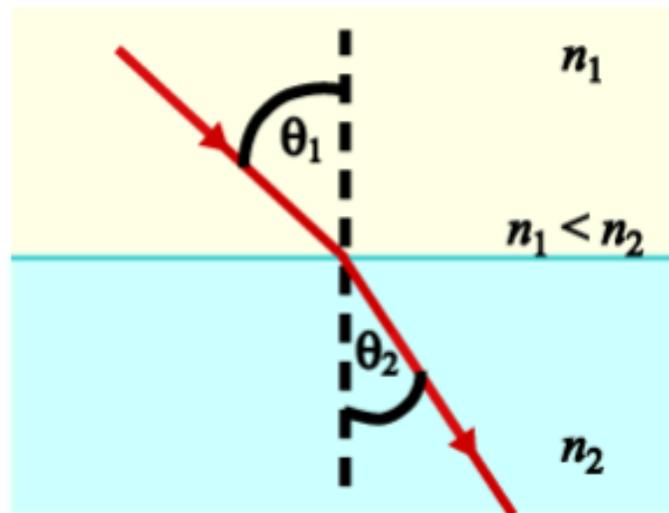
The law of refraction or Snell's law describes the amount of refraction which will take place. This law states that the index of refraction of the incident medium multiplied by the sine of the incident angle is equal to the index of refraction of the refracting medium multiplied by the sine of the refracted angle.

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

The sine of an angle θ for a right triangle is defined as the ratio of the length of the side opposite to the angle and the length of the hypotenuse.
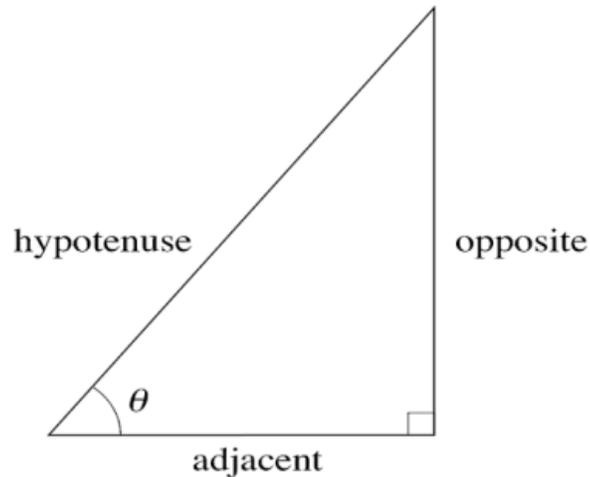
For θ the sine of is defined as follows:

$$Sin\theta = \frac{opposite}{hypotenuse}$$

We will be measuring the angles of incidence and refraction and substituting into Snell's law to solve for the index of refraction of glass.

Refraction: When light travels from one medium to another, it generally bends, this bending is called refraction.

Snell's law: The law of refraction is also known as Snell's law, Snell's law gives the relationship between angles of incidence and angle of refraction.

Laws of refraction of light

1. The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

2. The ratio of sine of angle of incidence to the sine of angle of refraction is a constant. This law is also known as Snell's law of refraction.

Important Notes

1- The speed of light in a vacuum is 3×10^8 m/s.

2- When light travels through something else, such as glass, water or oil it travels at a different speed.

3- The ability of a medium to refract light is also expressed in terms of its optical density.

4-The medium with larger refractive index is optically denser medium than the medium with comparatively smaller refractive index.

5- The speed of light is higher in a less dense medium than in a denser medium.

Rules of refraction:

Rule 1: When a light ray travels from a rarer medium to a denser medium, the light ray bends towards the normal.

Rule 2: When a light ray travels from a denser medium to a rarer medium, the light ray bends away from the normal.

H.W

What units does the index of refraction have? Why?