SNC2D PHYSICS

LIGHT & GEOMETRIC OPTICS
☞ Snell's Law
(P.441-442)

Snell's Law

Refraction as a phenomenon had been observed for centuries, but it was not until 1621 that its cause was stated mathematically. Willebrord Snell, a Dutch astronomer and mathematician, was credited with identifying the exact relationship between the index of refraction (n), the angle of incidence (i) and the angle of refraction (R).

$$n = \frac{\sin i}{\sin R}$$

normal

θ_1

interface n_1
             n_2

θ_2

May 19, 2013   2DPHYS - Snell's Law   1

Snell's Law

However, this formula was restrictive in that it only worked when light was travelling from air (or a vacuum) into another substance – it did not work when light travelled from a substance into air. With further study a more general formula was discovered.

RECALL!
The angles of the incident and refracted light rays are always measured from the normal.

normal

θ_1

interface n_1
             n_2

θ_2

May 19, 2013   2DPHYS - Snell's Law   2

Snell's Law

Snell's law *is a formula that uses values for the index of refraction to calculate the new angle that a ray will take as a beam of light strikes the interface between two media. If you call the indices of refraction of the two media n_1 and n_2 and call the angles of incidence and the angle of refraction θ_1 and θ_2 then the formula for Snell's law is:*

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

NOTE!

θ is a Greek symbol used in science and math to represent an unknown angle.

May 19, 2013   2DPHYS - Snell's Law   3

Snell's Law

SNELL'S LAW

$$\boxed{n_1 \sin \theta_1 = n_2 \sin \theta_2}$$

where n_1 is the index of refraction for the 1st medium

n_2 is the index of refraction for the 2nd medium

θ_1 is the angle of incidence (i) in the 1st medium

θ_2 is the angle of refraction (R) in the 2nd medium

May 19, 2013   2DPHYS - Snell's Law   4

✔ Check Your Learning

1. In an experiment, a block of cubic zirconia is placed in water. A laser beam is passed from the water (n = 1.33) through the cubic zirconia. The angle of incidence is 50°, and the angle of refraction is 27°. What is the index of refraction of cubic zirconia? (Be sure to use GRESS when answering these questions.)

$n_{cubic} = n_2 = 2.24$

May 19, 2013   2DPHYS - Snell's Law   5

✔ Check Your Learning

2. When light passes from air (n = 1.00) into water (n = 1.33) at an angle of incidence of 60°, what is the angle of refraction?

   R = θ_2 = 41°

✔ Check Your Learning

TEXTBOOK
P.441   Q.1-3
P.442   Q.1-3

NOTE!
- You may need to refer to Table 11.5/P.437 to find "n" values.
- Answers (P.441)   ☞   22°, 23°, 36°
  (P.442)   ☞   1.50, 1.90, 1.48