STAGE 1 PHYSICS

Snell's Law: Refraction of Light

Introduction

Refraction describes the bending of a light wave as it travels across the boundary separating two media. This phenomenon is caused by the change in the speed of the wave as it enters another medium (The Physics Classroom, 2018). The change in medium affects a wave as each type of wave has a fixed velocity in any given medium, and thus the velocity of a wave will change as it moves across an interface from one medium into another. The angle and wavelength at which the light enters a substance and the density of that substance, determines the degree to which the light is refracted. The refraction of light by atmospheric particles can create a variety of optical effects such as halos (produced as sunlight or moonlight) which are refracted by the ice crystals of cirrostratus clouds.

When a light ray passes from a less dense to a denser substance such as air to water, the light bends toward the normal. This normal refers to a line that is perpendicular to the boundary between the two substances. This bending occurs as the speed of light decreases in water due to its density.

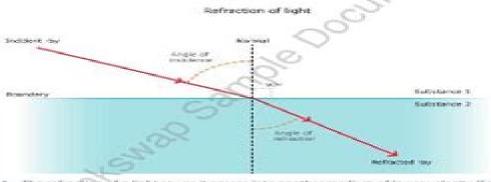


Figure 1 – The refraction of a light ray as it passes into another medium of lower velocity (Science Learning Hub., 2012).

With a light ray that passes from a denser to a less dense substance like water to air, the refracted light is bent away from the normal.

In 1621, the relationship between speed, wavelength and angles of incidence and refraction was determined experimentally by Dutch mathematician and physicist Willebrord Snell (Encyclopedia Britannica, 2018). This relationship is known as Snell's Law and can be mathematically expressed as: $n_1 \sin \theta_1 = n_2 \sin \theta_2$.

Where, $n_1 and n_2$ are the refractive indices of the two media

Where, 0, is the angle of incidence

Where, θ_{τ} is the angle of refraction

Snell's law refers to the relationship between the angle of incidence and the angle of refraction when light travels from one medium to another medium of different optical density.

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