

Additional Material – Bending Light

Refraction of Light

A ray of light changes its direction when it enters a medium. This happens because speed of light is different in different media.

For example, the speed of light is 2.99×10^8 m/s in vacuum and it is 2.98×10^8 m/s in air.

The angle between incident ray and normal is called **Angle of Incidence** and it is denoted as 'i'. The angle between refracted ray and normal is called the **Angle of Refraction**.

Angle of refraction is denoted by 'r'.

Refractive Index is the extent of change in direction of light in a given pair of media.

Speed of light in medium 1 is v_1 and in medium 2 it is v_2 .

Therefore, refractive index of medium 2 with respect to medium 1 (n_{21})

$$n_{21} = \text{Speed of light in medium 1} / \text{Speed of light in medium 2}$$

Laws of Refraction

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

2. The ratio of sine of angle of incidence and sine of angle of refraction is always constant for the light of given colour and for the pair of given media.

Second Law of Refraction is also known as **Snell's Law of Refraction**.

$$n = \sin i / \sin r$$

This constant 'n' is called refractive index of the second medium with respect to the first medium.

Refractive indices for yellow light (wavelength equal to 589 nanometres) of air, water and glass are 1.0003, 1.333 and 1.52 respectively.

Optical Density

Medium having greater value of refractive index is called optically denser medium.

Light will travel at less speed in optically denser medium (water or glass) compared to in an optically rarer medium (vacuum or air).