9.7 Some Natural Phenomena due to Sunlight

The Interplay of light with things around us gives rise to several beautiful phenomena. The spectacles of colours that we see around us all the time is possible due to sunlight.

While studying dispersion of visible (or white) light by a prism (Class X) and the electromagnetic spectrum (Chapter 8, Class XII), we got to know that colour is associated with the frequency of light or the wavelength of light in the given medium. In the visible spectrum, red light is at the long wavelength end (~700 nm) while the violet light is at the short wavelength end (~ 400 nm). Dispersion takes place because the refractive index of medium for different frequencies (colours) is different. For example, the bending of red component of white light is least while it is most for the violet. Equivalently, red light travels faster than violet light in a glass prism. Table 9.2 gives the refractive indices for different wavelength for crown glass and flint glass. Thick lenses could be assumed as made of many prisms, therefore, thick lenses show *chromatic aberration* due to dispersion of light. When white light passes through thick lenses, red and blue colours focus at different points. This phenomenon is known as *chromatic aberration*.

Table 9.2 Refractive indices for different wavelengths

Colour	Wavelength (nm)	Crown glass	Flint glass
Violet	396.9	1.533	1.663
Blue	486.1	1.523	1.639
Yellow	589.3	1.517	1.627
Red	656.3	1.515	1.622

The variation of refractive index with wavelength may be more pronounced in some media than the other. In vacuum, of course, the speed of light is independent of wavelength. Thus, vacuum (or air approximately) is a non-dispersive medium in which all colours travel with the same speed. This also follows from the fact that sunlight reaches us in the form of white light and not as its components. On the other hand, glass is a dispersive medium.

The blue of the sky, white clouds, the red-hue at sunrise and sunset, the rainbow, the brilliant colours of some pearls, shells, and wings of birds, are just a few of the natural wonders we are used to. We describe some of them here from the point of view of physics.