TENDER HEART HIGH SCHOOL, SECTOR-33'B, CHD.
SUBJECT - PHYSICS CLASS - IX
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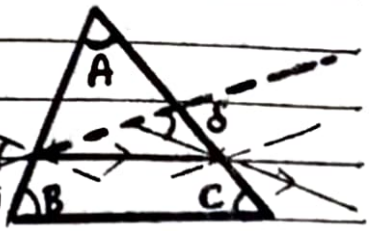
CHAPTER - 6 (SPECTRUM)

Before starting this chapter, students are advised to go through chapter-4 (especially 4(a) and 4(b)).

As we have already defined $\angle\delta$ in chapter-4, it was also stated that $\angle\delta$ depends on the following factors:



i) $\angle\delta$ depends on $\angle i$ (as done in Chapter-4)
ii) $\angle\delta$ is directly proportional to angle of prism(A).
iii) $\angle\delta$ is directly proportional to refractive index of the prism. iv) $\angle\delta$ is inversally proportional to colour (or wavelength, λ) of the light.

* VELOCITY of electromagnetic wave in air is same for different wavelengths ie. A light of red colour and a light of green colour will travel with same velocity in air (ie. with 3×10^8 m/s).

When light of different colours enter a medium, then the speed of light decreases with the decrease in wavelength and the emergent ray will be also of different colours. The deviation produced will be more by a light of least wavelength (because R.I. of glass increases with decrease in wavelength).

Constituents of white light — VIOLET, INDIGO, BLUE, GREEN, YELLOW, ORANGE, RED

from 4000 Å to 8000 Å ($1Å = 10^{-10}$ m, done in class IX.)

(Also known as VIBGYOR)

NOTE → Wavelength is the characteristic of colour, irrespective of its origin i.e., the light of the same colour obtained from different sources will have same wavelength. For example - red light coming out from a fire cracker

will have same wavelength as that of red light coming out of an electric bulb. Thus, colour is the subjective property of light related to its wavelength (λ).

DISPERSION OF WHITE LIGHT & FORMATION OF SPECTRUM.

When Sir Isaac Newton, while studying the image of a heavenly body formed due to refraction of white light by a lens, found that image was coloured at its images. After observing and repeating the experiment, he experimented further for a undiscovered nature of white light then. He allowed the white light from sun to enter a dark room through a small aperture (opening) in a window and placed a glass prism in the path of light rays and he observed the emerged light on a white screen. He observed a pattern of seven colours (ie. seven wavelengths).

SPLITTING OF WHITE LIGHT BY A PRISM INTO ITS CONSTITUENT COLOURS is known as DISPERSION.

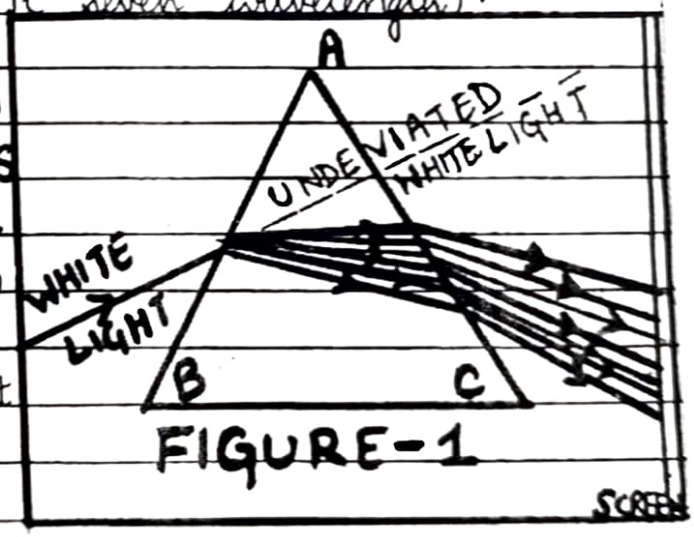


FIGURE-1

Note: Dispersion is occurring on the face AB only but refraction (ie. bending of light when medium is changed) is occuring on both faces - AB and AC, as shown in figure-1.

SPECTRUM: On passing white light through a prism, the band of colours seen on a screen is called the spectrum.

Formation of Rainbow is an example of dispersion where tiny rain droplets acts as a prism. These slowly falling rain droplets allows the light of

sun to incident on the face which is towards the sun and thus the light splitted into its constituent colours can be seen through the face opposite to the sun.

CAUSE OF DISPERSION OF WHITE LIGHT

The cause of dispersion of white light is the change in speed of light with change in wavelength. When white light enters the first surface of a prism, light of different colours will experience different angle of deviation ($\because \angle\delta \propto 1/\lambda$) That is, red colour having maximum wavelength among (V, I, B, G, Y, O, R) so it will have least angle of deviation. Thus, as seen in Figure-1, red coloured light is the closest among others to the undeviated white light. Thus, violet is the most deviated (as it has least wavelength) and red light is the least deviated.

NOTE→ At first surface AB both dispersion and refraction takes place and at surface AC only refraction takes place. Thus, the refracted colours at AB gets further separated on refraction at the second surface AC. Also as studied in Chapter-4, velocity (v), frequency (ν) and wavelength (λ) are related as $\boxed{v = \nu\lambda}$

Parents are requested to make their children try to answer questions of Exercise – 6(A). Further those answers can be checked and rectified by going through the solutions of Exercise – 6(A) which will be provided later.

SUMMARY → $\angle\delta$ decreases with increase in wavelength (i.e as $\lambda_{red} > \lambda_{violet}$, which means $\angle\delta_{violet} > \angle\delta_{red}$) and speed of light in free space (or air) for all colours is same (3×10^8 m/s).