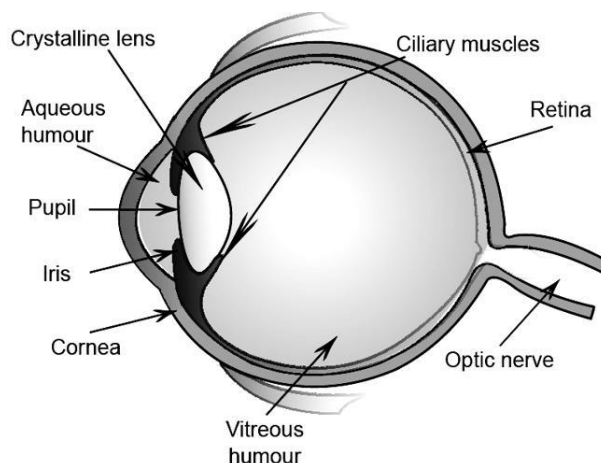


HUMAN EYE AND THE COLOURFUL WORLD

Table 9.1 Functions of the Parts of the Eye

Part	Function
Sclera	Protects and supports eyeball
Cornea	Refracts light rays
Pupil	Admits light
Choroid	Absorbs stray light
Ciliary body	Holds lens in place, accommodation
Iris	Regulates light entrance
Retina	Contains sensory receptors for sight
Rods	Make black-and-white vision possible
Cones	Make color vision possible
Fovea centralis	Makes acute vision possible
Other	
Lens	Refracts and focuses light rays
Humors	Transmit light rays and support eyeball
Optic nerve	Transmits impulse to brain



Far point : The maximum distance at which object can be seen clearly is far point of the eye. For a normal adult eye, its value is infinity.

Near point or Least distance of distinct vision:

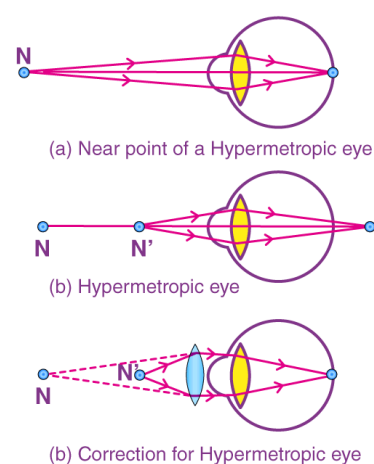
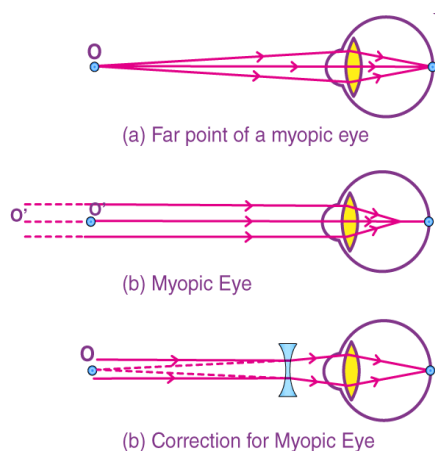
The minimum distance at which objects can be seen most distinctively without strain.

- For a normal adult eye, its value is 25 cm.
- Range of human vision – 25 cm to infinity.

Accommodation : The ability of the eye lens to adjust its focal length is called accommodation. Focal length can be changed with the help of ciliary muscles.

DEFECTS OF VISION

	Myopia	Hypermetropia
Clearly visible	Nearby objects	distant objects
not clearly visible	distant objects	Nearby objects
Also called	Short sightedness	Far sightedness
Cause	Larger eyeball or too thick eye lens	Smaller eyeball or loose of elasticity of ciliary muscles
Power of eye	Larger	Smaller
Far point	Less than ∞	∞
Near point	25 cm	More than 25 cm
Remedy	–ve power lens (convexo concave)	+ve power lens (concavo convex)



Presbyopia (Old age Hypermetropia)

It is the defect of vision due to which an old person cannot see the nearby objects clearly due to loss of power of accommodation of the eye.

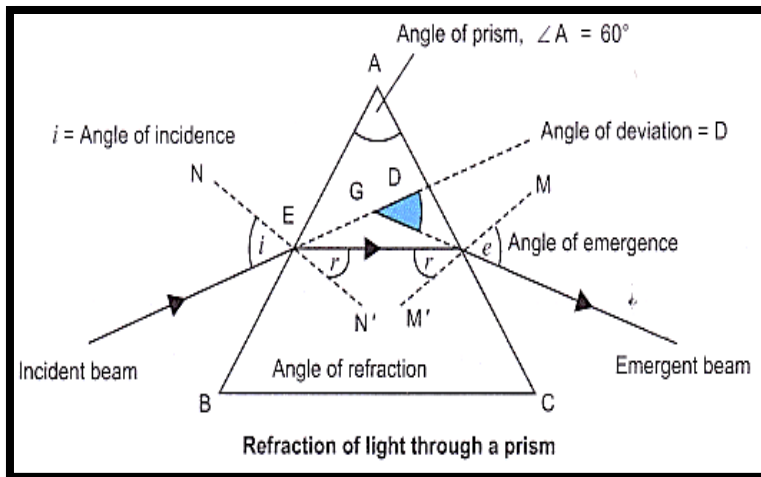
- The near-point of the old person having presbyopia gradually recedes and becomes much more than 25 cm away.

Causes

- Gradual weakening of ciliary muscles.
- Diminishing flexibility of eye lens.

Correction

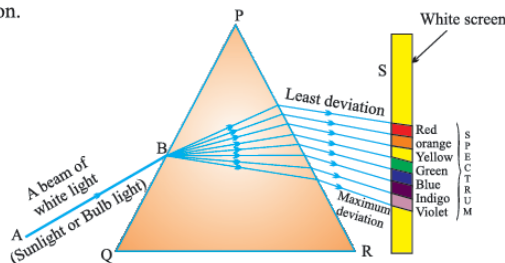
- Use of both concave and convex lens of suitable power.
- Sometimes a person may suffer from both myopia and hypermetropia.
- Such people require bifocal lens for correction.



Refraction of light through a prism

Dispersion of Light by Glass Prism

When white light is passed through a glass prism, it splits into its seven constituent colours to form a band of seven colours. This phenomenon is called dispersion.



Spectrum : The band of seven colours formed due to dispersion of white light is called spectrum.

Acronym : It is a group of alphabets that represent sequential colours in spectrum.

VIBGYOR

$$\text{Angle of deviation} \propto \frac{1}{\text{wavelength}}$$

- Red is the **least deviated** colour as it has largest/longest wavelength.
- Violet is the **most deviated** colour as it has smallest wavelength in visible spectrum.

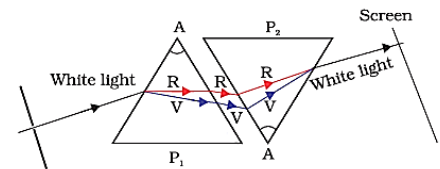
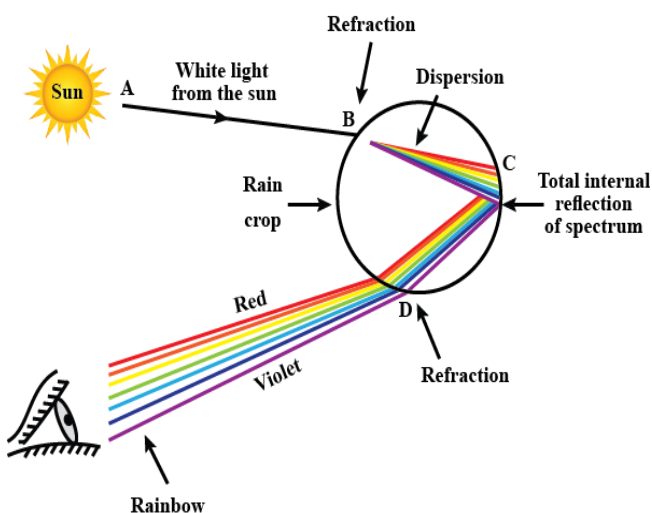
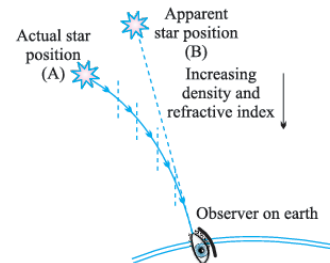


Figure 10.6 Recombination of the spectrum of white light

(ii) Stars when seen near the horizon appear slightly higher than their actual position due to atmospheric refraction.



The refractive index of earth's atmosphere in general increases from top to bottom. So, the light coming from a star near the horizon has to travel from rarer to denser medium and it bends towards the normal. As a result the star appears higher.

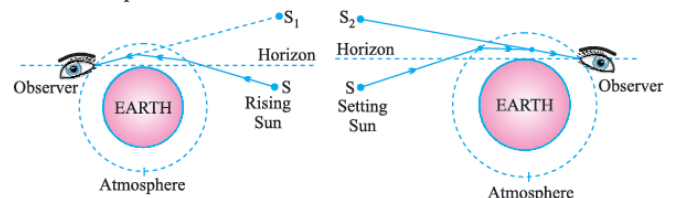
The air above hot surface becomes hot and rises. The space is occupied by cool air. The refractive index of hot air is less than that of cool air. So, the physical condition of the medium are not constant. Due to changing Refractive Index (RI) of medium, the light appears to come from different directions.

It results in fluctuation in apparent position of object.

(iii) Advanced sunrise

The sun appears about two minutes earlier than actual sunrise and the sun remains visible for about two minutes after actual sunset.

When the sun is below horizon, the rays have to pass from rarer to denser medium. So rays bend towards the normal. As a result the sun appears higher than its actual position.



(iv) Twinkling of stars

Stars are very far from us, so they behave as point source of light. Since the physical conditions of the earth's atmosphere are not constant the light from stars appears to come from different directions. This results in fluctuation of apparent position of star.

The amount of light coming from stars also vary due to changing Refractive Index of atmosphere.

The star appears bright when more light from star reaches our eyes and the same star appears dull when less amount of light reaches our eyes.

Both these effects are responsible for twinkling of stars.

- A rainbow is a natural spectrum appearing in the sky after a rain shower in direction opposite to sun due to dispersion of sunlight by tiny droplets of water in atmosphere.
- The water droplets act like small prisms.
- They refract and disperse the incident sunlight, **then reflect it internally, and finally, refract** it again when it comes out of the raindrop.
- Due to the dispersion of light and internal reflection, different colours reach the observer's eye.