



## The Human Eye

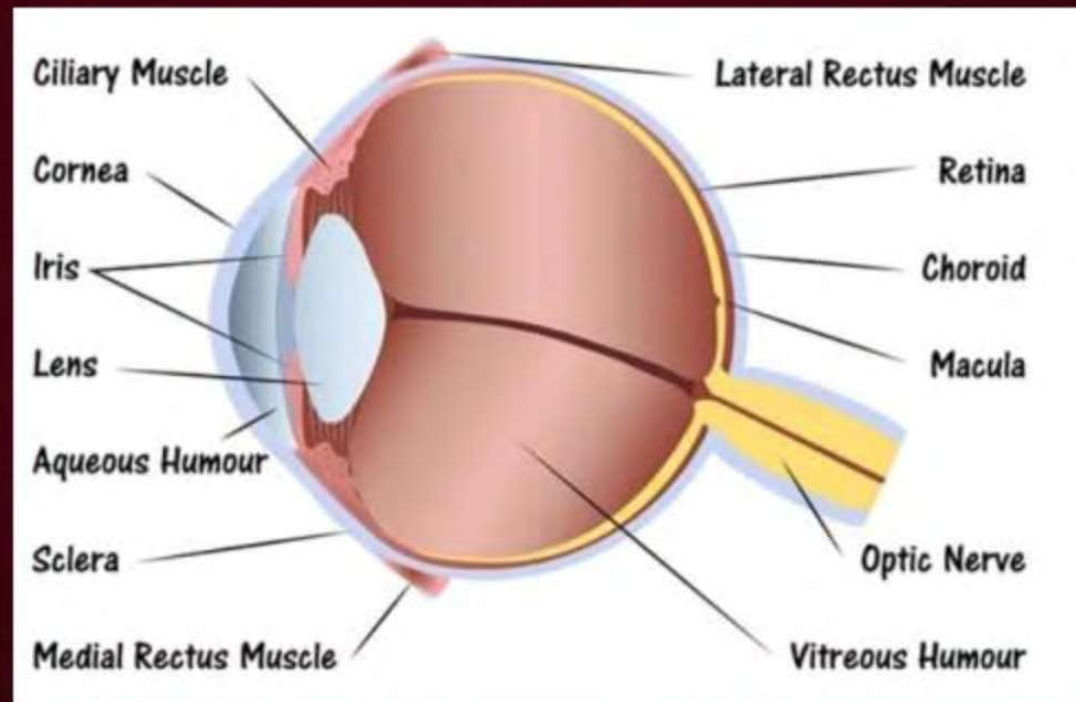


- ❑ The human eye is one of the most valuable and sensitive sense organs.
- ❑ It enables us to see the wonderful world and the colours around us.





## The Human Eye





## The Human Eye



### Lens

It is a transparent lens made of jelly like materials.

### Aqueous humour

The back surface of the eye.

### Pupil

The small hole in the iris.

### Iris

The colored diaphragm between the cornea and lens.

### Cornea

The transparent spherical membrane covering the front of the eye.



## The Human Eye



### Ciliary muscles

These muscles hold the lens in position.

### Vitreous humour

The space between eye lens and retina is filled with another liquid.

### Retina

The back surface of the eye.

### Optic nerves

The nerve that carries messages from the retina to the brain.





## Power of Accommodation



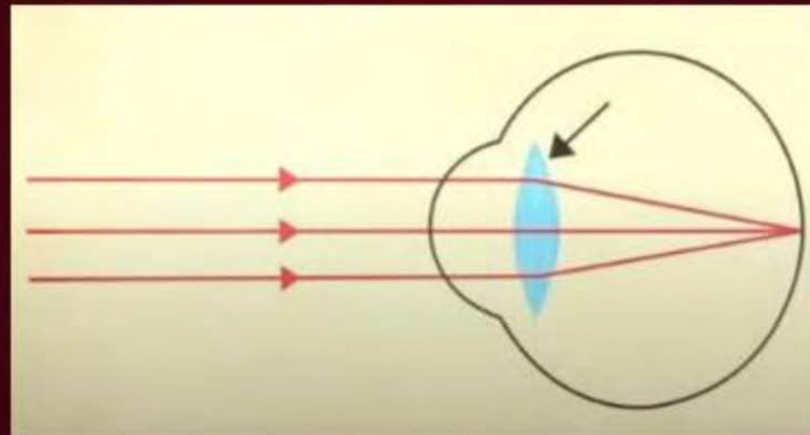
$$P \propto \frac{1}{f}$$

↓                      ↑

- ❑ The ability of the eye lens to adjust its focal length.
- ❑ When muscles are **relaxed**, the lens becomes thin. Its focal length increases, this enables us to see distant objects clearly.
- ❑ When muscles **contract**, the lens becomes thick, its focal length decreases, this enables us to see nearby objects clearly.

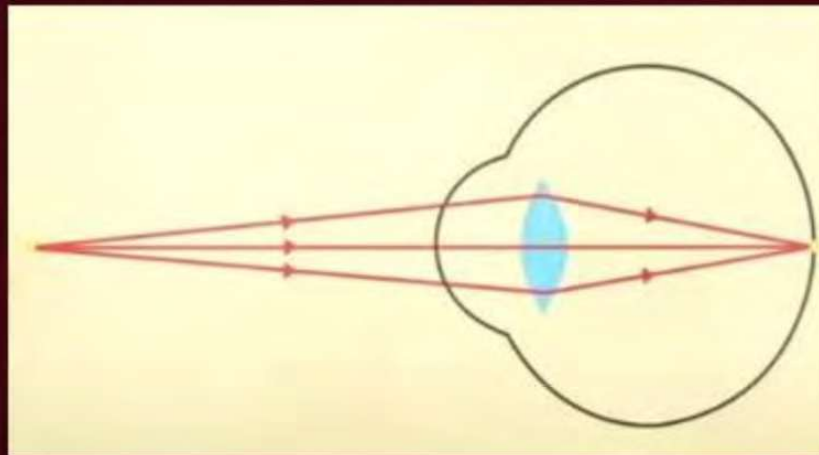
## Far Point

- ❑ The farthest point up to which a short sighted eye can see clearly.
- ❑ For a normal eye, the far point is infinity.



## Near Point ( L D D V )

- ❑ The nearest point up to which a long sighted eye can see clearly.
- ❑ For a normal eye, the **near point is about 25 cm** from the eye.





## Defects of Vision and Their Correction



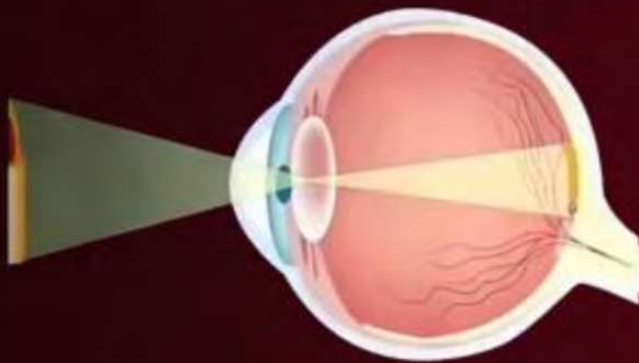
- ✓ ☒ MYOPIA
- ✓ ☒ HYPERMETROPIA
- ✓ ☒ PRESBYOPIA
- ✓ ☒ CATARACT
- ✓ ☒ ASTIGMATISM



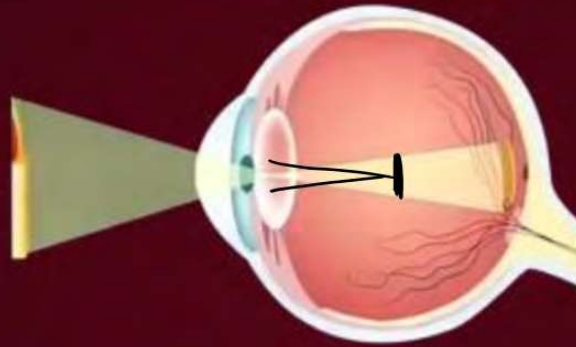
## **MYOPIA/SHORT SIGHTEDNESS/NEAR SIGHTEDNESS**

- ☐ When a person can see a near objects clearly, but a person can not see the distant images clearly.
- ☐ Image from between the retina. ✓
- ☐ It is due to
  1. Excessive curvature of eye lens. ✓
  2. Elongation of eye ball. ✓

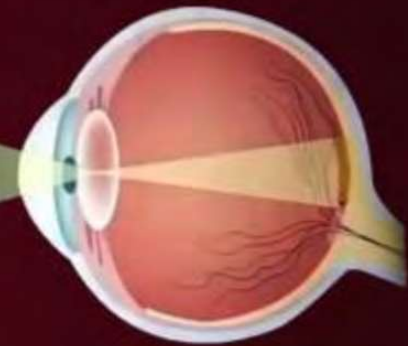
## MYOPIA/SHORT SIGHTEDNESS/NEAR SIGHTEDNESS



Normal Eye



Myopia Eye



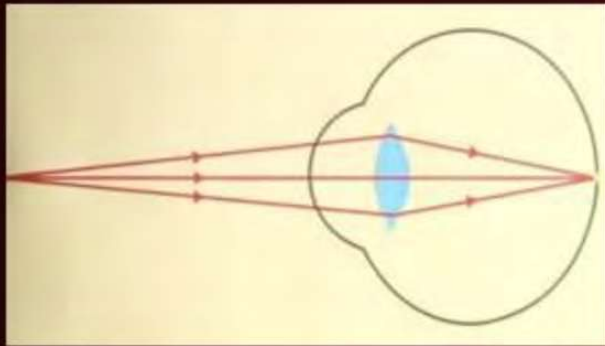
Corrected Eye



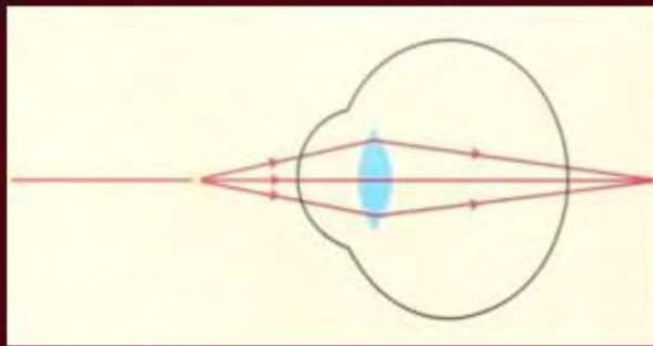
## HYPERMETROPIA/LONG SIGHTEDNESS/FAR SIGHTEDNESS

- ☐ When a person can <sup>see</sup> a distant objects clearly, but a person can not see the nearby object clearly.
- ☐ It is due to
  1. Decrease in the power of eye lens.  $P \downarrow \quad f \uparrow$
  2. Shortening of eye ball.

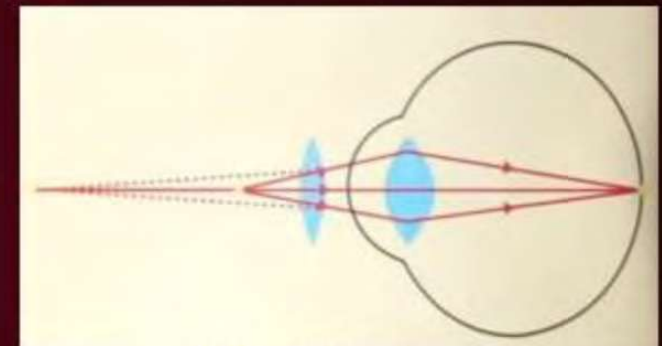
## HYPERMETROPIA/LONG SIGHTEDNESS/FAR SIGHTEDNESS



Normal Eye



Hypermetropia Eye



Convex  
Corrected Eye



## **PRESBYOPIA**

⇒ Bi-focal lenses



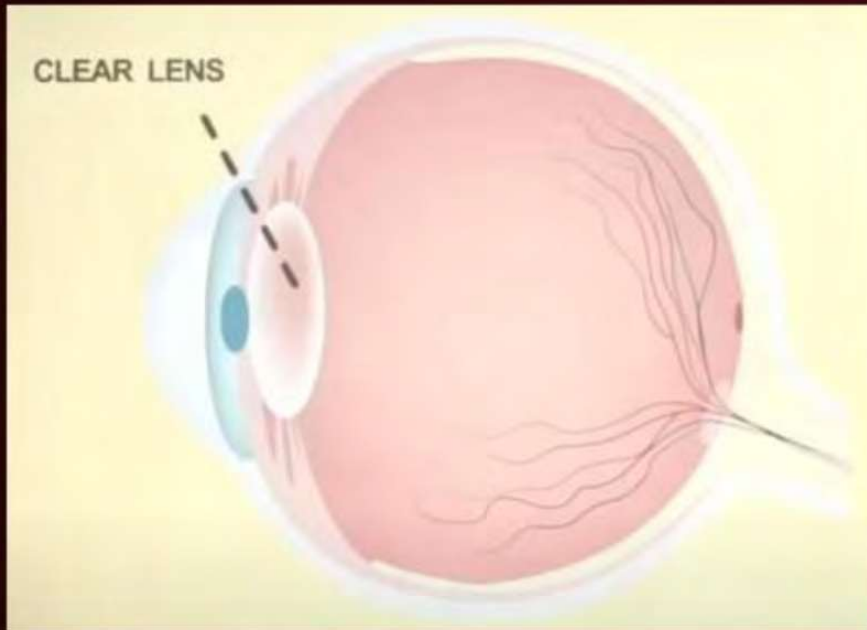
- ❑ It is a kind of defect in human eye which occurs due to ageing.
- ❑ It is due to
  1. Decrease in flexibility of eye lens.
  2. Gradual weakening of ciliary muscles.



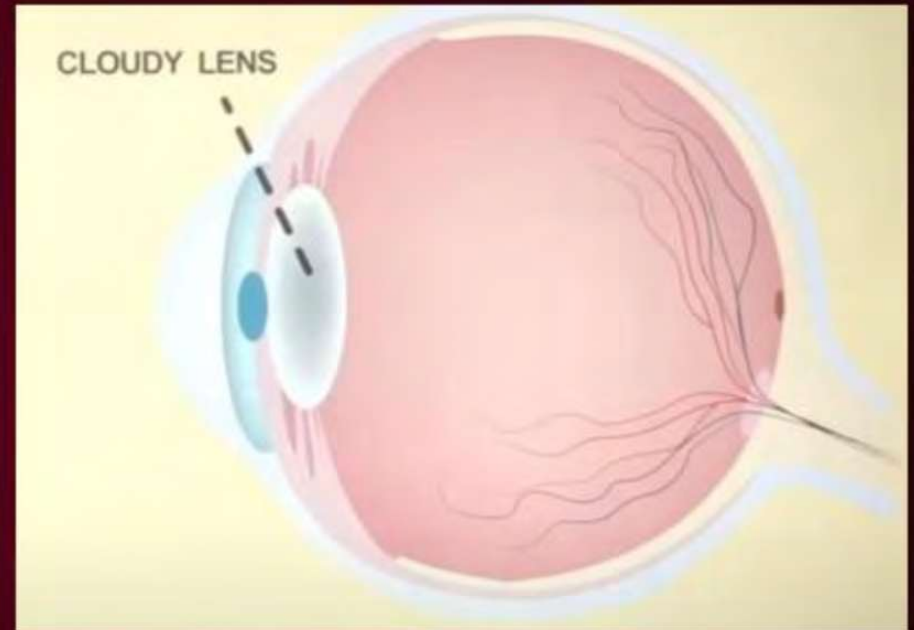
## CATARACT

- ☐ When a lens of people at old age becomes milky and cloudy.
- ☐ This causes partial or complete loss of vision.

## CATARACT



Normal Eye



Cataract Eye

## ASTIGMATISM

*→ cylindrical shaped lenses*

- ☐ When a person can not focus on both horizontal and vertical lines at the same time so the person can see objects clearly in one plane.
- ☐ It is due to irregularly shaped cornea or distorted lens.





## Refraction of Light Through a Prism



### PRISM

- It has two triangular bases and three rectangular lateral surfaces. These surfaces are inclined to each other.

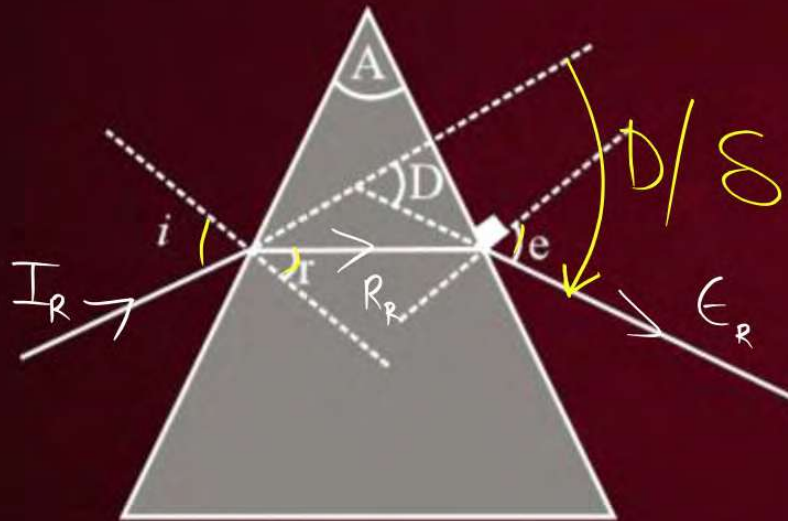
**Monochromatic Light** - It light contains light with a single wavelength.

↓      ↓  
Single color





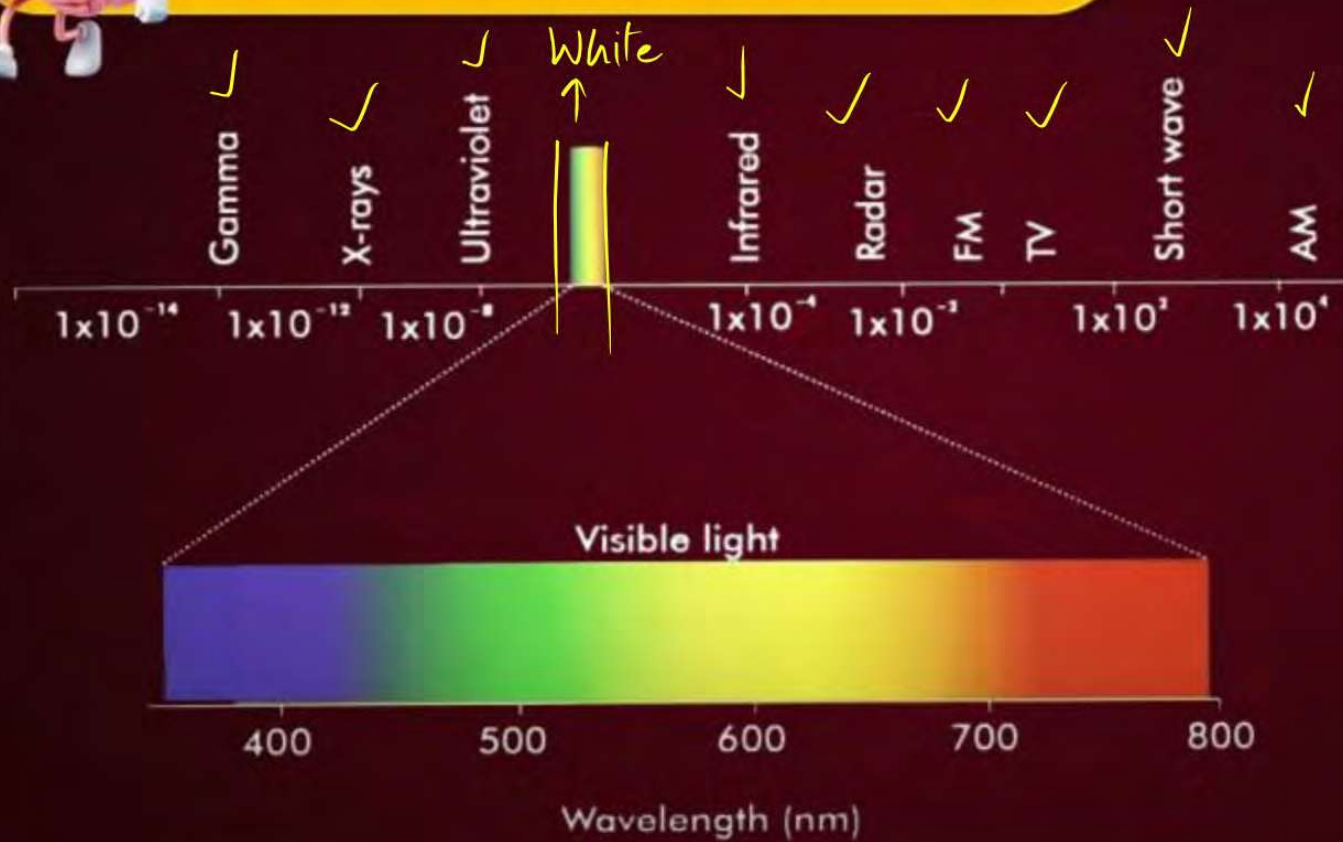
## Refraction of Light Through a Prism



- $\angle A$  = Angle of prism
- $\angle D$  = Angle of deviation
- $\angle i$  = Angle of incidence
- $\angle r$  = Angle of refraction
- $\angle E$  = Angle of emergence



# Electromagnetic Spectrum

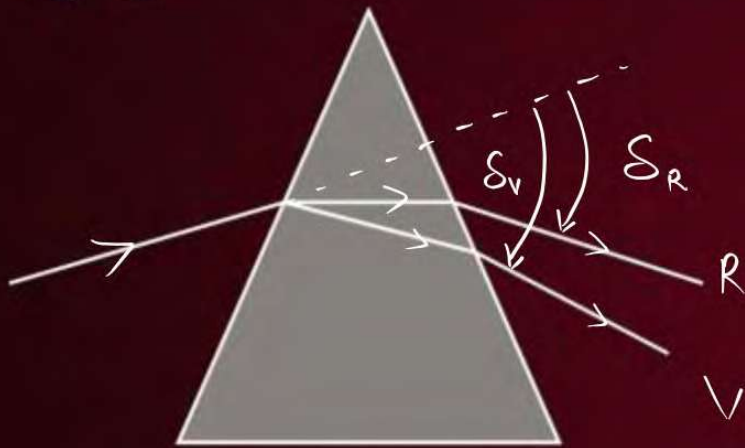


Rod  $\uparrow$  - intensity  $\uparrow$

Cone  $\uparrow$  - color  $\uparrow$



## Dispersion



- ❑ The splitting of white light into its constituent **seven colours** on passing through a glass prism.
- ❑ The band of seven colours so obtained is called **visible spectrum**.
- ❑ RED – Least deviate
- ❑ VIOLET – Maximum deviate

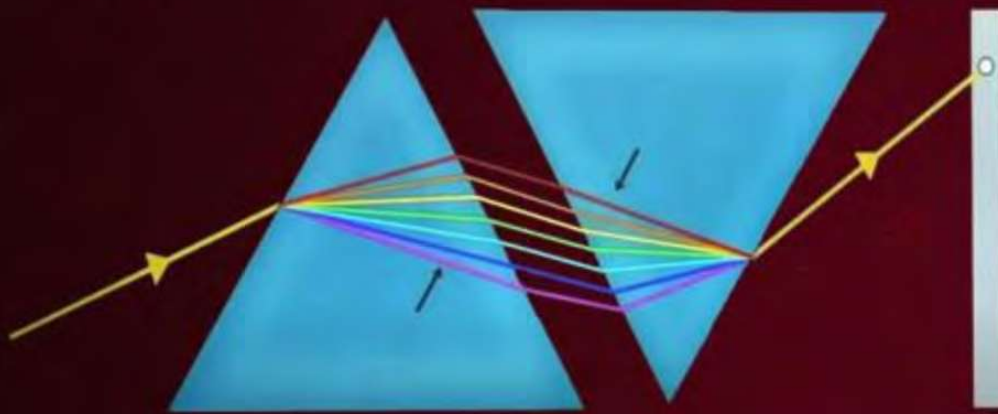
$$\delta_V > \delta_R$$
$$\lambda_R > \lambda_V$$

$$\lambda \uparrow \delta \downarrow$$





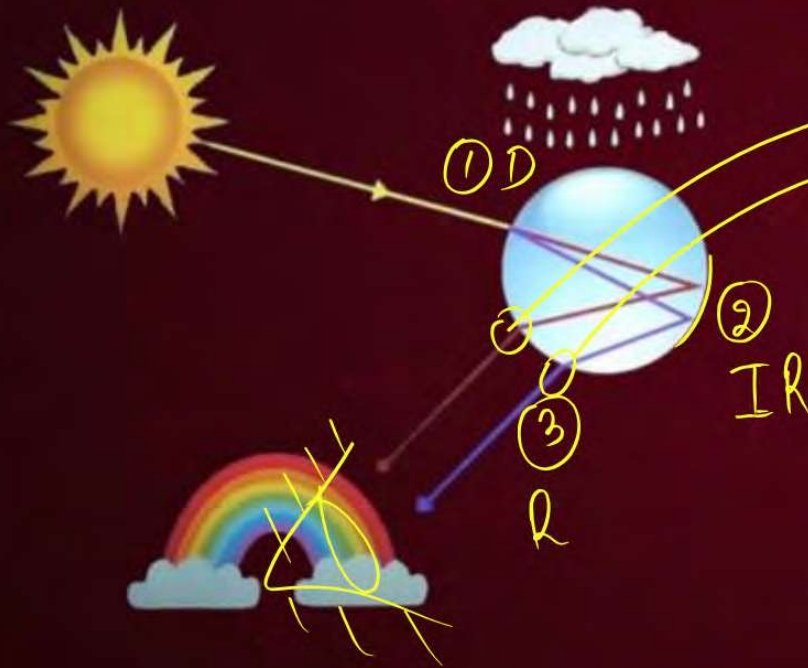
## Recombination of Spectrum



- ❑ Sir Isaac Newton was the first to use a glass prism to obtain the spectrum of sunlight.
- ❑ This experiment gave an idea that sunlight is made up of seven colours which is referred as white light.



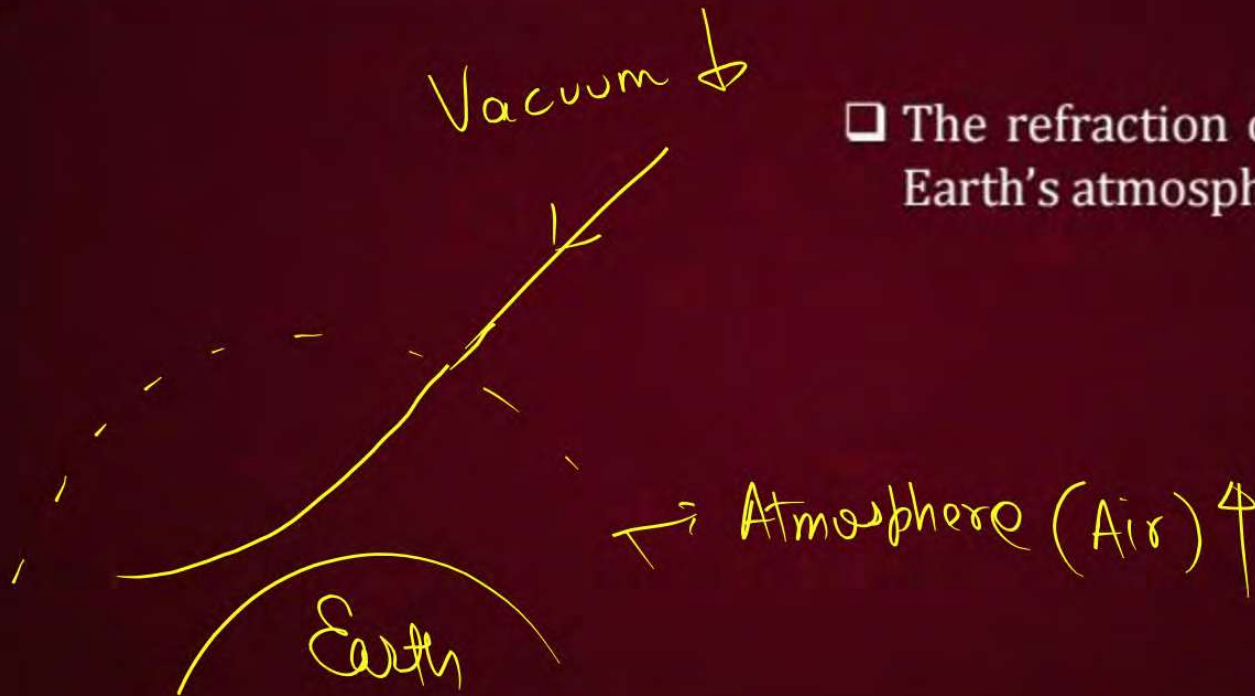
## Rainbow



- ☐ A rainbow is formed due to dispersion of light by tiny droplets of water which act as a prism.
- ☐ A rainbow is always formed in the direction opposite to that of the sun.



## Atmospheric Refraction



- The refraction of light caused by the Earth's atmosphere.



## Twinkling of Stars



Apparent ✗

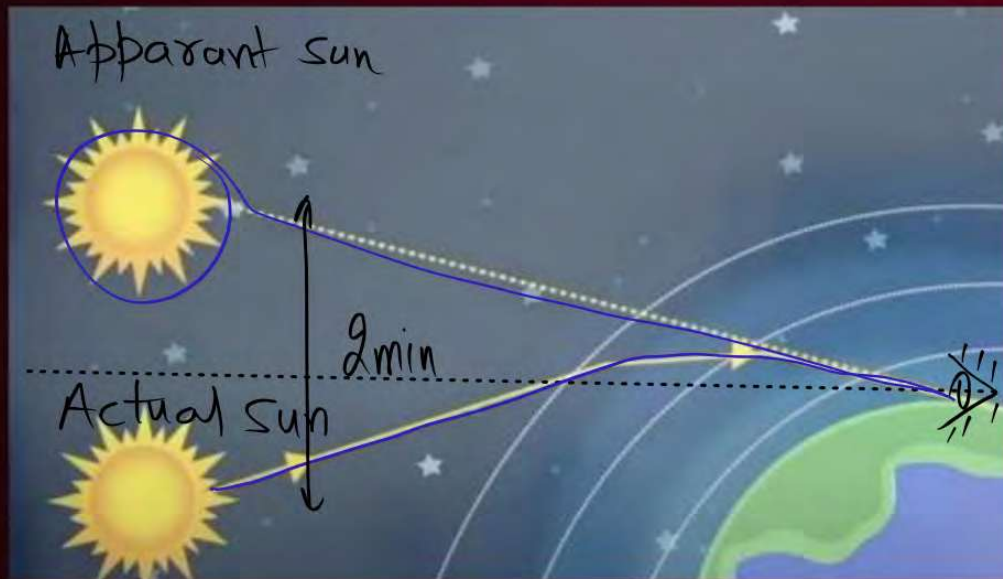


- ☐ Due to atmospheric refraction. ✓
- ☐ Gradually changing refractive index.
- ☐ The amount of intensity of starlight increases/decreases this causes twinkling of stars.
- ☐ It seems to be higher in the sky as actual they





## Advance Sunrise and Delayed Sunset



- ☐ Due to atmospheric refraction.
- ☐ Earth's atmosphere is not uniform, air layers has different densities and refractive indices.



## Scattering of Light



$\lambda \downarrow$  Scattering  $\uparrow$

Short wavelength

Scattering of light

Long wavelength

- It is a phenomenon of change in the direction of light on striking particles like an atom, molecules, dust particles.
- It was first studied by the scientist **Rayleigh**.



## Scattering of Light



- ❑ The intensity of light depends on two factors.

1. **Wavelength of light**

Light of short wavelength is scattered more than the light of long wavelength.

2. **Size of scattering particles**

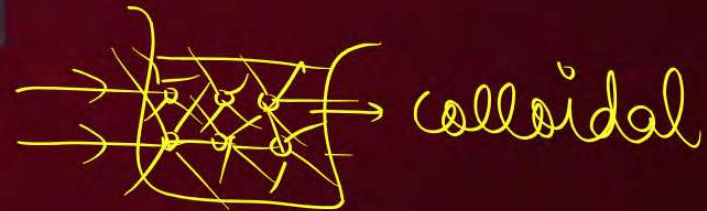
Small particles scatter light of shorter wavelengths whereas large particles scatter light of longer wavelegnths.



## Tyndall Effect



- ❑ Scattering of beam of light by a medium containing small suspended particles.







## Sky is Blue



- ☐ Due to scattering of light the Earth's atmosphere.
- ☐ Blue light has short wavelength.
- ☐ These particles have size smaller than the wavelength of the visible light.