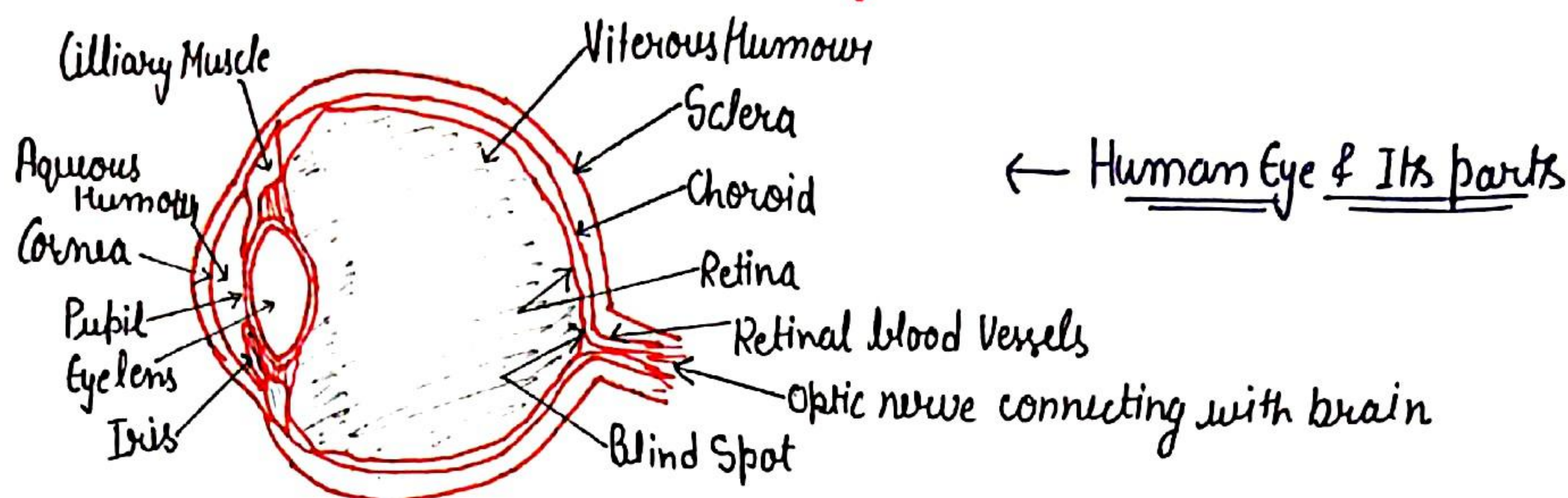


# Human Eye and the Colourful World.

The most sensitive and valuable sense organ of the human body is the Human Eye. It is like a camera and is based on the lens system.



## The Parts of Human Eye & It's functions:

1. Cornea →
  - A thin membrane covering the surface of eyeball, through which light enters into the eye.
  - Acts as a primary lens.
2. Iris →
  - A dark muscular diaphragm located just behind the Cornea.
  - Controls the size of pupil.
3. Pupil →
  - A black opening between the aqueous humour and the eye lens.
  - Regulates and controls the amount of light entering the eye.
4. Ciliary Muscles →
  - Controls the focal length of the eye lens and hold the lens in right position.
  - due to relaxation of these muscles focal length of lens increases.
  - When these muscles contract focal length of lens decreases.
5. Crystalline lens →
  - The eye lens is a transparent, crystalline & double convex lens.
  - Made of transparent & flexible tissues.
  - Focuses the incoming light rays from the object on the retina to form real & inverted images.
6. Retina →
  - A delicate membrane having enormous no. of light sensitive cells.
  - Acts like a screen on which image of objects are formed.
7. Optic Nerves →
  - It is formed by the nerve fibres attached with retina.
  - It carry nerve impulses or signals to the brain.
8. Aqueous Humour →
  - It is a transparent liquid filled behind the cornea.
  - It maintains intraocular pressure.
9. Vitreous Humour →
  - Filled between eye lens and retina.
  - keep retina in place by pressing it against the choroid.



Working of the eye {function} When a person looks towards any object, a reflected light from the object enters the pupil of the eye and falls on the eye lens (convex lens), which forms a real and inverted image on the retina of the eye that consists of some special cells in the shape of rods & cones. Such special cells transform light energy in the form of signals for the brain. These signals reach to the brain by optic nerve. At last, the brain interprets these signals and the person is able to see the objects.

Power of Accommodation • The focal length of the lens increases if its thickness decreases.  
• The focal length decreases, the thickness of the lens increases.

The ability of an eye to focus the distant objects as well as nearby objects on the retina by changing the focal length of the eye lens is known as accommodation of the eye.

For normal eye: • Far point - Infinity. • Near point - 25 cm.

For Distant Object  
↓  
Ciliary muscles relax.  
↓  
Eye lens becomes thin.  
↓  
Increase in focal length

For nearby objects  
↓  
Ciliary muscles contract.  
↓  
Eye lens becomes thick.  
↓  
Decrease in focal length.

### Defects of Vision

#### Myopia or Near-Sightedness

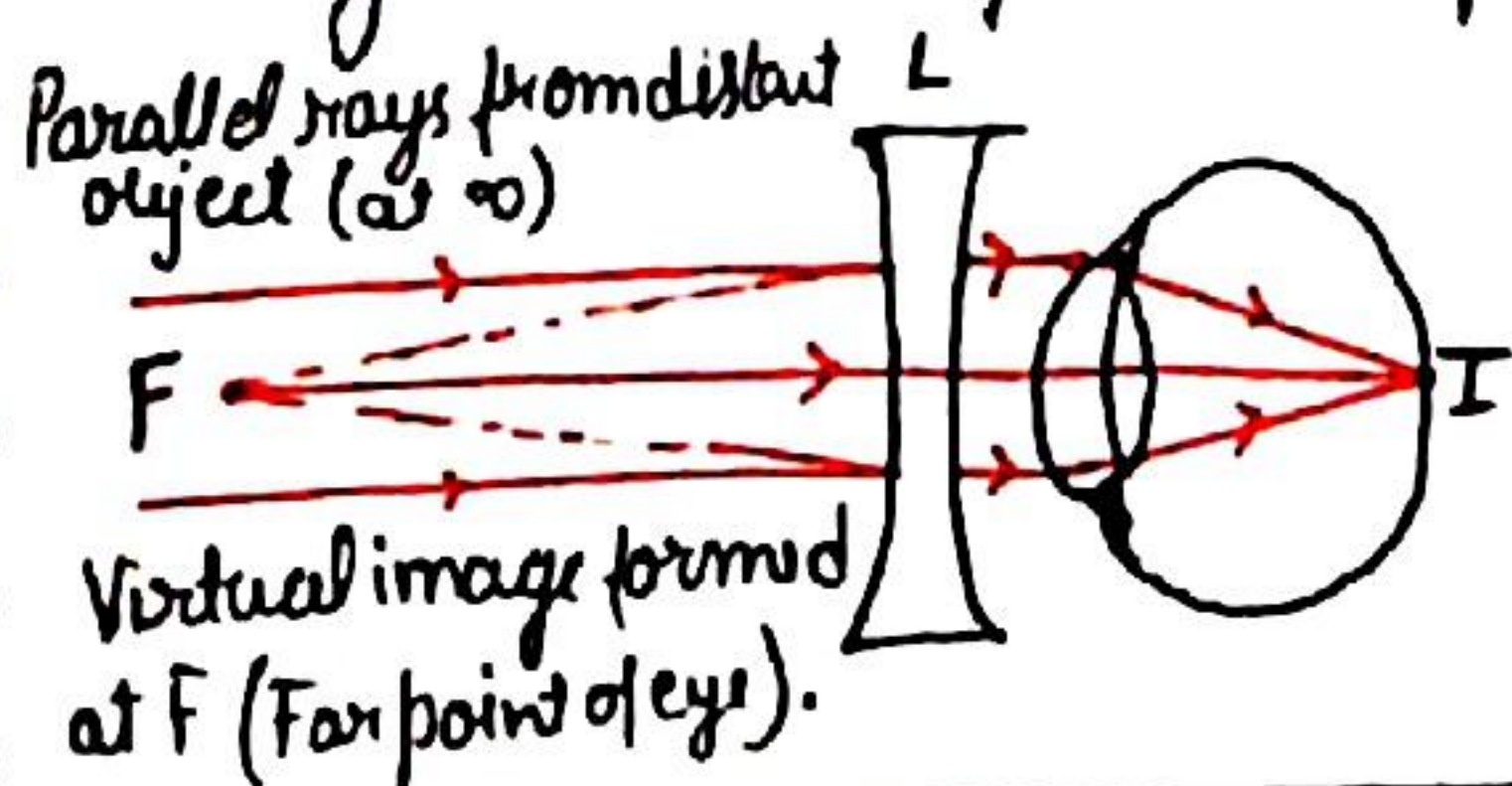
- Cannot see distant objects distinctly.
- Can see nearby objects clearly.
- Image of distant object is formed in front of the retina.

#### ↓ Causes

- Excessive curvature of the eye lens or decrease in the focal length of eye lens.
- Elongation of eyeball.

#### ↓ Correction

Using Concave lens of suitable power.



#### Hypermetropia or Far-Sightedness

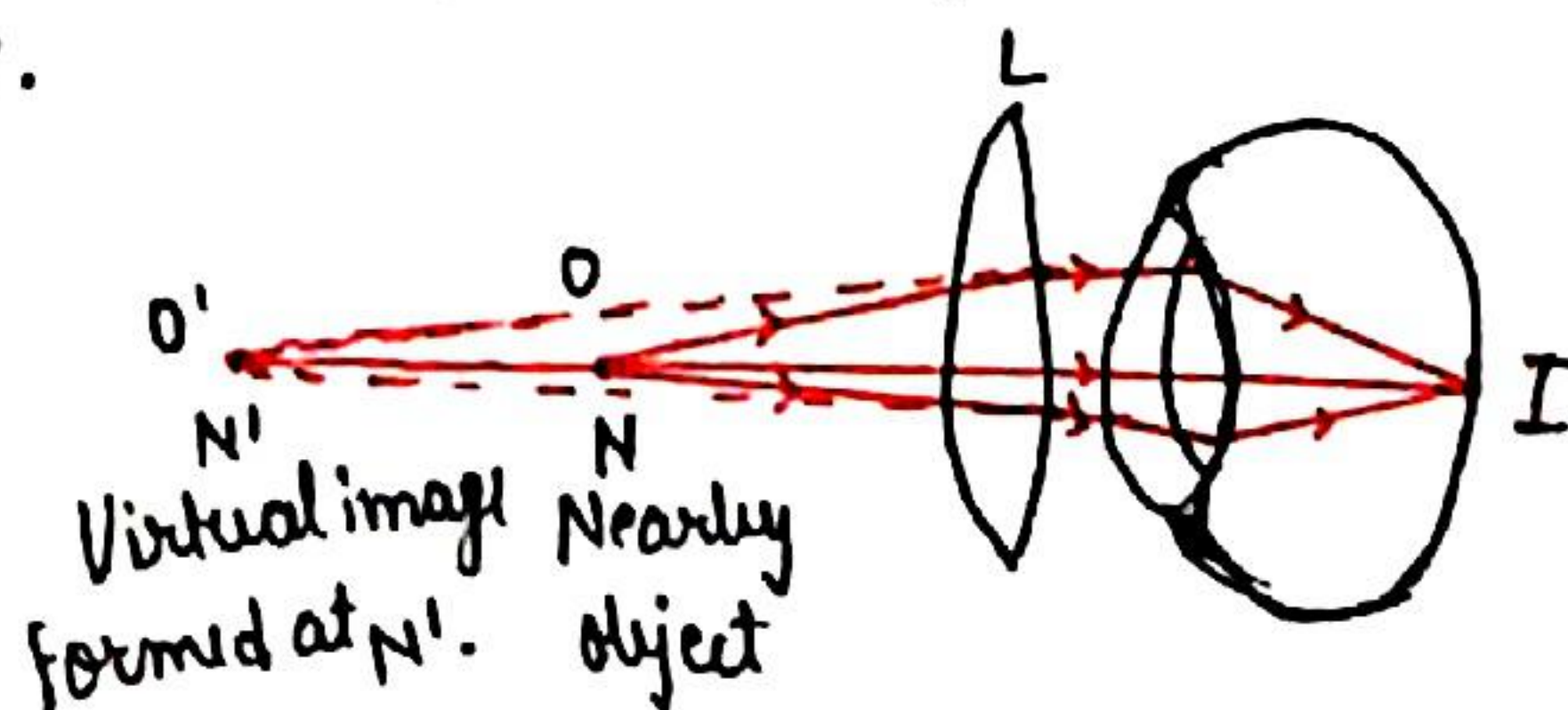
- Cannot see nearby objects distinctly.
- Can see distant objects clearly.
- Image of nearby object is formed behind the retina.

#### ↓ Causes

- Focal length of the eye lens is too long.
- Eyeball becomes short.

#### ↓ Correction

Using Convex lens of suitable power.





## Presbyopia

- Near point of the eye gradually recedes away with aging.
- Power of accommodation of eye decreases.

### ↓ Causes

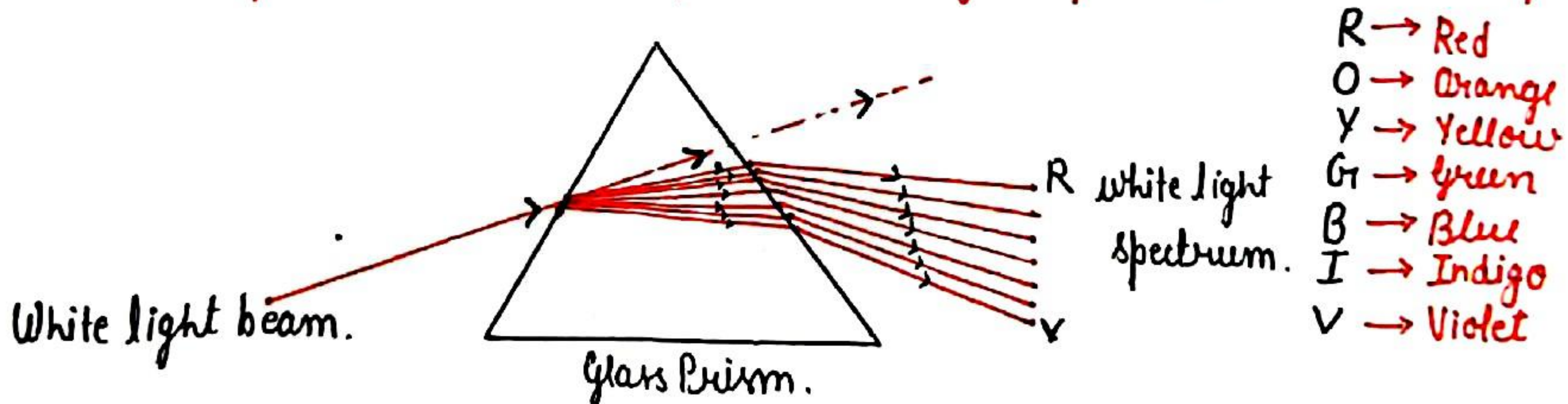
- Gradual weakening of the ciliary muscles.
- Diminishing flexibility of the eye lens.
- An eye suffers from both myopia and Hypermetropia.

### ↓ Correction

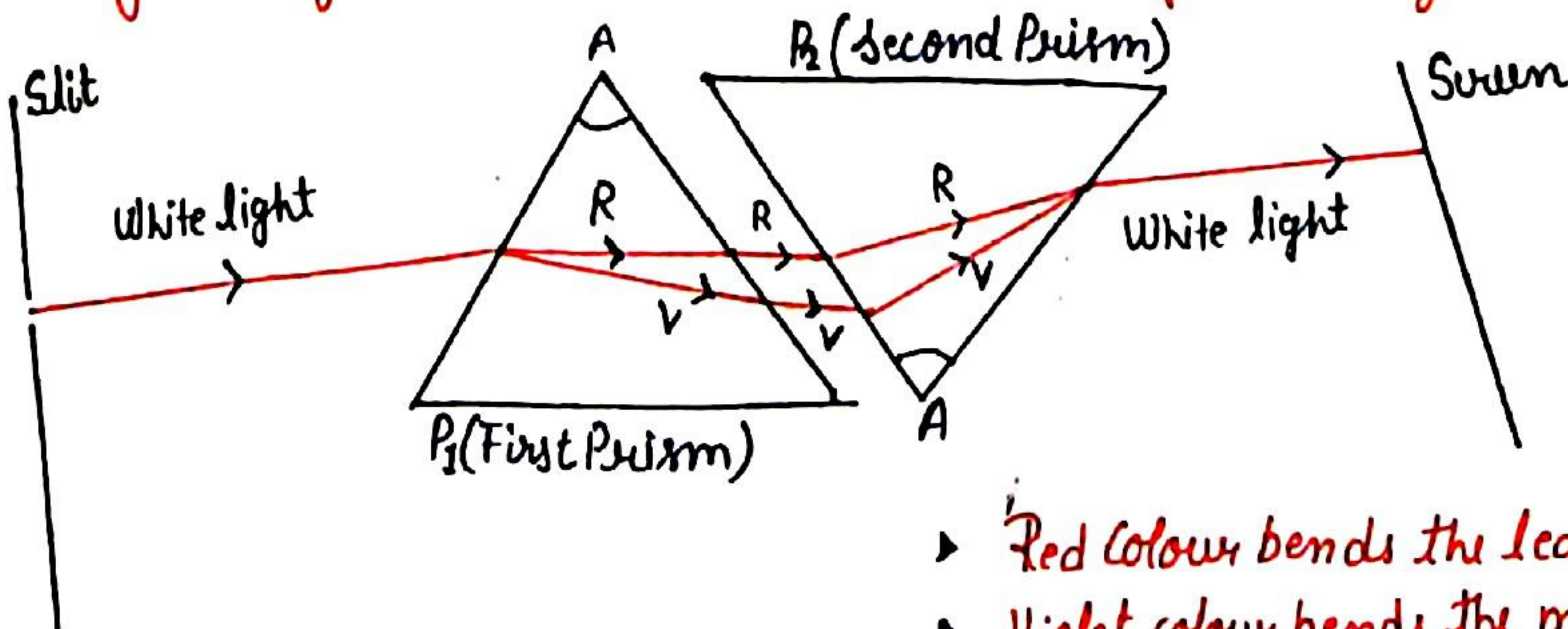
Bifocal lens.

- Upper portion consists of concave for distant vision.
- Lower portion consists of convex for near vision.

Dispersion of white light by a glass Prism The splitting of white light into its components due to different bending abilities of colours when it passes through a prism, is called Dispersion.



Recombination of White light. When white light is passed through a prism dispersion of light occurs and when another prism is kept inverted the dispersed light which was formed will get back to white light after passing through it known as recombination of white light.



- ▶ Red colour bends the least.
- ▶ Violet colour bends the most.

## Contract

- Eye lens becomes milky & cloudy.
- Image cannot be seen distinctly.

### ↓ Causes

- Protein layer formation over eye lens.

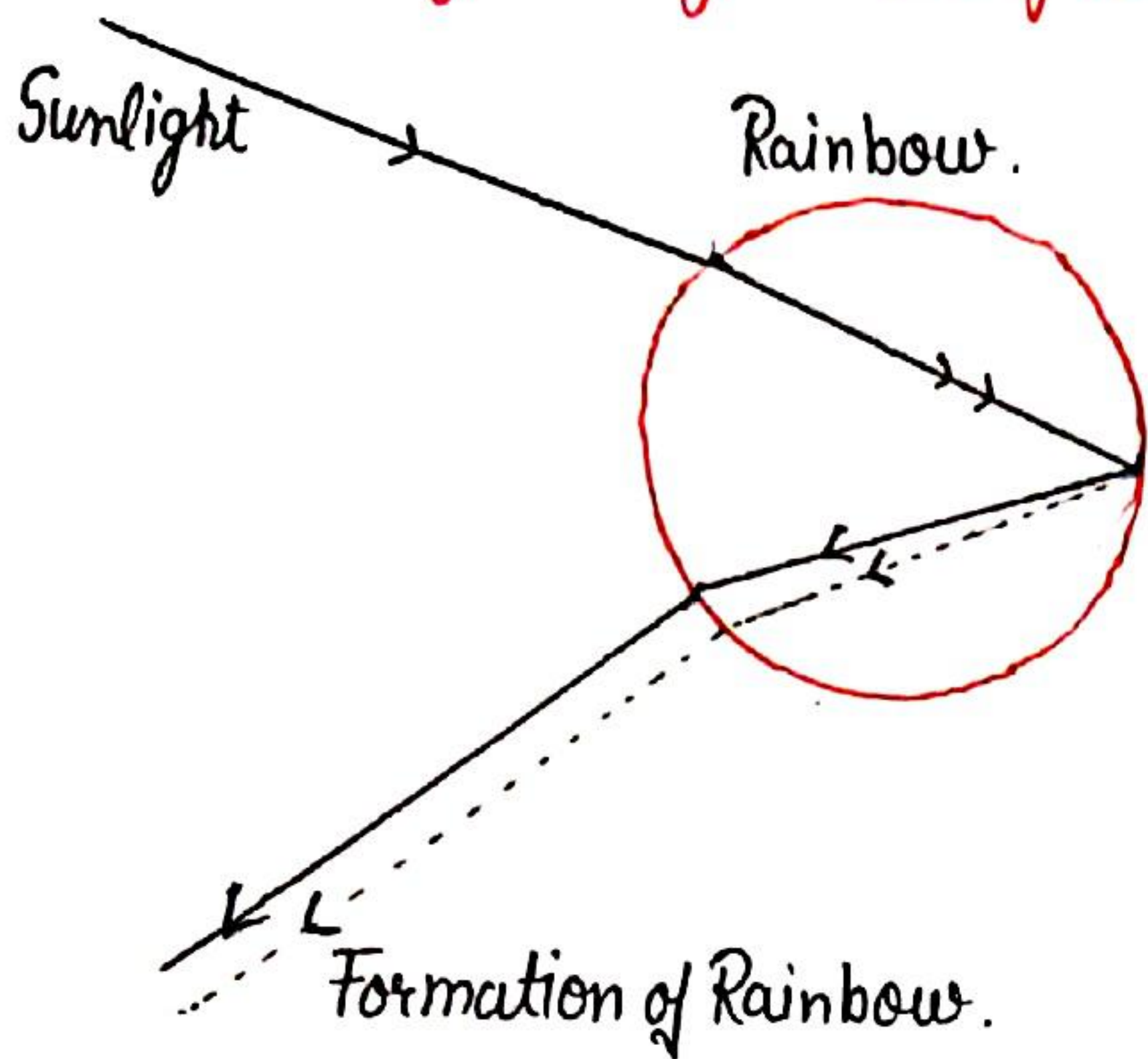
### ↓ Correction

- Contract surgery for removal of extra growth on eye lens to restore the vision.

Astigmatism :- When the eye of a person cannot focus on both horizontal and vertical border simultaneously, then such type of a vision defect is suffered to Astigmatism.



Spectrum (Rainbow) The rainbow is an arc of seven colours. (VIBGYOR), visible in the sky during the rainy season. The arc (called VIBGYOR) is Spectrum.



Rainbow is caused by → Dispersion of sunlight by tiny water droplets, acts like a small prism present in atmosphere.

Conditions for its formation →

- Presence of water droplets in the atmosphere.
- The sun must be at the back of observers.

Atmospheric Refraction • Due to the continuous variation in the density & temperature in the different layers of earth's atmosphere.

This layers will acts as a different medium.

- Sunlight gets refracted through these atmospheric layers. The phenomenon is called atmospheric refraction.

Some Natural Phenomenon Based on Atmospheric Refraction

Twinkling of Stars

The light coming from a star undergoes refraction due to varying optical densities of air at various altitudes. The star appears to be very bright at one moment & at the next moment it becomes very dim.

Apparent Star Position

As higher up in the sky, the surface is rarer but near to the earth, surface is denser. The ray coming from star bends. Refraction of light of the star take place and the star appears to be at a higher position.

Planets do not twinkle

They are larger in size and are much closer to the earth, so they can be taken as a collection of large no. of point-sized source of light. The total variation in the amount of light entering our eyes properly which reduces twinkling effect.

Advance Sunrise and Delayed Sunset The sun can be observed two minutes before the sunrise and after sunset because of atmospheric refraction.



Scattering of light When a ray of light passes through a path of suspended particles, it splits up in various random directions.

Such a phenomenon is known as Scattering of light.

- Scattering depends upon the size of particles. (In case of true and colloidal)
  - fine particles in air scatter blue colour.
  - Large-sized particle scatter longer wavelength of light.

## Basic Events due to Scattering

### Tyndall Effect

When a light ray passes through the air, the particles of dust, smoke & vapour present in air makes the path of the light ray visible. Such phenomenon is known as "Tyndall Effect."

### Colour of the sky Blue.

Blue component of white light (sunlight) is scattered more by the air molecules than the other fine particles present in the atmosphere. Blue has the shorter wavelength which scatter faster in comparison to other colours present in sunlight.

### Colour of the Sun at Sunrise & Sunset

Sky Appears Black :- When ~~there~~ there is no atmosphere (space) or no light (night), the scattering does not take place.

Sky Appears Red :- During Sunrise / Sunset the sun is near the horizon. Light passes through larger distance in the earth's atmosphere. Most of the blue light is scattered away. The red light does not get scattered and reaches our eyes.