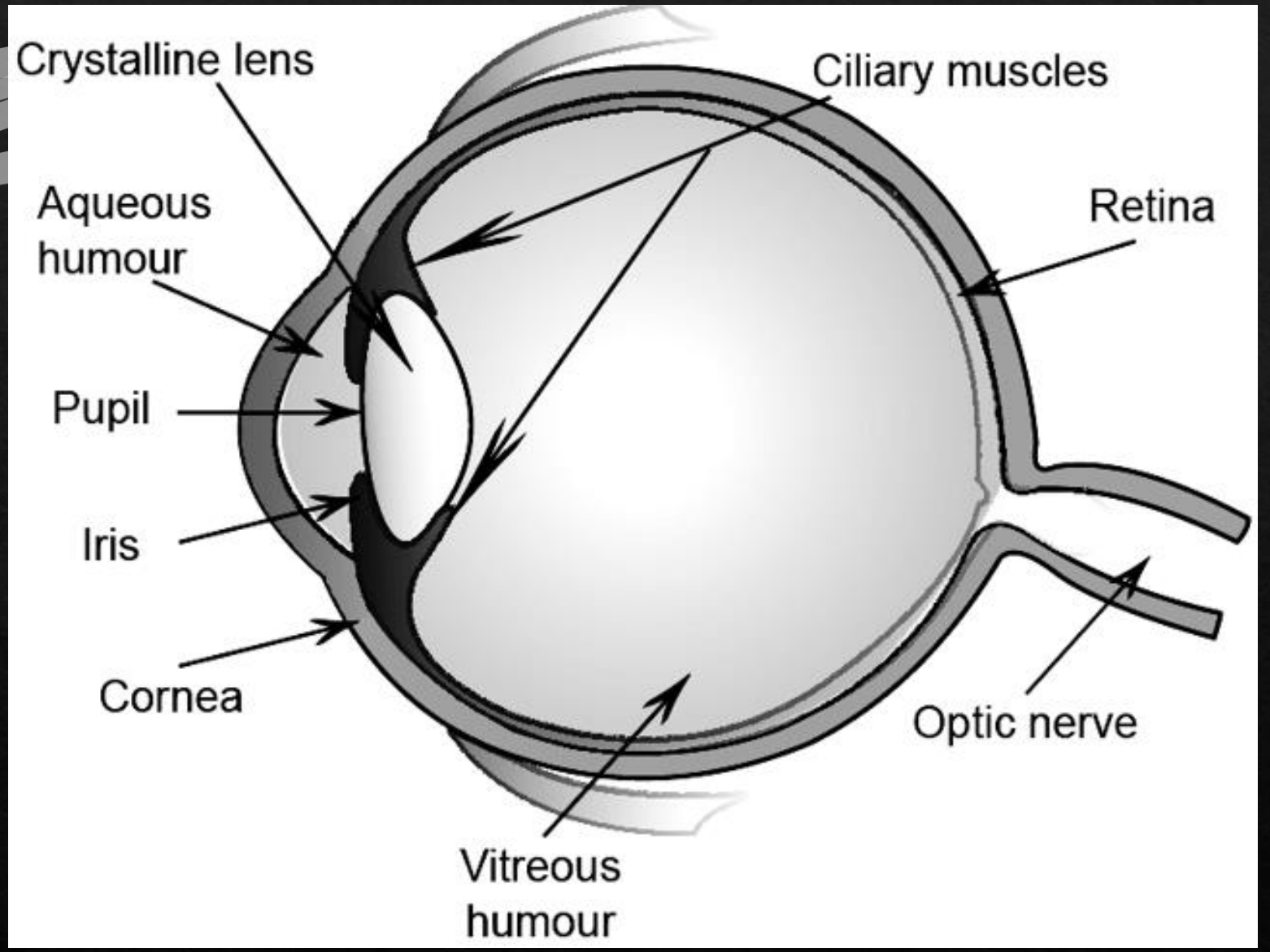
1a) The human eye :-

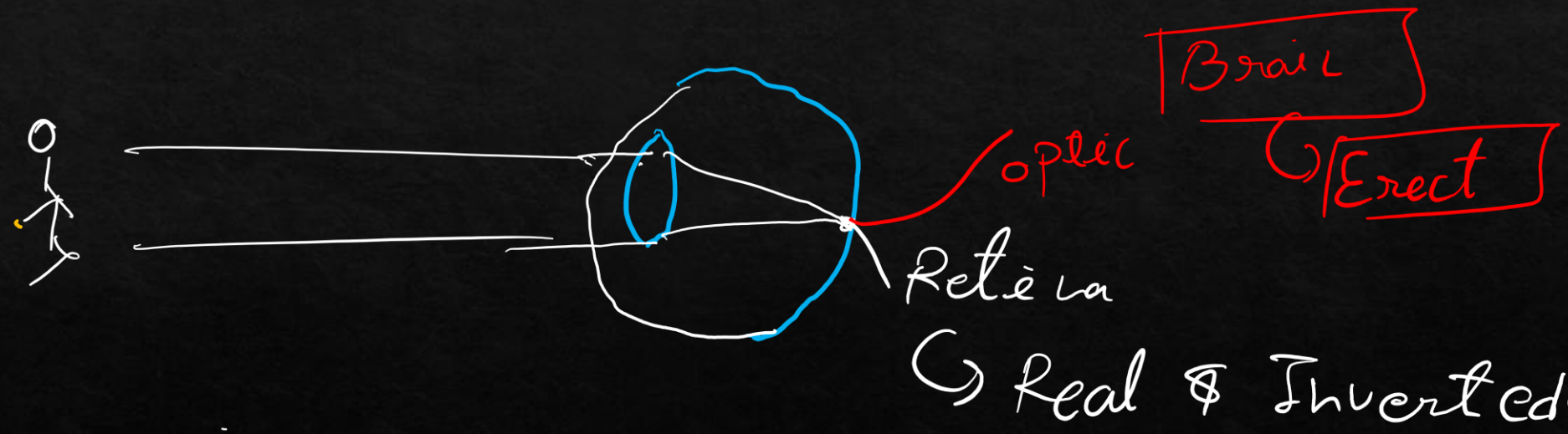
The human eye is the sense organ which helps us to see the colourful world around us.

The human eye is like a camera. Its lens system forms an image on a light sensitive screen called retina. The eye ball is almost spherical in shape with a diameter of about 2.3cm. Light enters the eye through a transparent membrane called cornea. Behind the cornea is a muscular diaphragm called iris which has an opening called pupil. The pupil controls the amount of light entering the eye. The eye lens helps to focus the image of objects on the retina. The ciliary muscles helps to change the curvature of the lens and to change its focal length.


Crystalline lens
Ciliary muscles
Aqueous humour
Retina
Pupil
Iris
Cornea
Optic nerve
Vitreous humour

b) Working of the eye :-

The eye lens forms a real, inverted image of the object on the retina. The light sensitive cells in the retina then produce electrical signals which are carried by the optic nerves to the brain. The brain processes the information and sends the message to the eye and then we see the object.



c) Power of accomodation of the eye :-

The ability of the eye lens to see both near and distant objects by adjusting its focal length is called the power of accommodation of the eye.

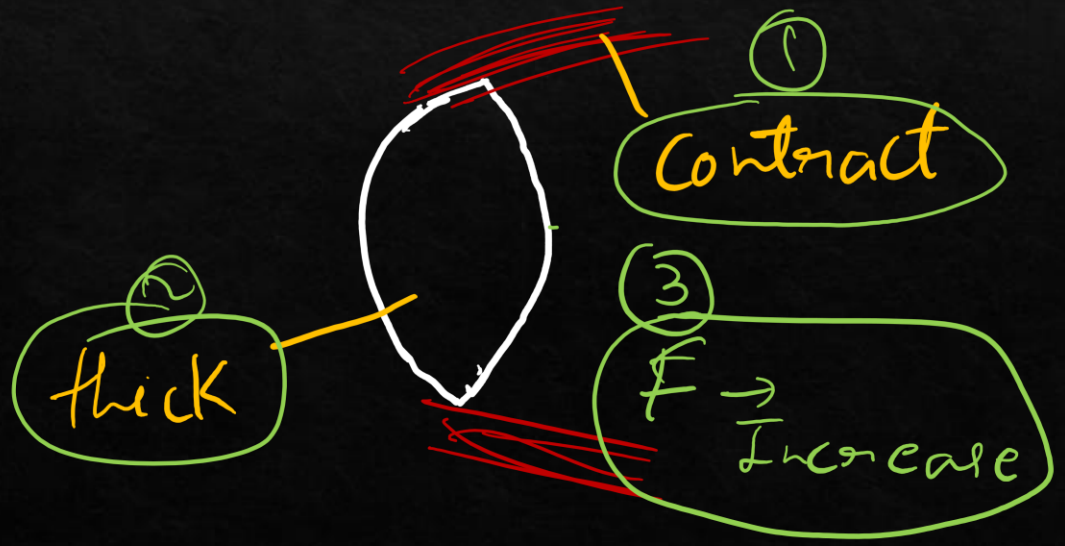
The eye lens is composed of a fibrous jelly like material. Its curvature can be changed to some extent by the ciliary muscles. The change in the curvature of the eye lens can change its focal length. When the muscles are relaxed, the lens becomes thin and its focal length increases and when the muscles contract, the lens becomes thick and its focal length decreases.

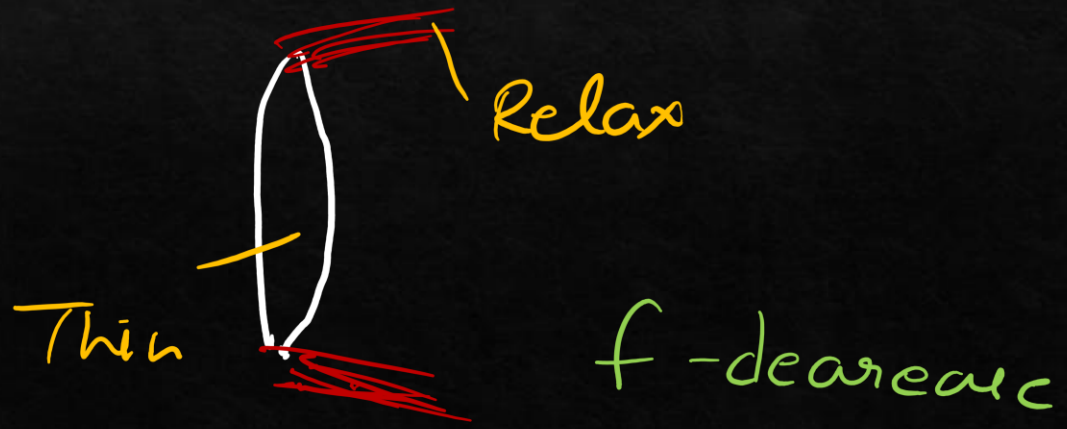
d) Near point :-

The minimum distance at which the eye can see objects clearly is called the near point or least distance of distinct vision. For a normal eye it is 25cm.

e) Far point :-

The farthest distance upto which the eye can see objects clearly is called the far point of the eye. For a normal eye it is between 25cm and infinity.





2) Defects of vision and their correction :-

i) Myopia or near sightedness :-

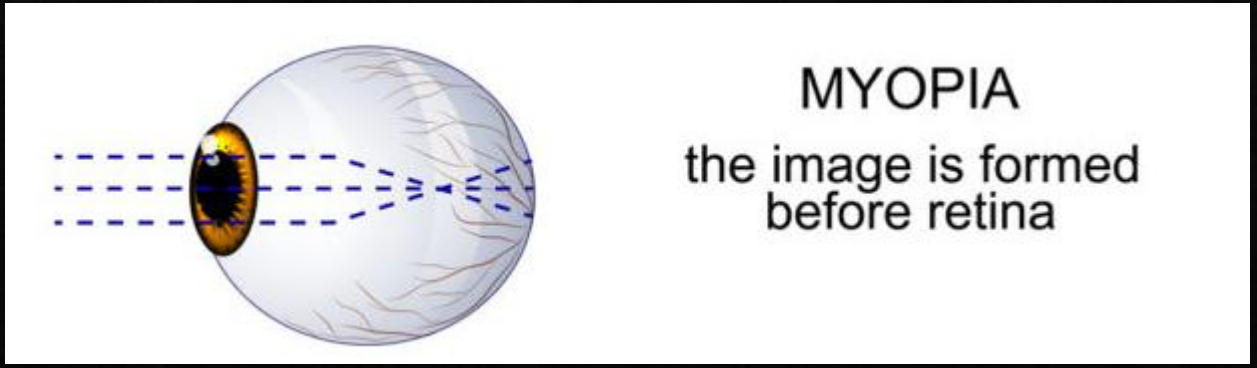
Myopia is a defect of vision in which a person can see nearby objects clearly but cannot see distant objects clearly because the image is formed in front of the retina.

This may be due to:-

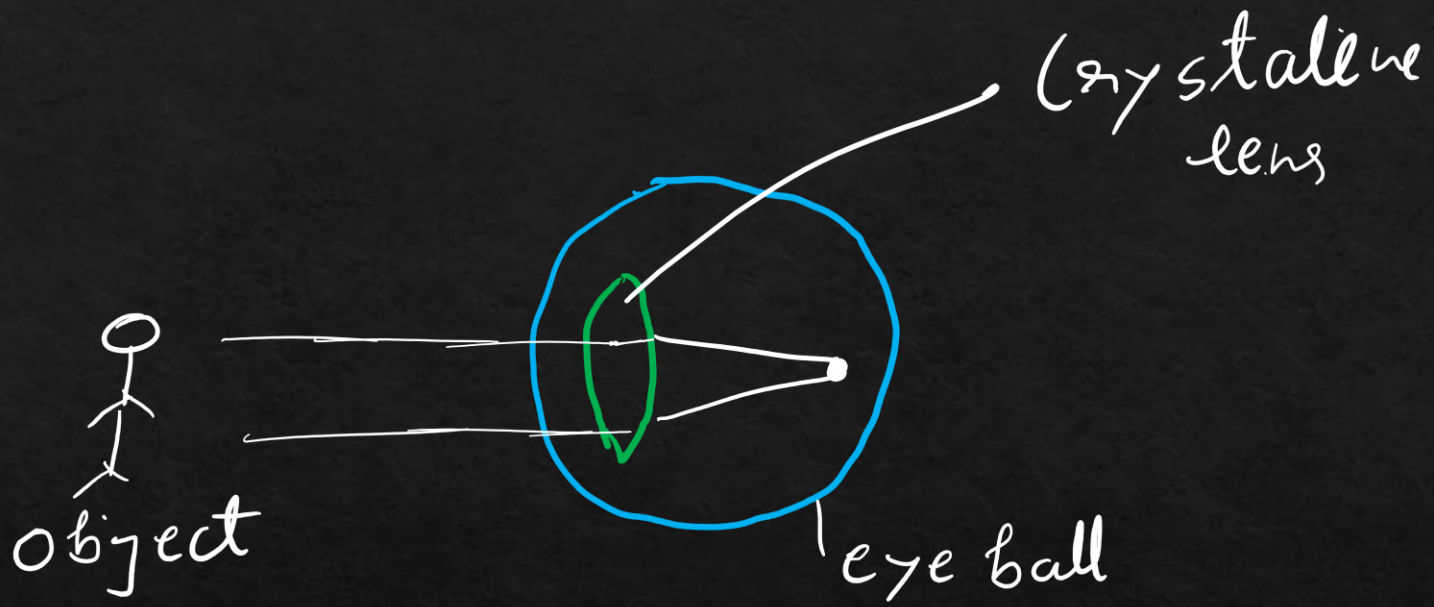
i) Increase in curvature of the eye lens

ii) Increase in the length of the eye ball.

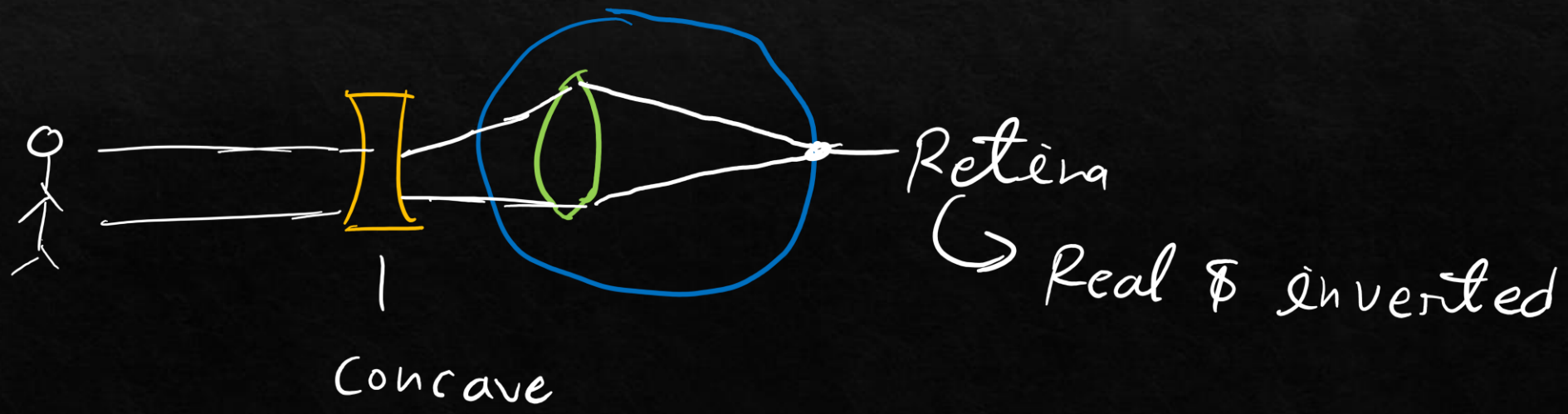
It can be corrected by using suitable concave lens.



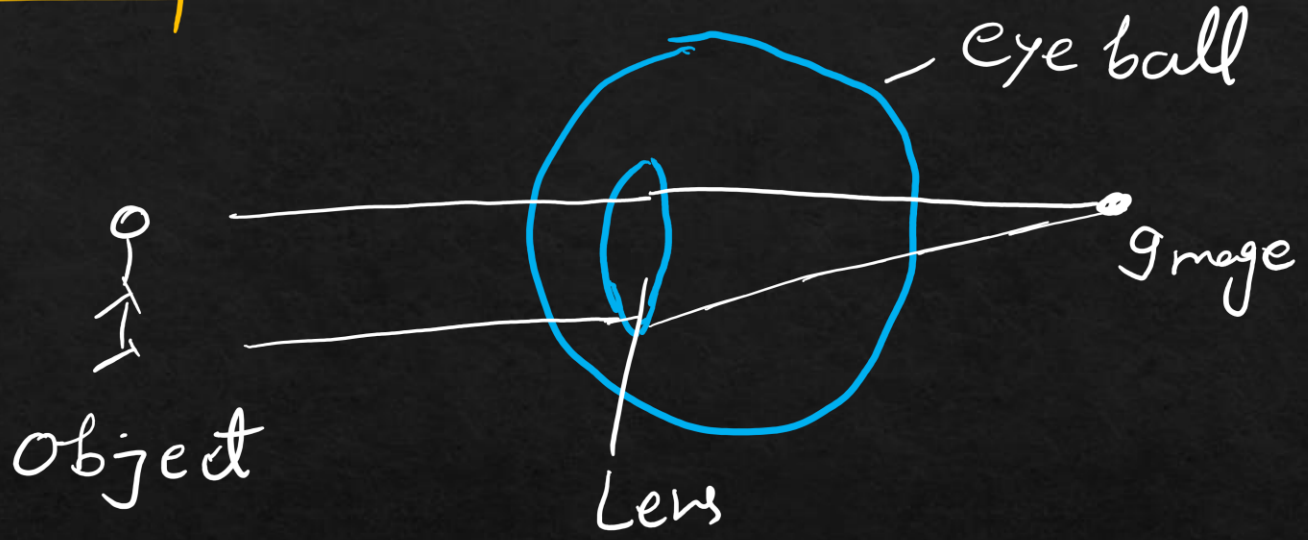
Myopia



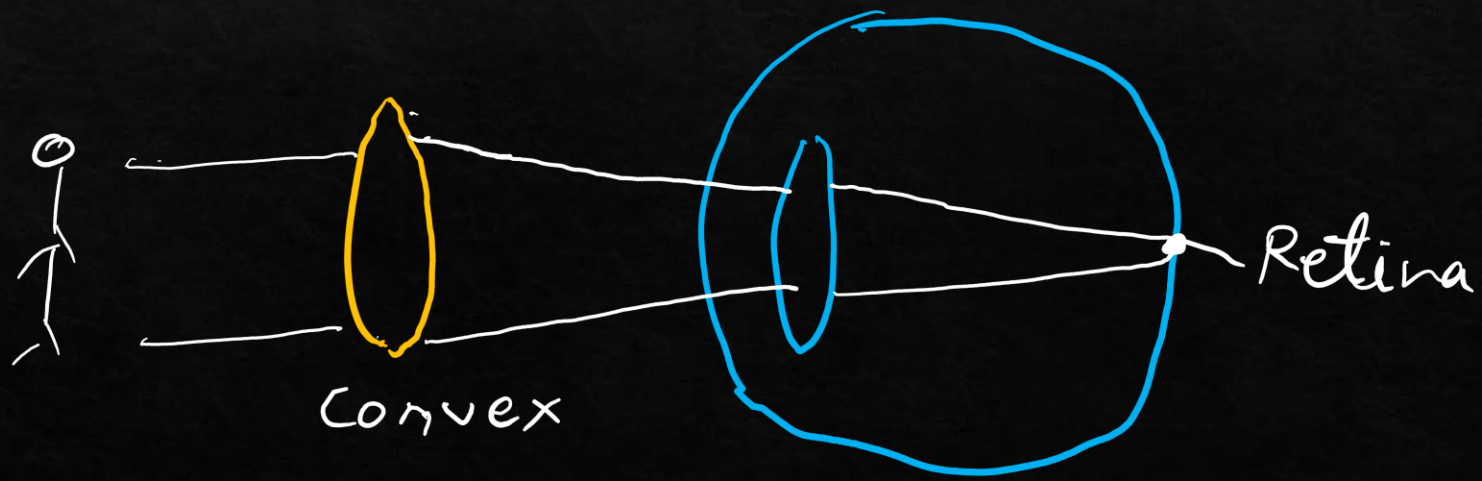
Concave -



Hypermetropia -



Correction - Convex -



ii) Hypermetropia or far sightedness :-

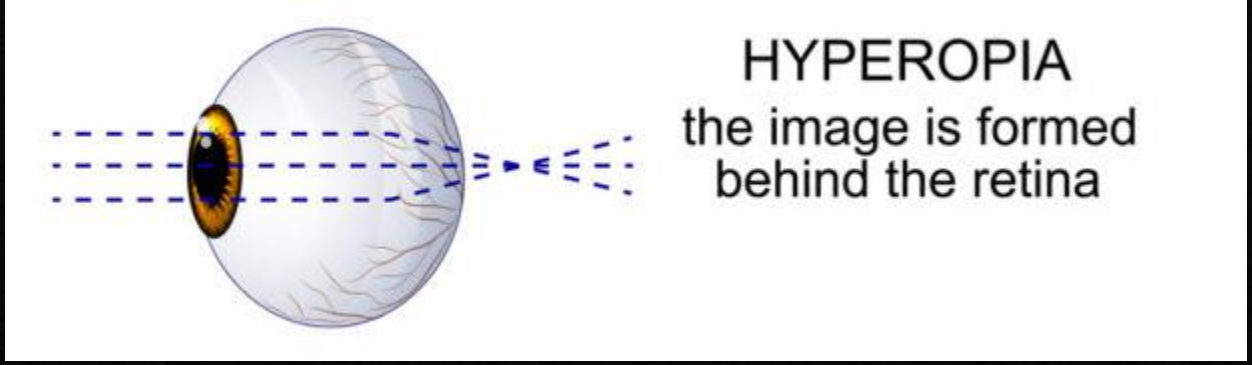
Hypermetropia is a defect of vision in which a person can see distant objects clearly but cannot see nearby objects clearly because the image is formed behind the retina.

This may be due to:-

i) Decrease in curvature of eye lens

ii) Decrease in the length of the eye ball

It can be corrected by using a suitable convex lens.



iii) Presbyopia :-

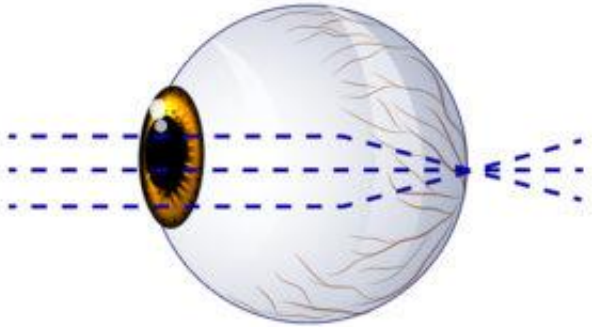
Presbyopia is a defect of vision in old people in which they are not able to see nearby objects clearly due to the increase in the distance of near point.

This is due to the weakening of the ciliary muscles and decrease in the flexibility of the eye lens. It can be corrected by using suitable convex lens.

Sometimes they are not able to see both nearby and distant objects clearly. It can be corrected by using bifocal lenses consisting of both concave and convex lenses. The upper part is concave for correction of distant vision and the lower part is convex for correction of near vision.

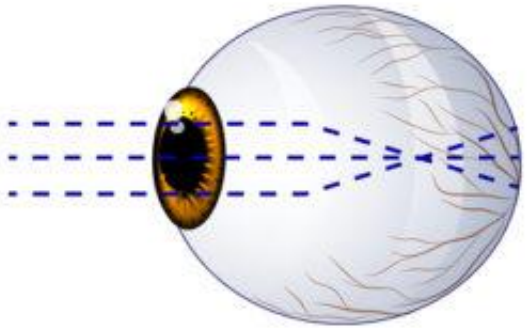
Bifocal lenses

MYOPIA AND HYPEROPIA



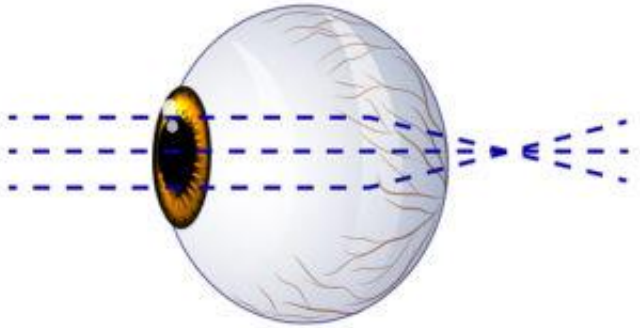
NORMAL VISION

the image is formed on the retina



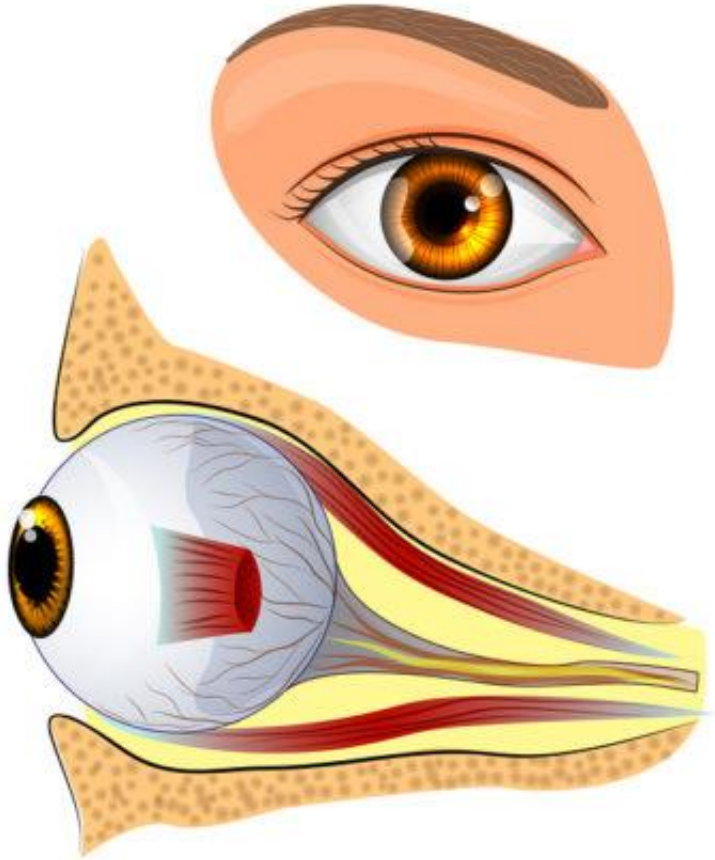
MYOPIA

the image is formed before retina



HYPEROPIA

the image is formed behind the retina



Astigmatism -

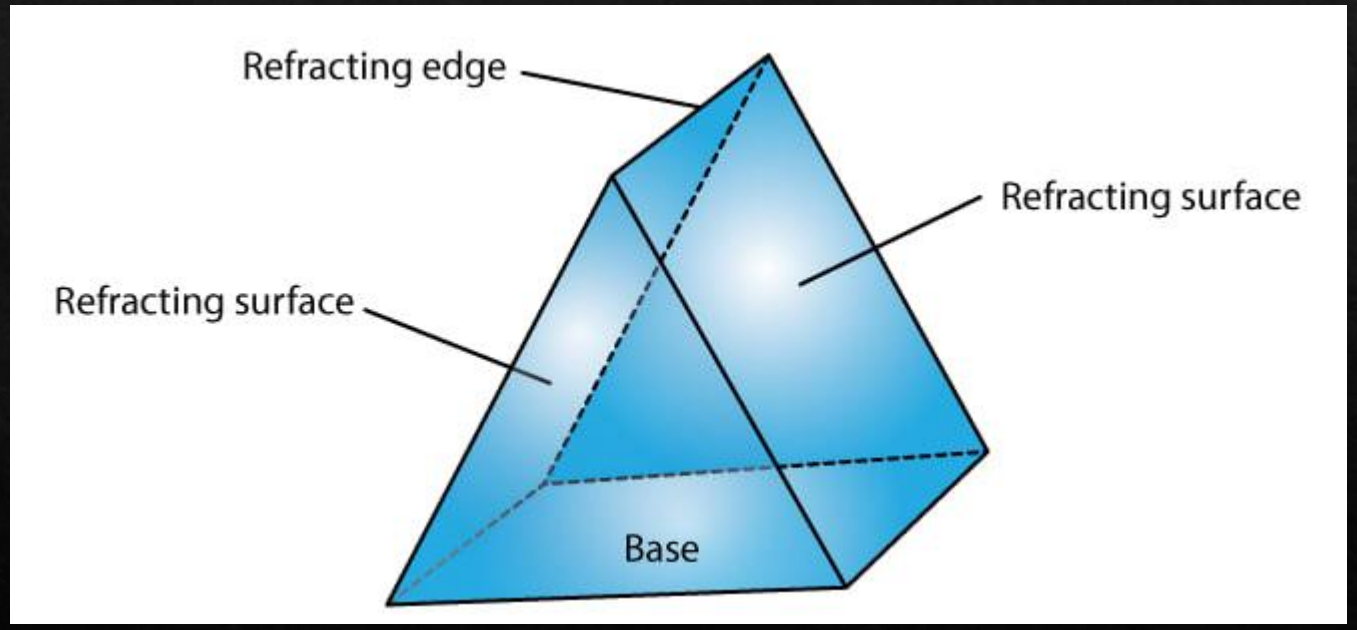
The vision of person becomes blurred because he is not able to focus on both horizontal aswell as vertical lines simultaneously.

Cause - → Irregular shape of cornea
→ Imperfect spherical nature of eye lense.

Correction - Corrected by using spectacles having cylindrical lens.

Prism

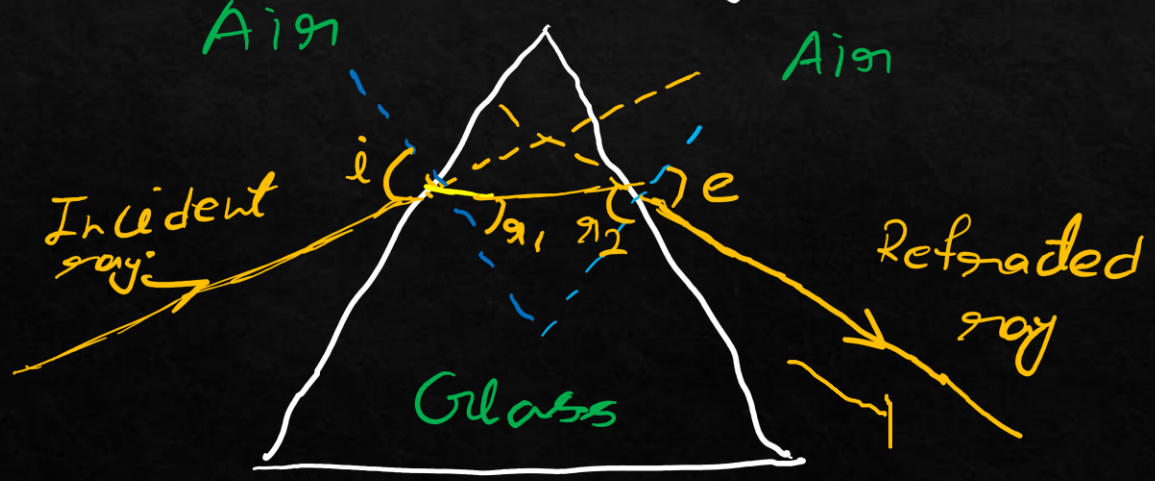
A prism is a transparent medium bounded by five plane surface.



Prism

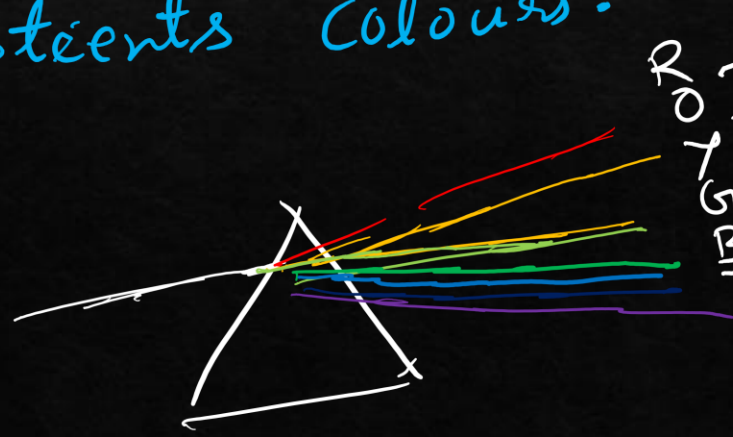
Refraction through prism

↳ When light passes through prism it gets deviate as -

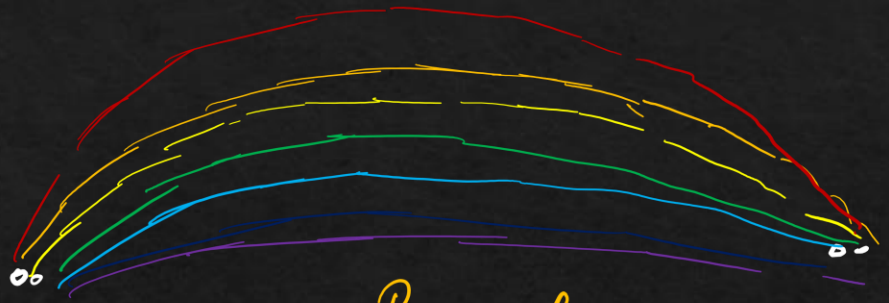


Dispersion of white light beam by prism

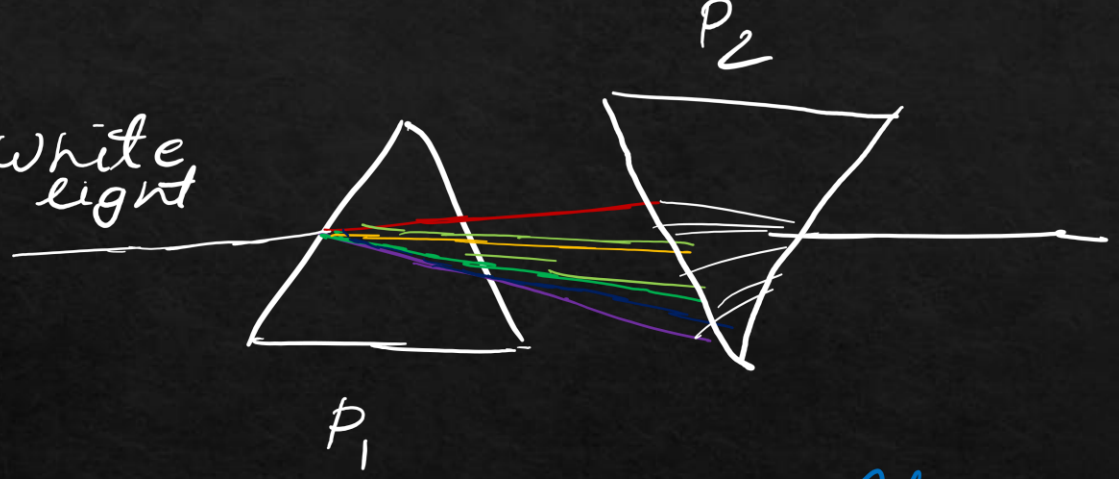
↳ Splitting of white light by prism into its constituents colours.



R — Red
O — Orange
Y — Yellow
G — Green
B — Blue
I — Indigo
V — Violet

① 

Rainbow.



② Rainbow ⟶ Sky ⟶ after rain

⟶ Always formed in opposite direction to the sun.

↳ caused due to dispersion of white light by tiny water droplets in Atmosphere.

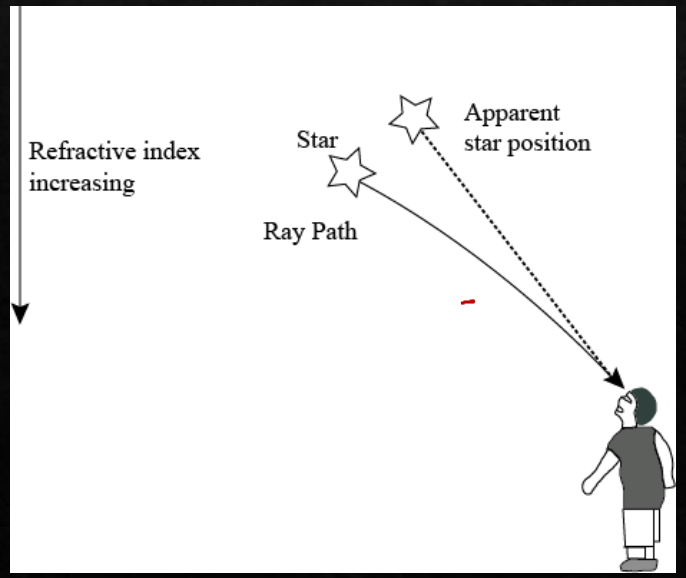
Atmospheric Refraction –

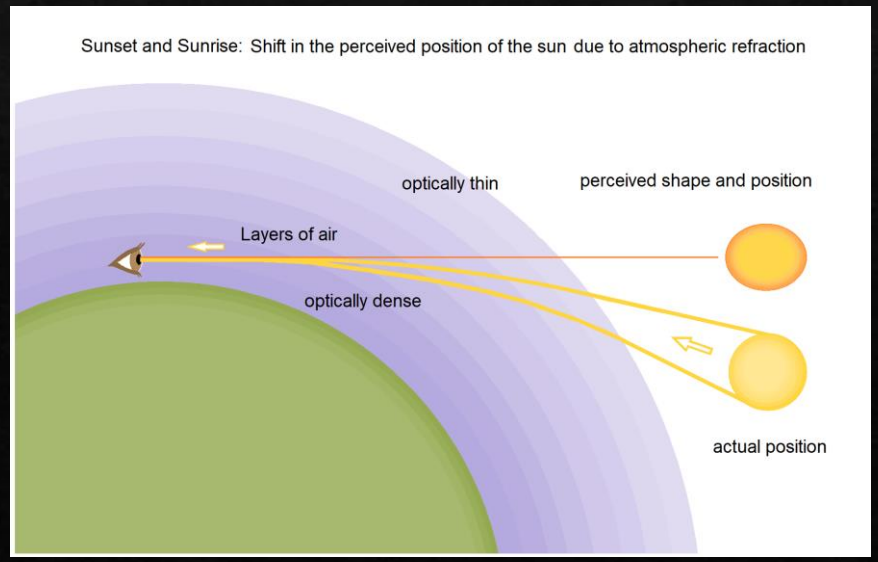
It is defined as "Refraction of light by earth's atmosphere."

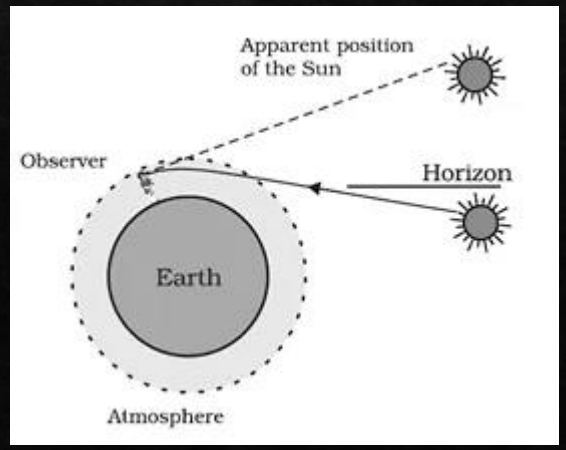
① Twinkling of Stars

② Oval shape of sun in morning & Evening

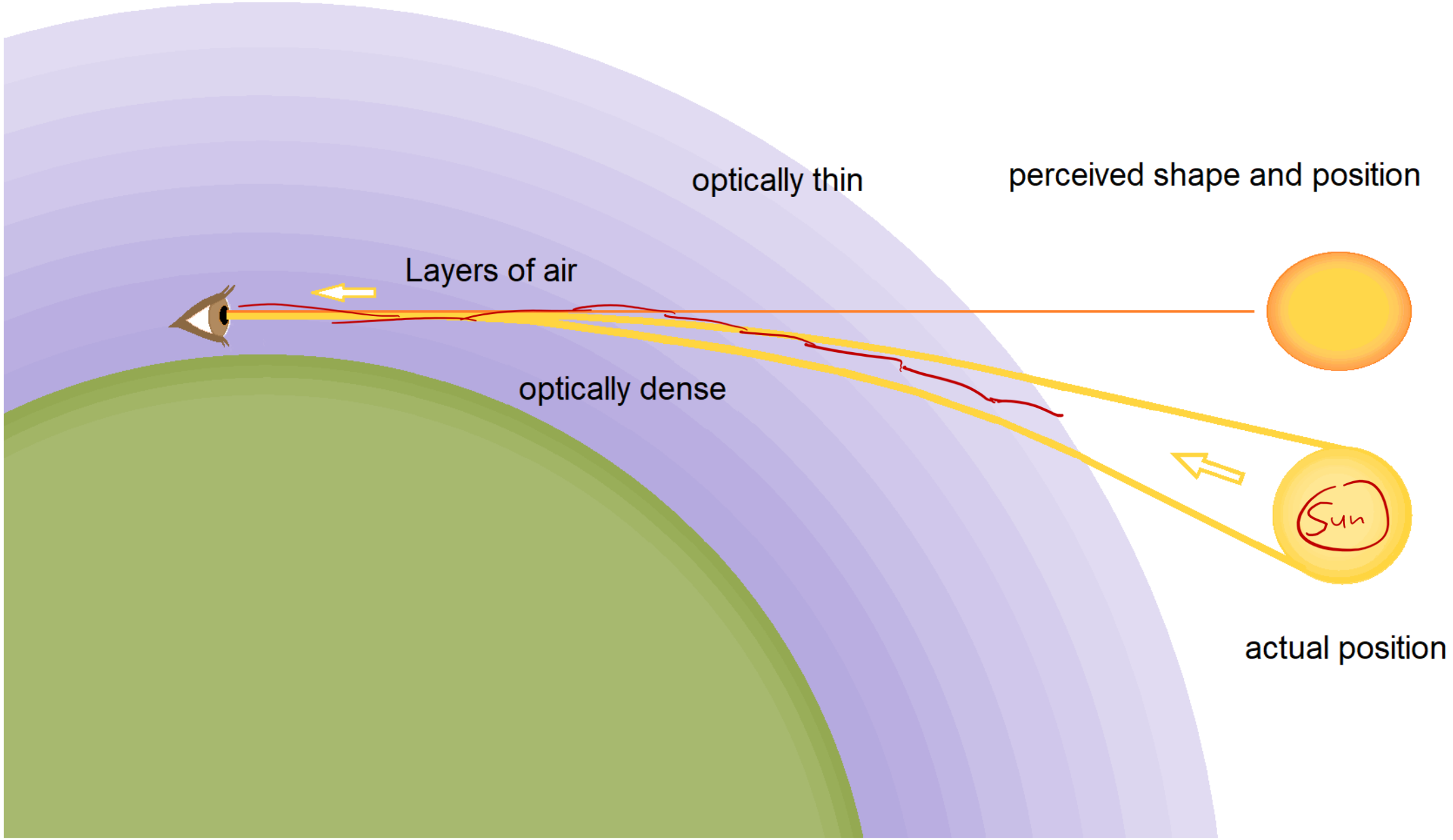
③ Duration of Sun's Visibility







Sunset and Sunrise: Shift in the perceived position of the sun due to atmospheric refraction



③ - Tyndal Effect.

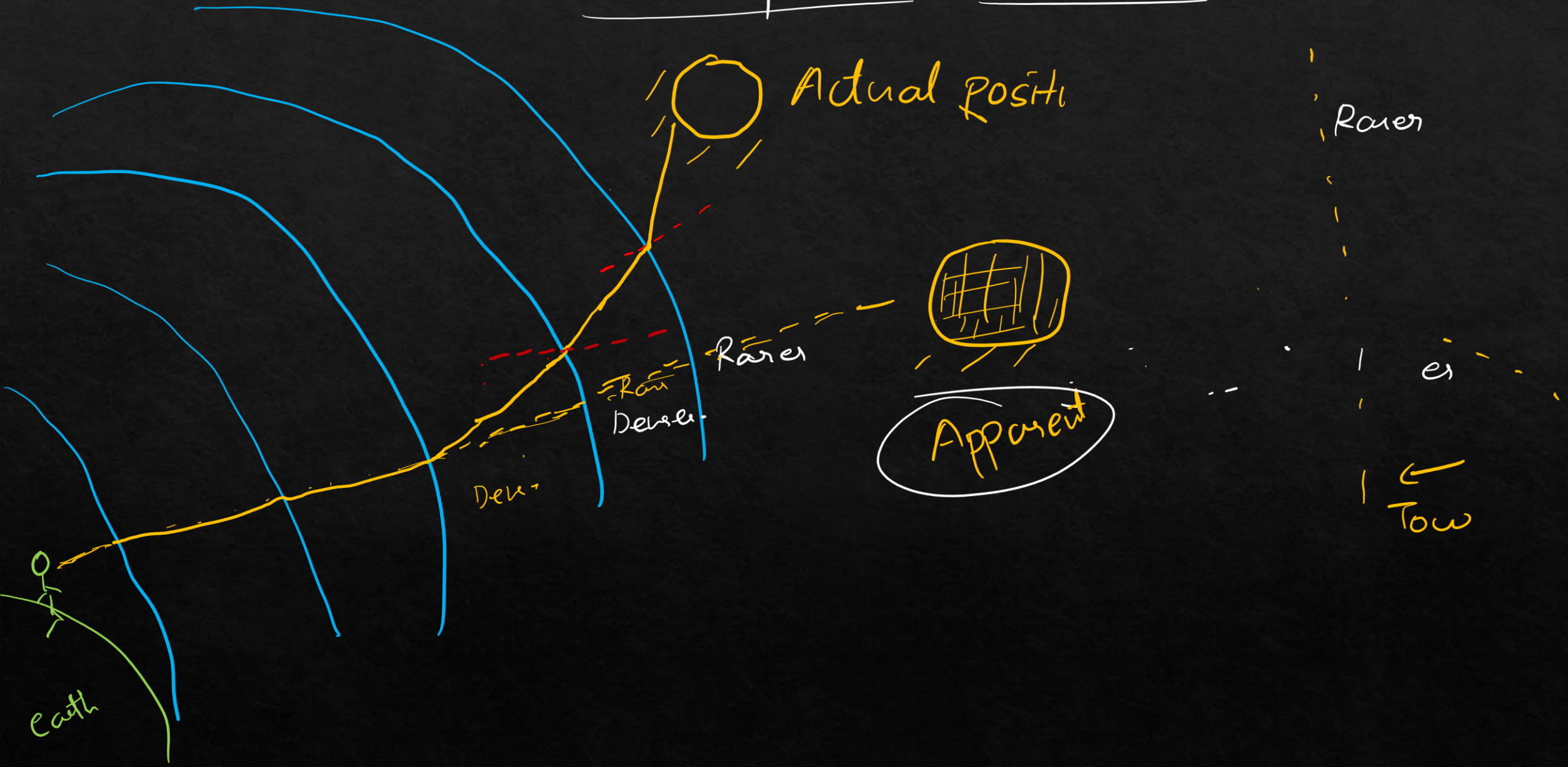
① - Atmosphere Refraction -

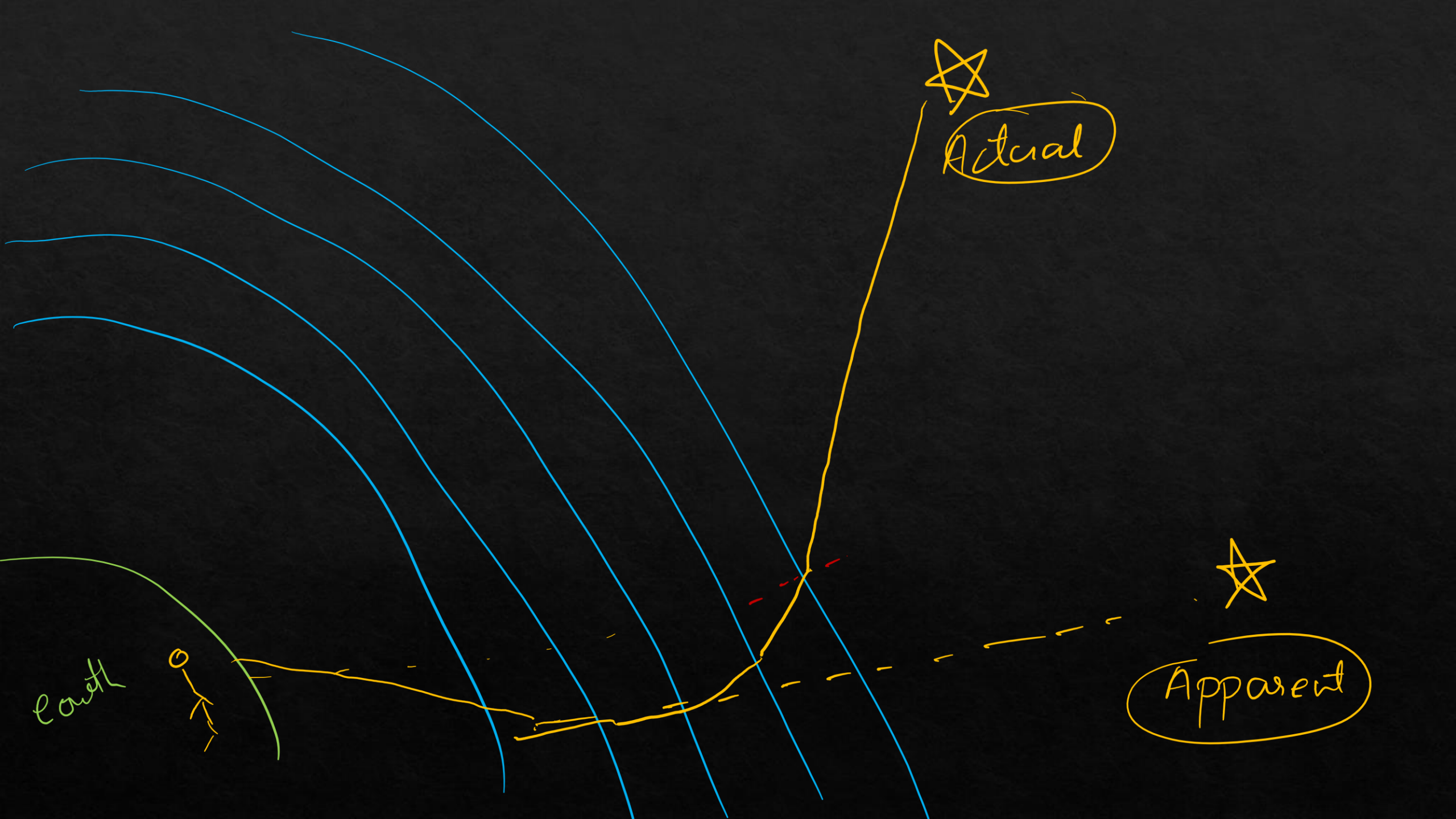
1. Twinkling of Star.
2. Oval of sun in Morning & Evening.
3. Duration of Sun's Visibility.

② - Scattering of light. → Traffic signal - Red.

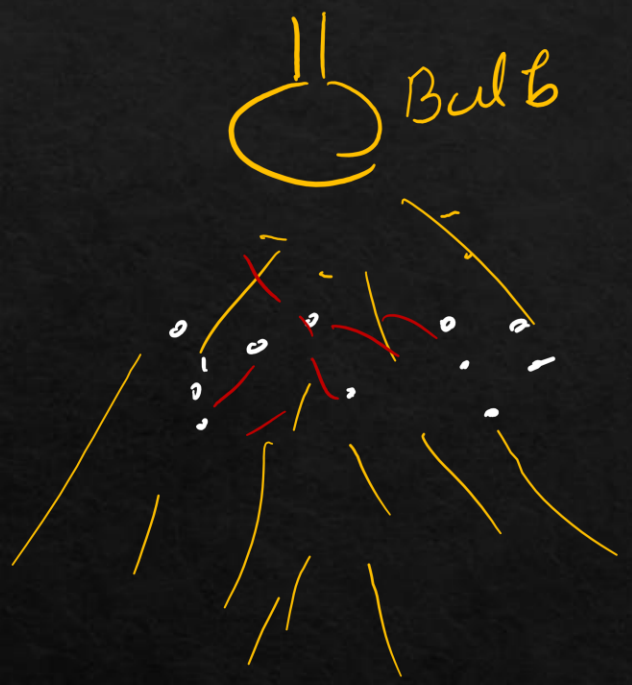
1. Blue colour of Sky.
2. Reddish Colour Sun at Sunset and Sunrise.

Atmospheric Refraction




Actual
Apparent
Earth

Scattering of light -



फैलना

light red

Dark Red

medium

molecule

Collision

Spread

Light Wavelength ⟶ Scattering ↓↓

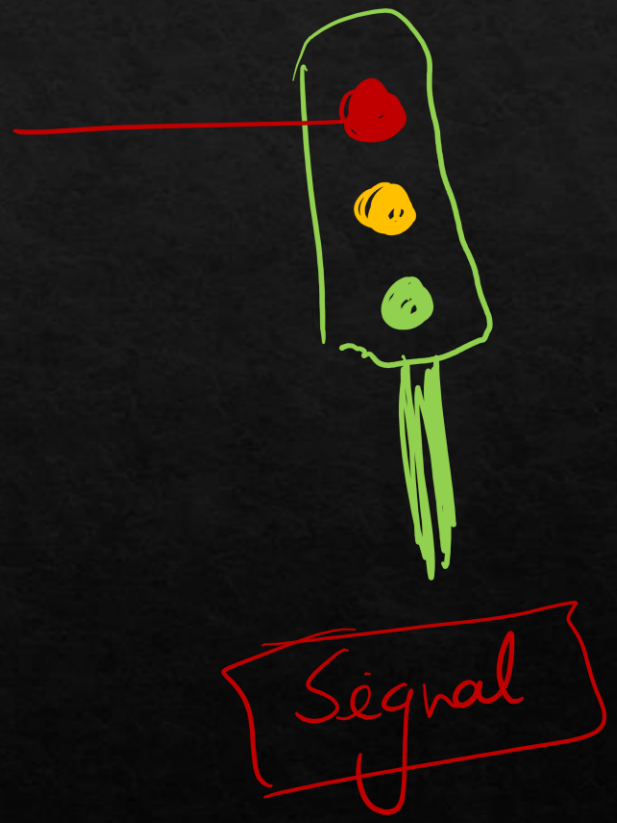
Light wavelength ↓↓ ⟶ Scattering ↑↑

(1)

(2) - Blue colour of Sky -

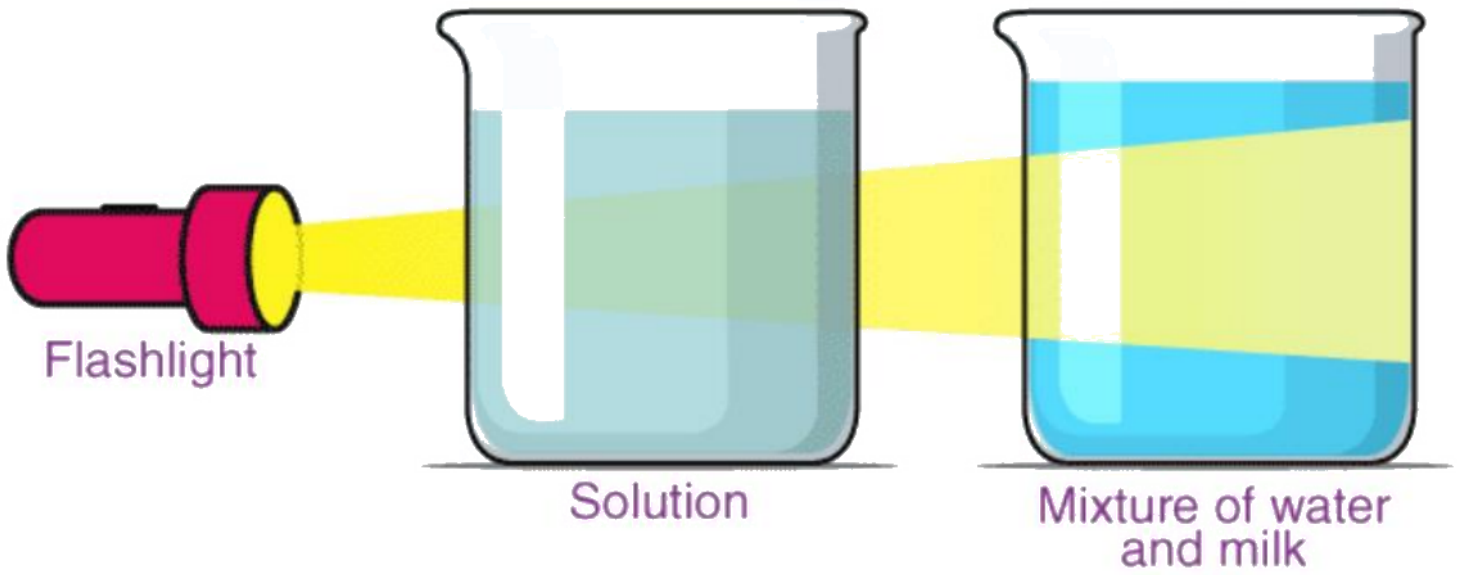
(3) Sun → morning & Evening

↳ Red.



The Tyndall effect is the phenomenon in which the particles in a colloid scatter the beams of light that are directed at them. This effect is exhibited by all colloidal solutions and some very fine suspensions. Therefore, it can be used to verify if a given solution is a colloid. The intensity of scattered light depends on the density of the colloidal particles as well as the frequency of the incident light.

When a beam of light passes through a colloid, the colloidal particles present in the solution do not allow the beam to completely pass through. The light collides with the colloidal particles and is scattered (it deviates from its normal trajectory, which is a straight line). This scattering makes the path of the light beam visible, as illustrated below.



- Milk is a colloid that contains globules of fat and protein. When a beam of light is directed at a glass of milk, the light is scattered. This is a great example of the Tyndall effect.
- When a torch is switched on in a foggy environment, the path of the light becomes visible. In this scenario, the water droplets in the fog are responsible for the light scattering.
- Opalescent glass has a bluish appearance when viewed from the side. However, orange-coloured light emerges when light is shined through the glass.

Colloidal Solution -

Solvent
Solute → Size

↓
milk

water

↓
Tyndal effect.

Collidal Solution.

Colloidal molecule