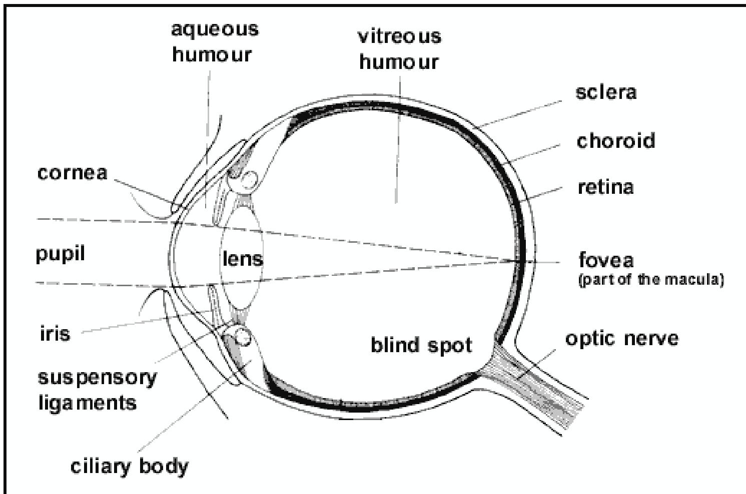
The human eye is one of the most valuable and sensitive sense organs. It enables us to see the wonderful world and the colours around us. Eye helps us to see near and distant objects clearly. Thus, of all the sense organs, the human eye is the most significant one as it enables us to see the beautiful, colourful world around us

Let us begin by learning the structure of the human eye.

Structure of human eye



Human eye is the most important organ of our body which is an optical device that serves as our organ of sight. The human eye is like a camera.

The Eye ball of the human eye is spherical in shape. Diameter of the eyeball is 2.3cm. Though there is a marginal difference in size in some people. It consists of a tough fibrous membrane called sclera that protects the internal parts of the eye.

Cornea:

- First part of eye is the Cornea.
- The cornea is located at the front portion of the eye.
- It is the transparent window that bulges outwards (having a convex shape).
- It is responsible for the maximum refraction (bending) of the light that enters the eye.

- Behind the cornea is a ring-shaped membrane called the iris.

Iris:

- Iris is the coloured part of the eye.
- The iris has an adjustable circular opening that is located at the centre of the iris, called the pupil.

Pupil:

- The pupil regulates and controls the amount of light entering the eye.
- A clear watery fluid called the aqueous humor fills the space between the cornea and the iris.
- Aqueous humor nourishes the cornea and the lens and gives the eye it's shape.
- Situated behind the iris and pupil is a colorless, transparent structure called the crystalline lens.

The lens

- It is made of a jelly type transparent material and is a biconvex structure.
- The eye lens forms an inverted real image of the object on the retina.

Retina:

- **The** screen of the eye, is referred to as retina because the light rays come through the pupil and passes through the lens and converges on a screen called retina.
- Retina is the light-sensitive inner lining of the back of the eye.

Suspensory ligament:

- The ciliary muscle and lens are supported by **the *suspensory ligament.***
- Suspensory ligaments are elastic-like structures present in the eye that helps to keep the lens in its position.
- The other end of the suspensory ligament is connected to the ciliary muscles.

Ciliary muscles

- It surrounds the lens.
- Ciliary muscles determine the shape of the lens.
- They help in adjusting the focal length of the lens by contraction or relaxing. Vitreous humour lies behind the lens and forms the bulk of the eye.
- It is a dense, clear, jelly like fluid which helps to maintain the shape of the eye and it also refracts light onto the retina.

Optic nerves:

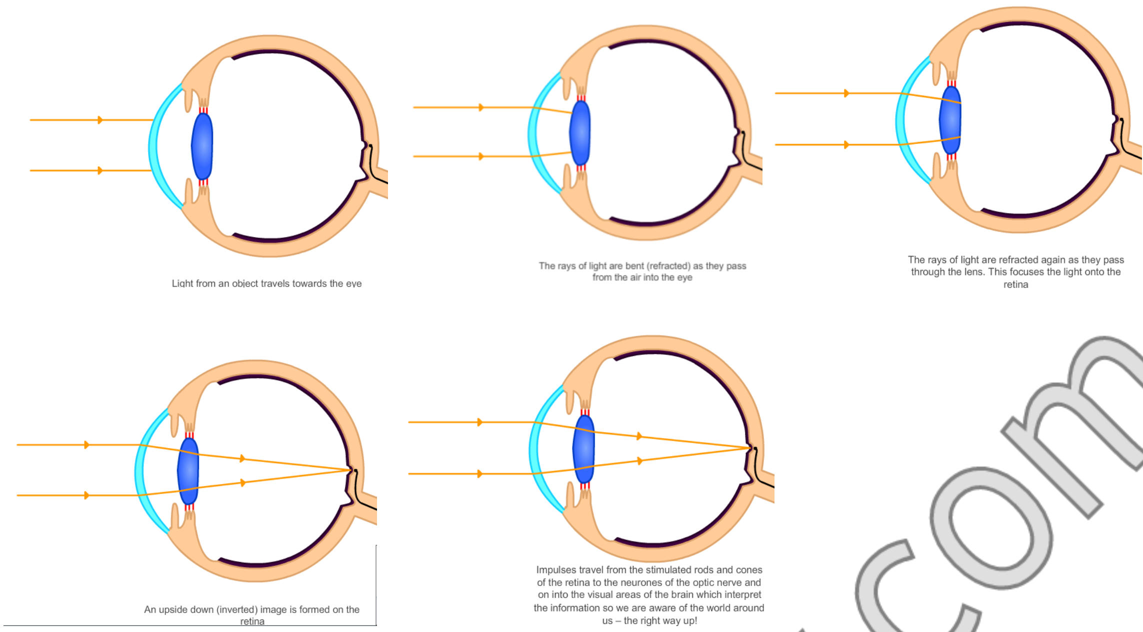
- There are some nerves that connect the retina with the brain and it is called the optic nerves.
- It is located at the back of the eye. Optic nerves are bundle of over one million nerves fibers that carry visual messages from the retina to the brain.

Blind spot: Blind spot is the small region where the optic nerve and the retina meet. It has no sensory organs.

Eyelids protect the eye from dust and other foreign particles.

Working of eye:

- Basic working of a human eye is similar to a camera.
- Light reflects off from the objects and enters the eyeball through a transparent layer of tissue at the front of the eye called the cornea.
- The cornea bends the light rays through the pupil – the dark opening in the center of the colored portion of the eye.
- The adjusted light passes through the eye's natural crystalline lens.
- Since the eye lens is convex in nature, the resulting image is real, small, and inverted. This image is formed on the retina.
- The retina converts these light rays into electrical signals that is relayed to the brain via the optic nerve. The brain processes the information it receives, so that in turn, we can see.



Role of iris and pupil:

- The eye works much the same as a camera.
- The shutter of a camera can close or open depending upon the amount of light needed to expose the film in the back of the camera.
- The eye, like the camera shutter, operates in the same way. The iris and the pupil control how much light to let into the back of the eye.
- The iris contains muscles that allow the pupil to become large and small.
- The iris actually regulates the amount of light entering the eye by adjusting the size of the pupil opening.
- If the amount of light rays incident on the eye is high, then the iris contracts thereby reducing the size of the pupil.
- This will reduce the intensity of light (allow only small amount of light to pass through the pupil) thus protecting our eyes from damage.
- Similarly, if the intensity of the incident light is low, then the iris widens and the pupil dilates or gets bigger so as to facilitate entrance of sufficient amount of light

thereby enabling us to view the image clearly.

- Iris monitors the amount of light entering our eye by changing the size of the pupil.
- In bright light, the iris closes (or contracts) and makes the pupil opening smaller to restrict the amount of light that enters your eye.

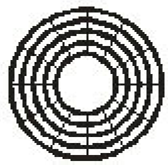
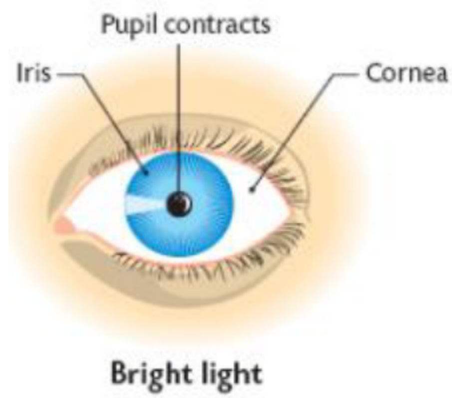


Fig: The iris in bright light



- In dim light, the iris expands (or dilates) and makes the pupil opening larger to increase the amount of light that enters your eye:

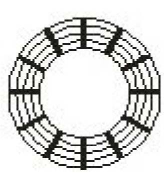
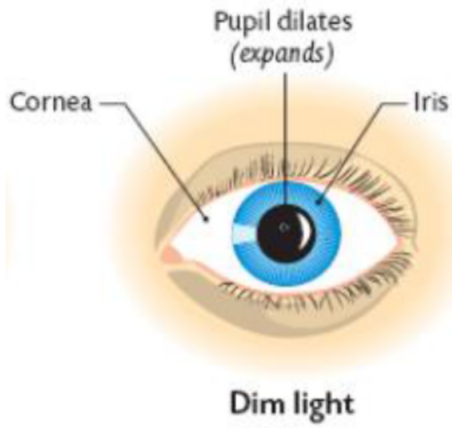


Fig: The iris in dim light



- But, it takes time for Iris and Pupil to change its size.

Why are we not able to see the things clearly when we come out of a darkroom Eg. While coming out of a movie hall?

When we are in dark, pupil size is bigger. As we come out of dark room, its size needs to become smaller. For that time-interval person is unable to see. Similarly, **we are not able to see objects clearly for some time when you enter from bright light to a room with dim light.**

When the light is very bright, the iris contracts the pupil to allow less light to enter the eye. However, in dim light the iris expands the pupil to allow more light to enter the eye. As we come out of bright room, its size needs to become larger. For that time-interval person is unable to see.

Power of accommodation:

- Is it possible to focus sharply on both near and distant objects?
- We can adjust the lens in our eyes to produce sharp images of both near and distant objects. This ability is called accommodation.
- What exactly happens during accommodation?
- The rays of light coming into the eye from a close object for example a book you are reading tend to be travelling differently to the rays of light from an object that are distant e.g., sun, stars etc.
- The rays of light which reach your eye from a close object tend to be spreading out

– they are diverging. As a result, they need a lot of bending to bring them into focus on your retina.

- When we are viewing a distant object like the stars, the rays of light are travelling as almost parallel rays. As a result they need less bending to bring them into focus on your retina.
- Whether the close or at a distance, the image is formed on the retina in both the cases.

We have learnt the formula of lens in our earlier chapter

$$1/v-1/u= 1/f$$

Where, 'v'= image distance.
When the object is at a distance (i.e.,far), then image distance =2.3cm(diameter of eyeball)
When object is close, then the image distance= 2.3cm(diameter of the eyeball)(distance between lens n image)

As the image is formed on the retina in both the cases. Therefore, we can say that the image distance will be the same in every case = 2.3cm

Therefore, 1/v is constant.

Now, From the formula, we know 'u'=object distance.

This is variable because when the object is far, then 'u' will be more similarly when the object is near, then 'u' will be less.

As 'u' is variable, the focal length 'f' in

1/v-1/u= 1/f is variable.

This implies that the **Focal length of eye lens should change as distance of object from eye changes.**

How does the focal length change or how does lens change shape?

The focal length changes by action of ciliary muscles. The crystalline lens is surrounded by circular muscles called the ciliary muscles. These muscles are attached to the lens by the suspensory ligaments. These ligaments do not stretch or give. The ciliary muscles contract or relax in response to the type of light entering the eye:

Light from distant objects: The ciliary muscles relax, the suspensory ligaments are pulled tight and this in turn pulls the lens long, thin and relatively flat. This is the original shape of the lens.

Light from close objects: As object comes closer to eye, the ciliary muscles contract, the suspensory ligaments go slack and the lens becomes shorter and fatter. This changes the focal length.

Power of accommodation or Accommodation is the power of eye to change its focal length so that it can see both near and distant objects.

i) Focusing on a nearby object

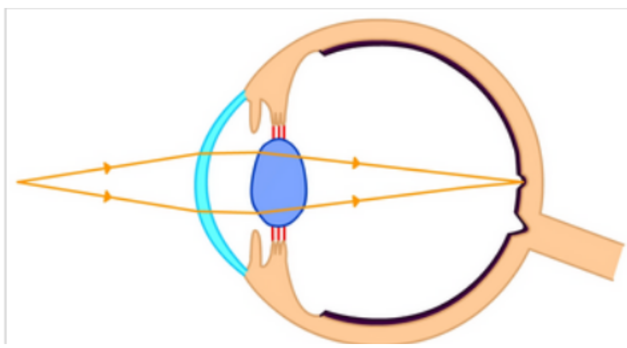


Fig: The lens becomes rounder(more convex)

Light rays are diverging so still need lots of bending when they reach the lens. Lens becomes shorter, fatter and much more convex (rounded) so that it can bend the light to bring it into focus on the retina.

ii) Focusing on a distant object

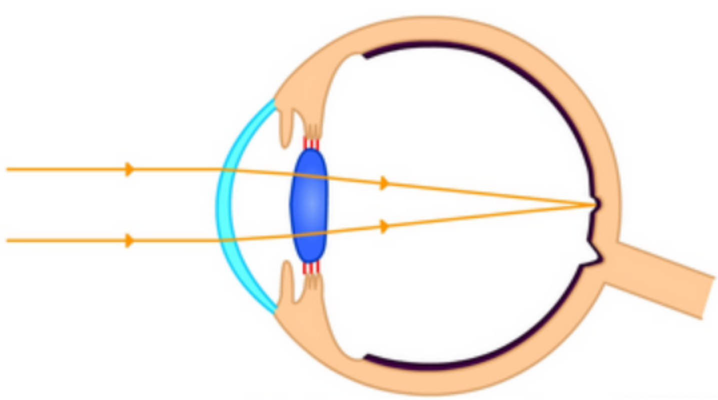


Fig: The lens becomes flatter(less convex)

Light rays almost parallel so need little more bending to bring them into focus on the retina once they have passed through the front of the eye. Lens stretched long, thin and relatively flat so it has little effect.

While referring to the accommodation of the eye, we should remember that there is a limit for the ciliary muscles to contract.

If an object comes very close to eye in the range of 25cm then ciliary muscles do not contract anymore. This ceases the change in focal length. So, vision is not clear.

We can see an object clearly only if it is lies from infinity to 25cm.

Near point- Near point or least distance of distinct vision is the point nearest to the eye at which an object is visible distinctly.
For a normal eye the least distance of distinct vision is about 25 centimetres.
However, it varies with age of the person. For example, for infants it is only 5 to 8 cm.

Far Point

Far point of the eye is the maximum distance up to which the normal eye can see things clearly. It is infinity for a normal eye.

Defects of eye and correction:

A normal eye can see all objects over a wide range of distances i.e., from 25 cm to infinity. But due to certain abnormalities the eye is not able see objects over such a wide range of distances and such an eye is said to be defective. Some of the defects of vision are

1) **Myopia or shortsightedness/near sightedness**
2) **Hypermetropia or long sightedness**
3) **Presbyopia**
4) **Cataract**

Myopia: Myopia is also known as **near-sightedness**. A person with myopia can see near objects clearly while distant objects appear blurred. In such a defective eye, the image of a distant object is formed in front of the retina and not at the retina itself. Consequently, a nearsighted person cannot focus clearly on an object farther away than the far point for the defective eye.

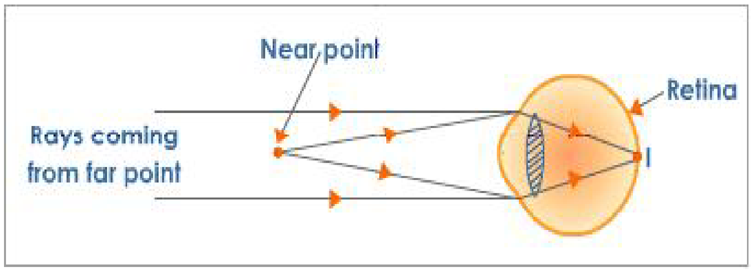
***Causes*:**

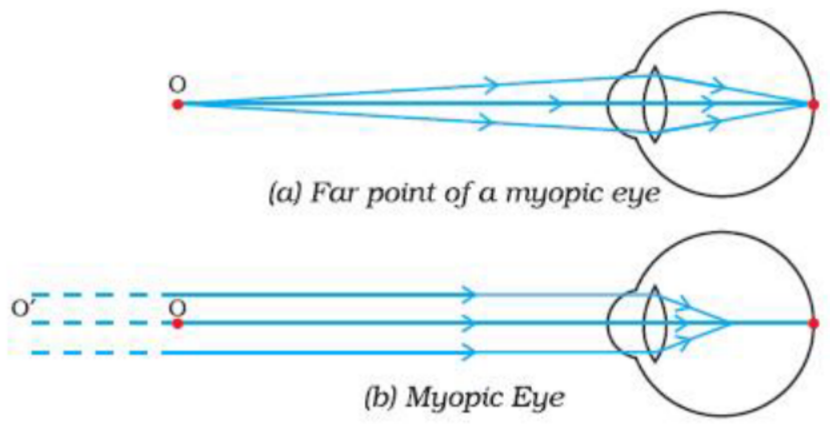
This defect arises because the power of the eye is too great due to the decrease in focal length of the crystalline lens. This may arise due to either

(i) Excessive curvature of the cornea, ie., Converging power of lens increases

(ii) Elongation of the eyeball, that is, the distance between the retina and eye lens is increased.

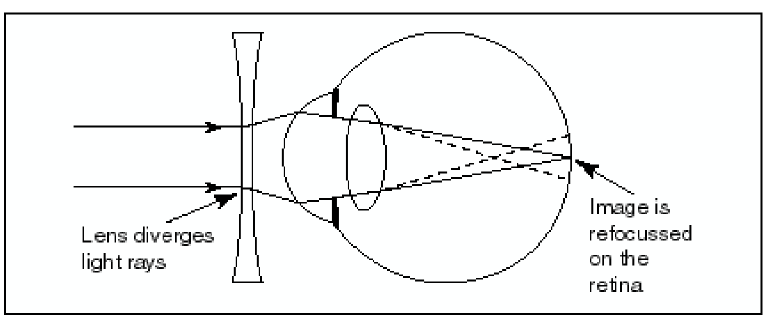
Normal Eye





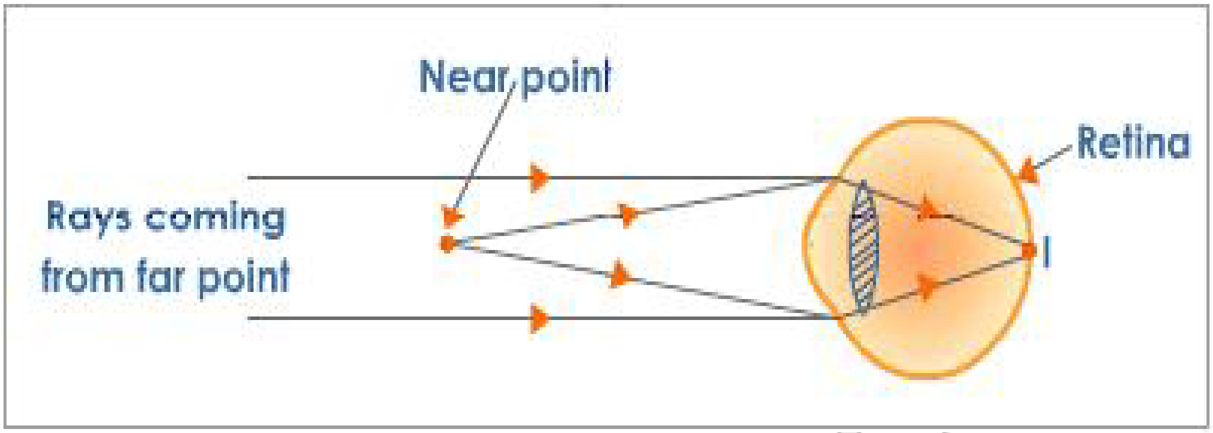
Correction **:-**

This *defect* can be *corrected* by using a *concave (diverging*) lens. A concave lens of appropriate power or focal length is able to bring the image of the object back on the retina itself.



Hypermetropia: Hypermetropia is also known as **far-sightedness**. A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point, for the person, is farther away from the normal near point (25 cm).

Normal Eye



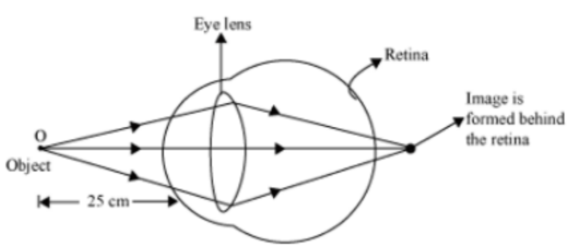
Causes of Hypermetropia

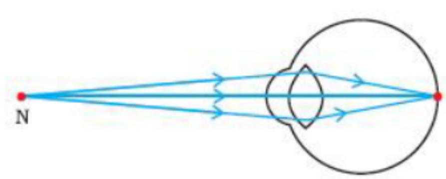
Hypermetropia is caused due to the following reasons:

(i) Increase in focal length of the eye lens i.e., the focal length of the eye lens is too longi.e., the converging power of lens decreases

(ii) The eyeball becomes too short, so that light rays from the nearby object, cannot be brought to focus on the retina to give a distinct image.

Hypermetropic Eye

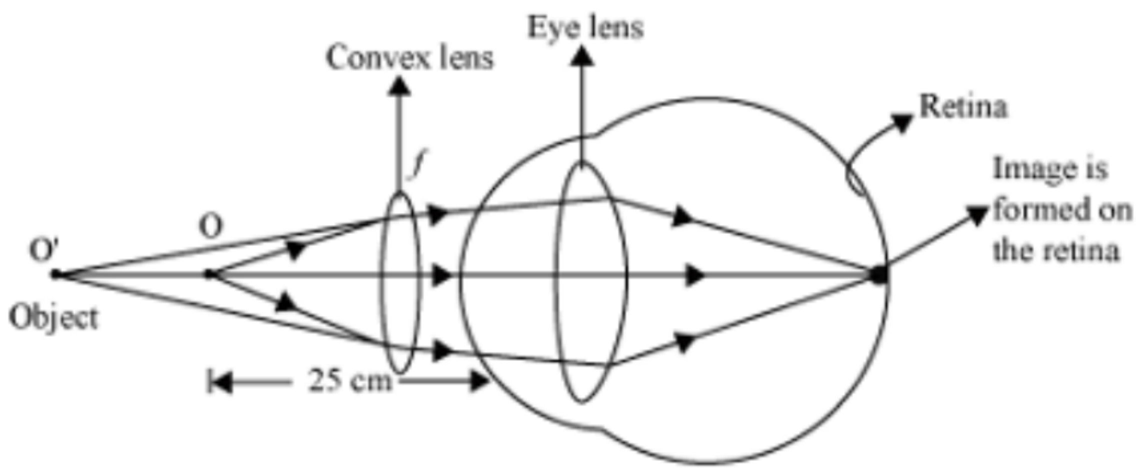




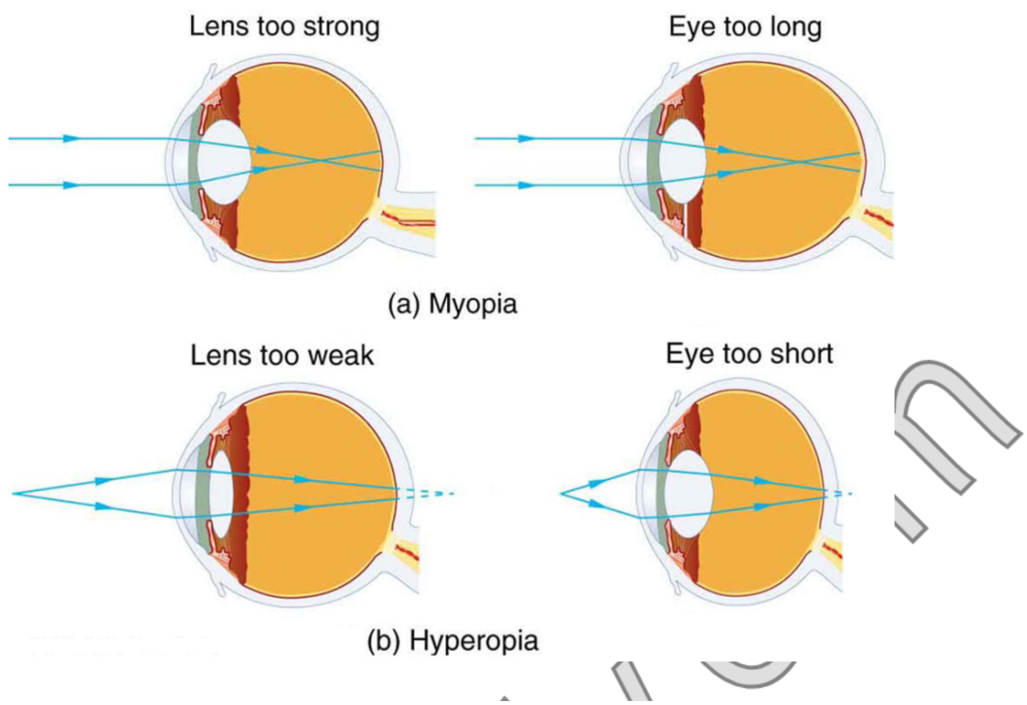
(a) Near point of a Hypermetropic eye

Correction:

This defect can be corrected by using a convex(*converging*) lens of appropriate power. Eye-glasses with converging lenses provide the additional focusing power required for forming the image on the retina. Converging lens increases the converging power of the eyelens.



Type of person	**Far point**	**Near point**
Normal	infinity	25cm
Myopic person	Less than infinity	25cm
Hypermetropia	infinity	greater than 25cm

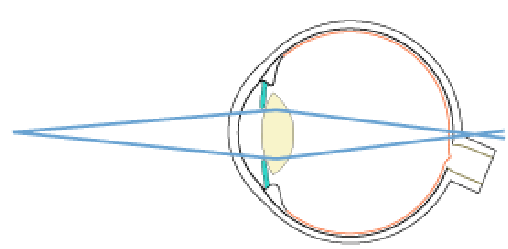


Presbyopia:

Presbyopia, progressive form of farsightedness that affects most people by their early 60s. The power of accommodation of the eye decreases with ageing. Most people find that the near point gradually recedes.

Causes:

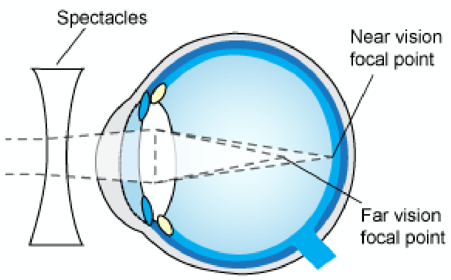
It arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the crystalline lens.

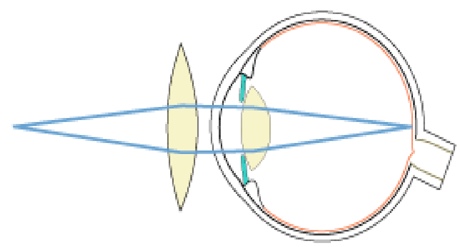


Presbyopia - The image of a near object focuses behind the retina.

Correction:

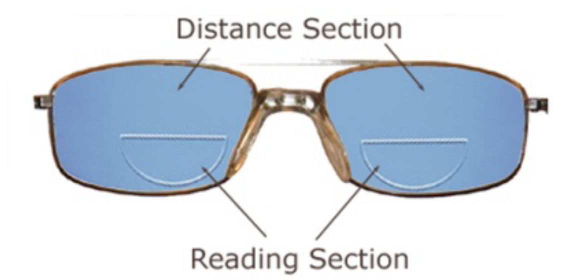
Simple reading eyeglasses with convex lenses correct most cases of presbyopia. Sometimes, a person may suffer from both *myopia* and *hypermetropia*. Such people often require *bi-focal lenses*. In the bi-focal lens, the upper portion of the bi-focal lens is a concave lens, used for distant vision. The lower part of the bi-focal lens is a convex lens, used for reading purposes.



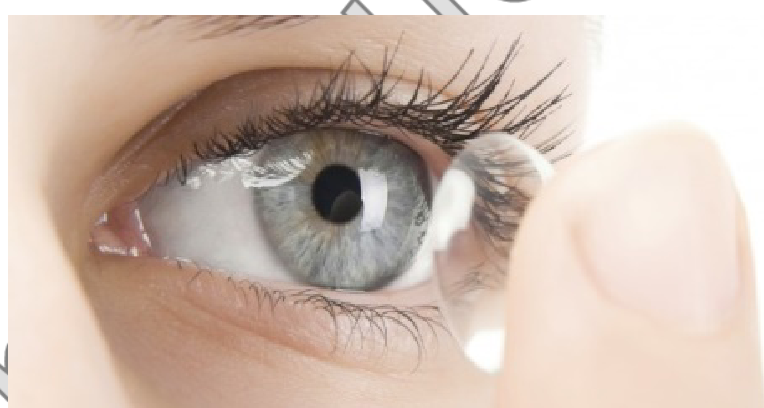


Correction for presbyopia - A plus lens focuses the image on the retina.

Bifocal glasses



These days, it is possible to correct the refractive defects with contact lenses or through surgical interventions

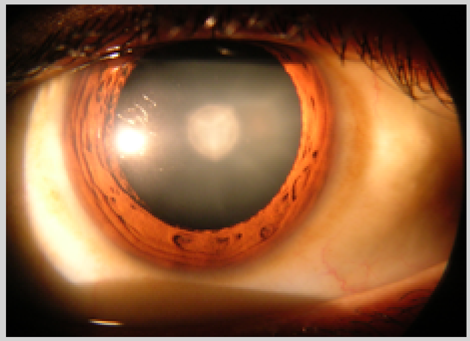


Cataract-

- Cataract is a condition of partial or complete loss of vision.
- During old age, the crystalline lens of some people becomes milky and cloudy.
- This causes partial or complete loss of vision. It is possible to restore vision through a cataract surgery.

- In this surgery, the cloudy lens is removed and replace with an artificial lens.

Cataract

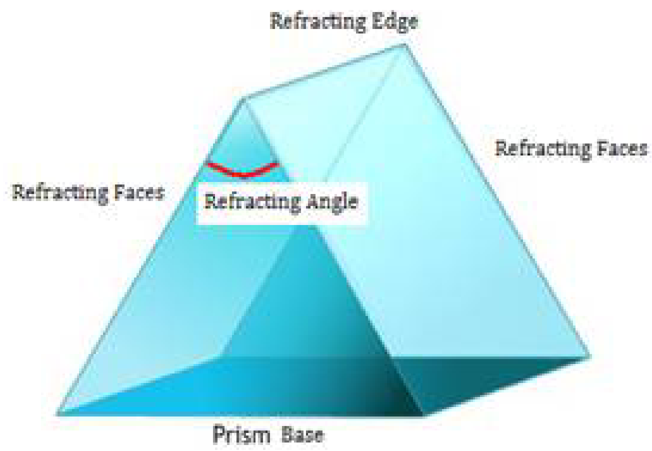


Why do we have two eyes for vision and not just one?

There are several advantages of our having two eyes instead of one. It gives a **wider field of view**. A human being has a horizontal field of vision of about 150 degrees with one eye and of about 180 degrees with two eyes.

This gives a **better judgment of distance of object**. The ability to detect faint objects is, of course, enhanced with two detectors instead of one. As our eyes are separated by a few centimetres, each eye sees a slightly different image

Glass prism



- A triangular glass prism is a transparent object made of glass having two triangular bases and three rectangular lateral surfaces.
- These surfaces are inclined to each other. The angle between its two lateral faces is called the **angle of the prism**.
- The rectangular sides of a glass prism are not parallel to each other but the triangular ends are parallel.
- The refraction of light through the rectangular sides of the prism (which are not parallel to each other) is different in behavior than the refraction of the ray through a rectangular slab (where faces are parallel).
- The refraction of a glass prism is always studied through its rectangular sides (the inclined sides).

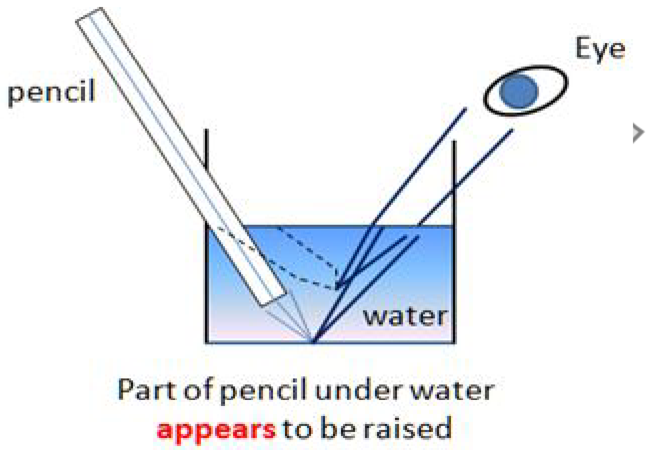
Refraction of light through prism:

Refraction:

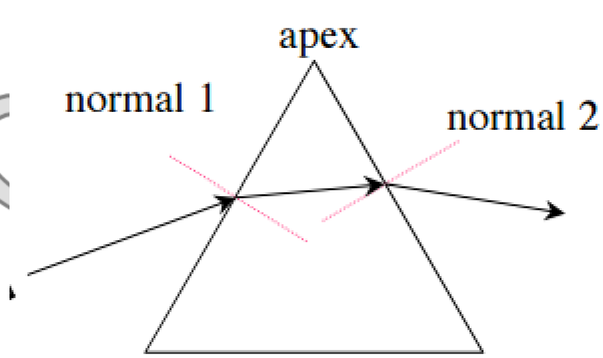
Light not only bounces off surface it goes through some of them often slowing down and changing direction in the process called refraction. The process of bending of light ray, which is travelling from one medium to another medium is called refraction.
Light ray passing from one medium (air) to another medium bends and travels. It occurs at the point where light travels from one medium to another of different density.

Example: Pencil immersed in water appears as if it was bent. When you take out the pencil from the water you will not observe any bends.

The light ray coming from the object bends and comes to form an image in our eye, hence will look as if it was bent.



The incoming ray is refracted, and curves towards the normal 1, it is then transmitted through the prism, until it reaches the other surface, and refracted again, away from the normal 2. The end result is always that the ray is deflected away from the apex of the prism

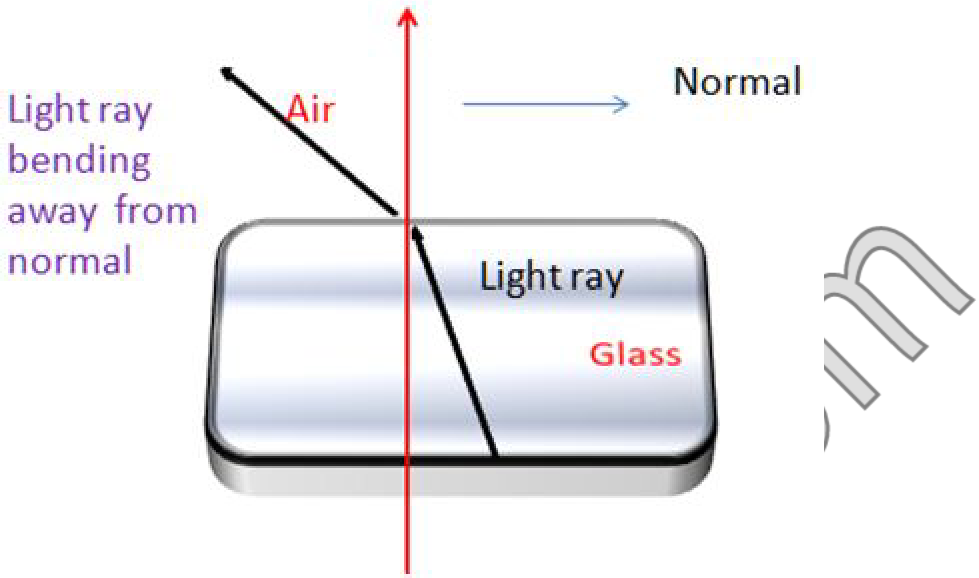


Any object that has a lower refractive index, then it is **called rarer medium**

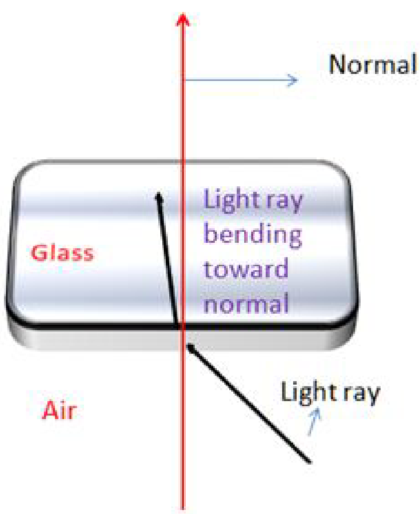
Any object that has a larger refractive index, then it is **called denser medium.**

Refraction of light when it moves from denser to rarer medium:

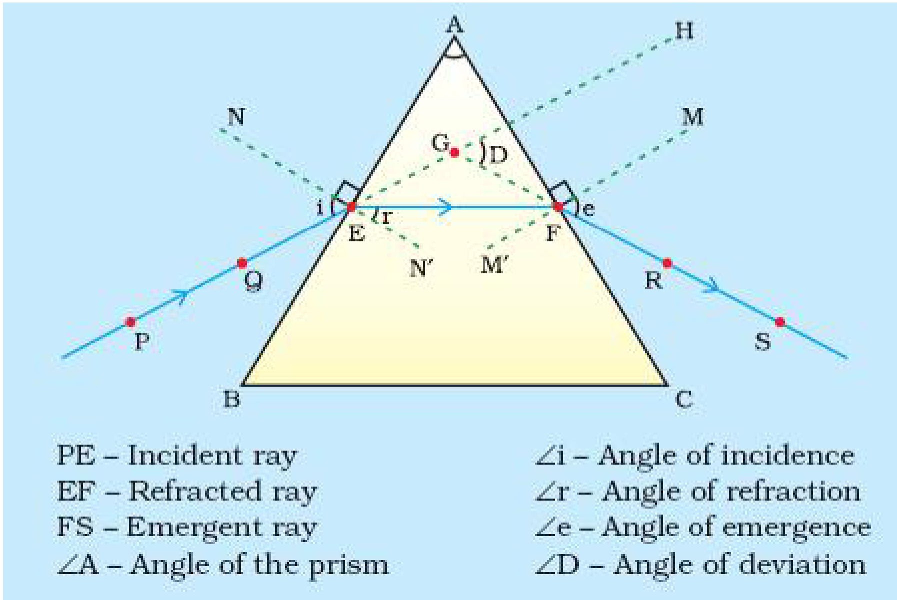
When light passes from a more dense to a less dense substance, (for example passing from water into air), the light is refracted (or bent) away from the normal. (Air - rarer medium, Glass - denser medium.)



When light passes from a less dense to a more dense substance, (for example passing from air into water), the light is refracted (or bent) towards the normal in the denser medium. (Air - rarer medium, Glass - denser medium.)



Refraction of light through prism:



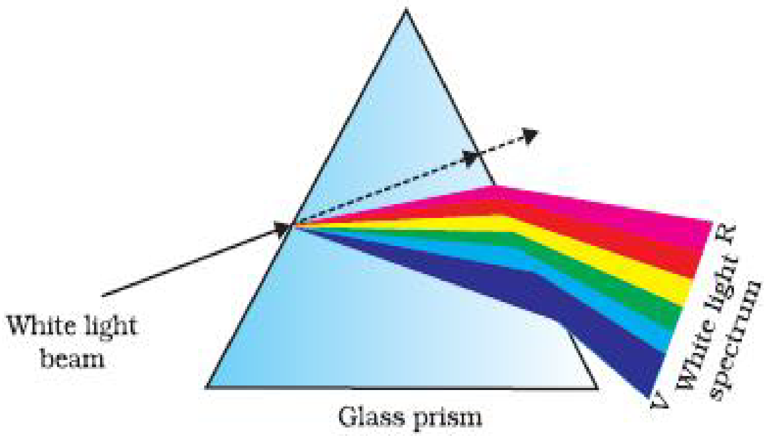
- We can see that a ray of light is entering from air to glass at the first surface AB.
- The light ray on refraction has bent towards the normal.
- At the second surface AC, the light ray has entered from glass to air. Hence it has bent away from normal.
- The peculiar shape of the prism makes the emergent ray bend at an angle to the direction of the incident ray.
- This angle is called **the angle of deviation**. In this case ∠D is the angle of deviation.

Difference in refraction of light through glass prism and glass slab

Glass slab has parallel refracting surfaces while a glass prism does not have parallel refracting surfaces. Therefore, In case of glass slab, the incident ray emerges parallel to the emergent ray, while in case of prism; the incident ray makes an angle with the emergent ray, i.e. angle of deviation. (so, its not parallel)

Dispersion of light

Newton proved that white light is made up of 7 colours namely VIBGYOR. He proved it by using a glass prism

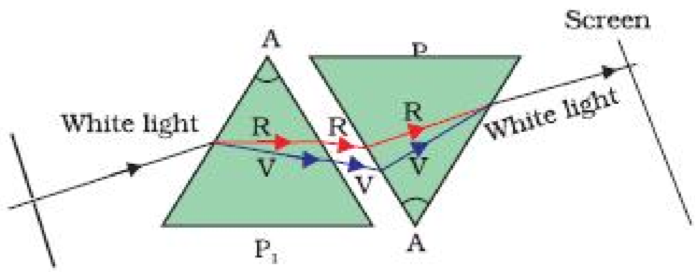


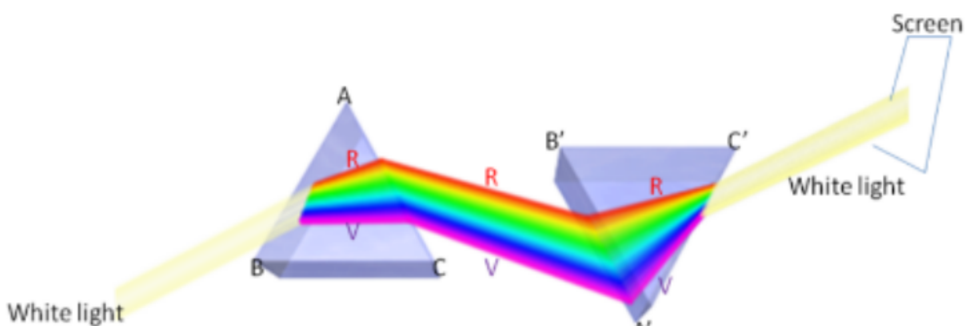
- When a beam of white light is passed through a glass prism, it is split up into a band of colours called **spectrum.** This phenomenon is called **dispersion of white light.**
- The spectrum of white has the colours violet, indigo, blue, green, yellow, orange and red (VIBGYOR).
- He allowed sunlight to pass through the prism. He saw the white light was split into 7 different colours.
- We can define dispersion as the splitting of white light into 7 colours on passing through a transparent substance like glass prism is called dispersion of light.
- The sequence of seven colours obtained from dispersion of white light is called spectrum of white light.

You have seen that white light is dispersed into its seven-colour components by a prism. Why do we get these colours? Different colours of light bend through different angles with respect to the incident ray, as they pass through a prism(on refraction). The red light bends the least while the violet the most. Thus the rays of each colour emerge along different paths and thus become distinct. It is the band of distinct colours that we see in a spectrum.

Isaac Newton was the first to use a glass prism to obtain the spectrum of sunlight. He tried to split the colours of the spectrum of white light further by using another similar prism. However, he could not get any more colours. He then placed a second identical prism in an inverted position with respect to the first prism. This allowed all the colours of the spectrum to pass through the second prism. He found a beam of white light emerging from the other side of the second prism. This observation gave Newton the idea that the sunlight is made up of seven colours. Any light that gives a spectrum similar to that of sunlight is often referred to as white light.

Recombination of the seven colours of the dispersed white light to get white light is known as **Recomposition of light**.





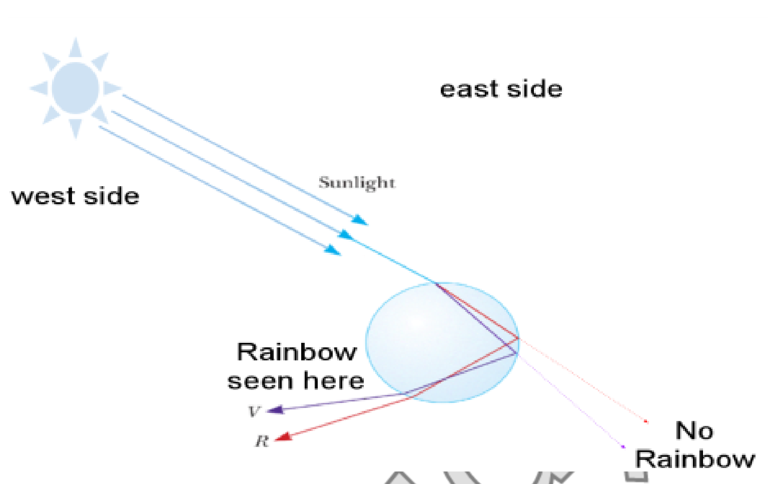
Application of dispersion

i) **Formation of Rainbow**- Rainbows are generally formed after rains. It is a concentric coloured circular arc in the sky when the sun rays fall on rain drops during or after a shower.

- The small droplets of rain water which remain suspended in air just after the rains act like a prism. The white light enters from air to water medium.
- When white light from the sun enters a spherical raindrop, the light is refracted and dispersed. The different colours of light are bent through different angles.
- When different colours of light fall on the back inner surface of the water drop, it (water drop) reflects them (different colours of light) internally(total internal reflection).

- The water drop finally refracts the different colours of light again when it comes out of raindrop.
- Due to the dispersion of light and internal reflection, different colours reach the observer's eye, and the observer can see a rainbow.

Rainbow is formed opposite to the sun. Raindrops act like prism. Rainbow is an example of natural dispersion



Atmospheric refraction:

- When light ray travels from one medium to another, there is bending of the ray. This happens because the two mediums have different refractive index.
- Let us now consider the medium air. Air can be cold as well as hot. When air is hot, its refractive index is less whereas when air is cold, its refractive index is more.
- We can thus say that **the refractive index of air depends on temperature**.
- Therefore, during winter, the air is cold therefore refractive index of air will be more and in summer , the air is hot and therefore it's the refractive index is less.

Let us now consider a situation where in light rays moves from hot air towards cold air, what happens to the light ray? Does it bend?

Here we can see that there is bending of the light ray because the refractive index of hot air and cold air is different.

Similarly, when light rays travels from space to reach the surface of earth, it travels through a layer of atmosphere. The temperature of the atmosphere varies at different places. It has varying temperature thus has varying refractive index.

When a light ray enters the atmosphere, there is refraction of the light ray and hence travels along a curved path as there is continuous change of temperature in the atmosphere, so the ray undergoes continuous refraction.

Therefore, we can say that path of light is bending continuously due to continuous refraction. This is **called atmospheric refraction.**

Variation of temperature is different at different times. This results in change in path of light at different times.

Let take a look at some phenomena associated with atmospheric refraction.

1) Apparent position of stars

2) Advance sunrise and delayed sunset.

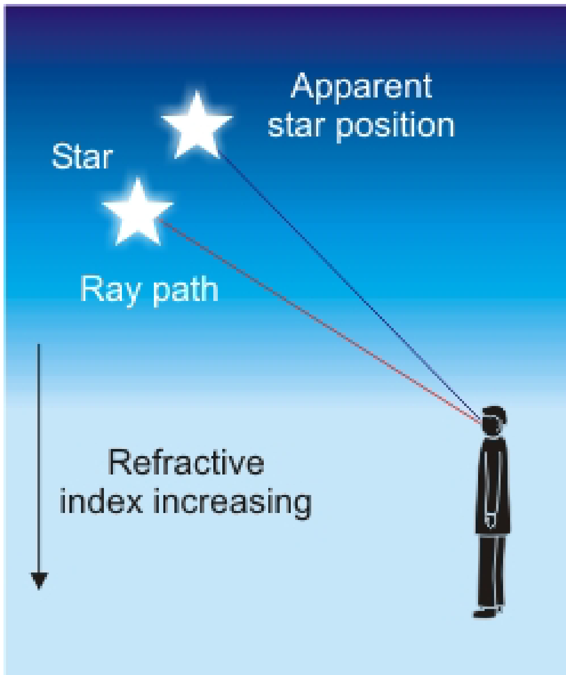
3) Twinkling of stars

4) Planets don’t twinkle

5) Flickering of flame

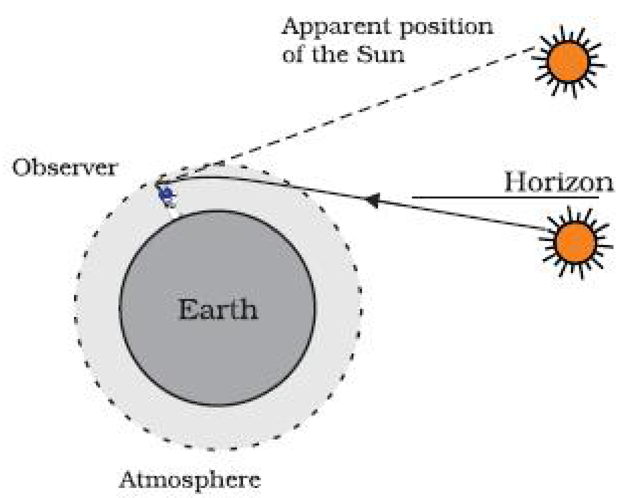
Let us learn about these phenomenon one by one in detail

1) **Why does the star appear slightly higher than its actual position?**



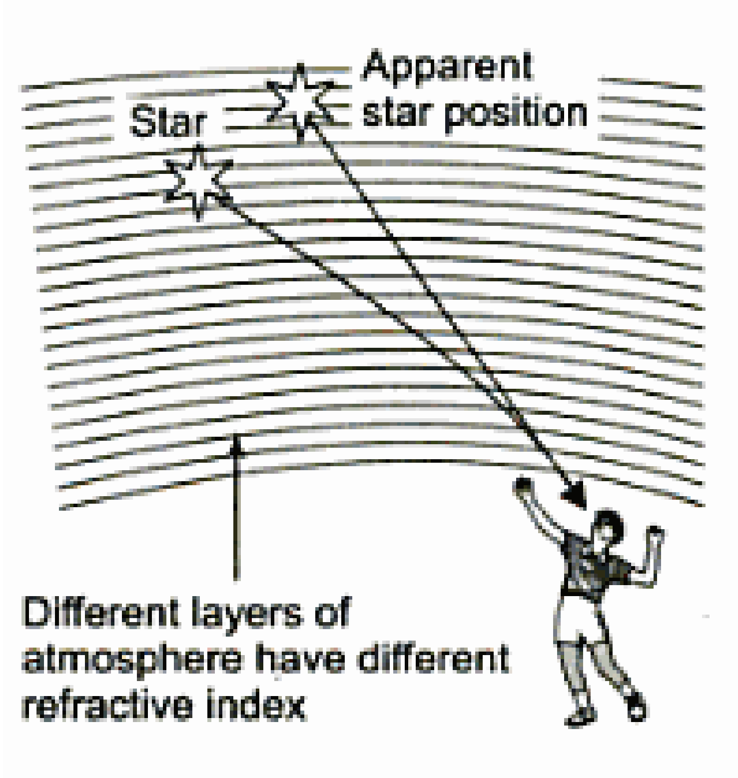
Light from stars undergoes continuous refraction as it enters the earth's atmosphere. Since the refracted ray bends towards the normal, the stars appear at different position and appear slightly higher than their actual positions. The apparent position of the star also changes gradually due to change in the earth's atmosphere. Therefore, the apparent position of the star fluctuates. As a result, the path of light from the star varies.

2) **Advance sunrise and delayed sunset :**



The Sun is visible to us about 2 minutes before the actual sunrise, and about 2 minutes after the actual sunset because of atmospheric refraction. The density of the air in the atmosphere is not the same everywhere. At some places it is higher and in some places it is less. The higher the density, the greater is the refractive index of air. At sunrise or at sunset, the sun is either at the horizon or below the horizon. Hence the light rays from the sun has to travel a larger distance through the atmosphere. As the rays travels from rarer to denser medium, they start bending more and more towards the normal(observer). Hence, there is change in the altitude of the sun and they appear at a higher position than they actually are. The sun is visible to us about 2 minutes before actual sunrise and 2 minutes after sunset because of atmospheric refraction.The apparent flattening of the Sun's disc at sunrise and sunset is also due to the same phenomenon.

3) **Twinkling of stars.**



The twinkling of stars is due to the atmospheric refraction. Light from the stars undergoes continuous atmospheric refraction as it passes through the layers of the atmosphere. Since the atmosphere bends the refracted rays towards the normal, the apparent position of the star is slightly different from its actual position. So, the star appears slightly above than its actual position when viewed near horizon. The apparent position of the star changes gradually due to the change in the earth's atmosphere. Therefore, the apparent position of the star changes and the path of light from the star also vary. Due to this change in the brightness of light from the star, the star appears to be twinkling.

4) **Planets don't twinkle:**

The Planets are very close to earth as compared to the stars. So, the intensity of light we receive from the planets is very large. Therefore, small variations in their positions and brightness are not noticeable . Thus, the brightness of the planet seems to remain the same. The continuously changing earth's atmosphere is unable to cause variations in the light rays coming from the planet. Therefore, planets do not twinkle

5) **Flickering of flame**

- The air above the fire is hotter than surrounding air.
- The hotter air is lighter(less dense) than the cooler air above it, and has a refractive index slightly less than that of the cooler air above it.
- Since the physical conditions of the refracting medium (air) are not stationary, the apparent position of the objects, as seen through the hot air, fluctuates.

Scattering of light

- Scattering of the light is a very important phenomenon of our daily life.
- **Throwing of light in different directions on passing through regions of small particles is called scattering of light.**
- This scattering is the result of the presence of various particles in the atmosphere.
- Our planet earth consists of various mixtures of particles like smoke, molecules of air, dust particles and water droplets.
- These diffused particles reflect the light before it reaches the earth.
- The scattering of the light by the colloidal particles is known as the **Tyndall effect**.
- The size of the particles determines the colour of the scattered light.
- Some are l**arge particles like dust, water droplets while others are small particles like oxygen molecules, nitrogen molecules etc. Large particles scatter all colours while small particles scatter blue colour the maximum and red light gets scattered less.**
- **Red light is used for showing danger signs**
- The primary reason why the color red is **used** for **danger signals** is that **red light** is scattered the least by air molecules. The wavelength of red light is more than any other colour. So red light is able to travel the longest distance through fog, rain, and the alike.

Tyndall effect

- **When sunlight enters into the room through a window or when sunlight** passes through a canopy of a dense forest, we are able to see the path of light rays due to the scattering of light by the small dust particles that are present in the air.
- The suspension of small particles in a medium are called colloid. When light rays are incident on these dust particles, a part of it gets scattered and the remaining light continues to travels in the same direction.
- Due to this, light from each particle reaches our eyes and enables us to see the path of light. This phenomenon of light to get scattered by particles in a colloidal solution is called Tyndall effect. It is named after its discoverer, 19^{th} century British physicist John Tyndall.

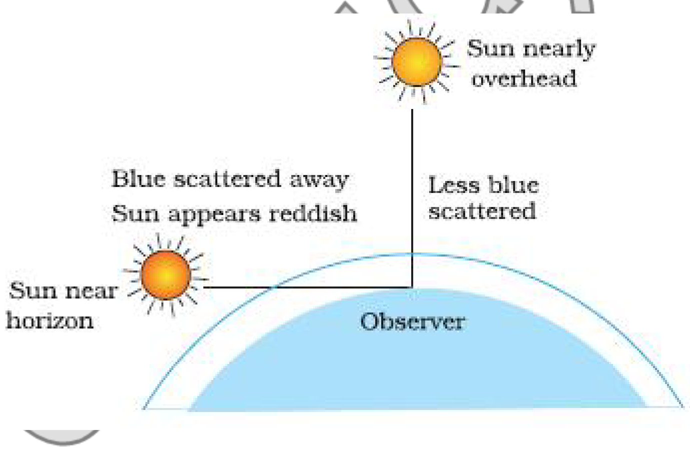
- Tyndall discovered that when white light is passed through a clear liquid having small suspended particles in it, the blue colour of white light having shorter wavelength is scattered much more than the red colour having larger wavelength

Practical use of Tyndall Effect:

i) **Blue colour of the sky**:

The molecules of air and other fine particles in the atmosphere are smaller in size than the wavelength of visible light. As sunlight travels through the earth's atmosphere, it gets scattered by the atmospheric particles. The blue colour of visible light has a shorter wavelength than the red colour of light, therefore blue colour is scattered the most. Therefore, the sky appears blue. **Water in deep seas appears blue because of this scattering of light.**

ii) The sun appears reddish during sunset and white during sunrise



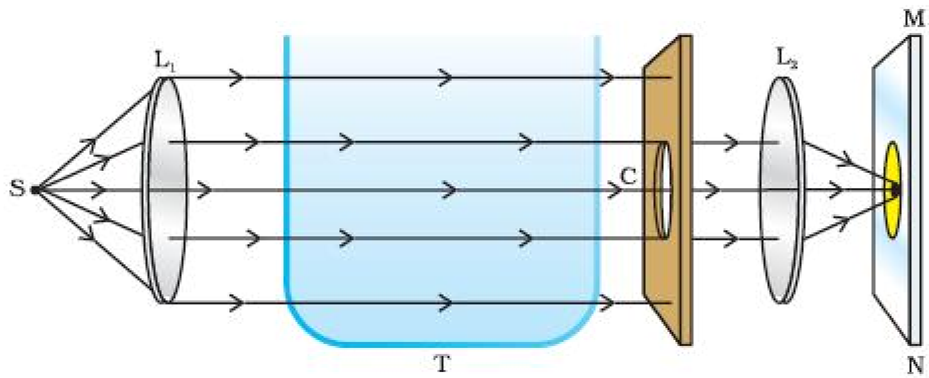
- Light from the Sun near the horizon passes through thicker layers of air and larger distance in the earth's atmosphere before reaching our eyes.
- However, light from the Sun overhead would travel relatively shorter distance. At noon, the Sun appears white as only a little of the blue and violet colours are scattered.
- Near the horizon, most of the blue light and shorter wavelengths are scattered away by the particles.

- Therefore, the light that reaches our eyes is of longer wavelengths. This gives rise to the reddish appearance of the Sun.
- The medium of air becomes rarer as we start moving at high altitudes. Due to the absence of air molecules or any other particles, there is no scattering of light.
- That is why, the sky appears dark from space or to an astronaut flying at very high altitudes.

Experiment to prove scattering of light

Activity 1

Place a strong source (S) of white light at the focus of a converging lens (L1). This lens provides a parallel beam of light. n Allow the light beam to pass through a transparent glass tank (T) containing clear water. Allow the beam of light to pass through a circular hole (c) made in a cardboard. Obtain a sharp image of the circular hole on a screen (MN) using a second converging lens (L2).



Dissolve about 200 g of sodium thiosulphate (hypo) in about 2 L of clean water taken in the tank. Add about 1 to 2 mL of concentrated sulphuric acid to the water.

You will find fine microscopic sulphur particles precipitating in about 2 to 3 minutes. As the sulphur particles begin to form, you can observe the blue light from the three sides of the glass tank. This is due to scattering of short wavelengths by minute colloidal sulphur particles. Observe the colour of the transmitted light from the fourth side of the glass tank facing the circular hole. It is interesting to observe at first the orange red colour and then bright crimson red colour on the screen.

This activity demonstrates the scattering of light that helps you to understand the bluish colour of the sky and the reddish appearance of the Sun at the sunrise or the sunset.