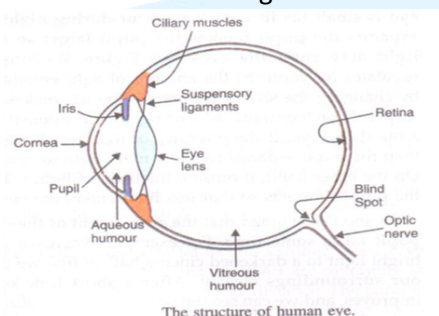


The human eye works on the refraction of light through a natural convex lens made of transparent living material and enables us to see things around us



The main parts of the human eye are : Cornea, Iris, Pupil, Ciliary muscles, Eye lens, Retina and Optic nerve

TERM RELATED TO EYES CORNEA

1. The front part of the eye is called cornea.
- (2) It is made of a transparent substance and it is bulging outwards.
- 3) The outer surface of cornea is convex in shape.
- (4) The light coming from objects enters the eye through cornea.

IRIS AND PUPIL

1. Iris is a flat, coloured, ring-shaped membrane behind the cornea of the eye.
2. There is a hole in the middle of the iris which is called pupil of the eye.
3. Thus, pupil is a hole in the middle of the iris. The pupil appears black because no light is reflected from it

EYE LENS

1. The eye-lens is a convex lens made of a transparent, soft and flexible material like a jelly made of proteins.
2. The eye-lens is held in position by suspensory ligaments

CILIARY MUSCLES - Ciliary muscles change the thickness of eye-lens while focusing. In other words, the focal length of eye-lens (and hence its converging power) can be changed by changing its shape by the action of ciliary muscles

RETINA-The screen on which the image is formed in the eye is called retina. The retina is behind the eye-lens and at the back part of the eye

BLIND SPOT- blind spot is a small area of the retina insensitive to light where the optic nerve leaves the eye.

When the image of an object falls on the blind spot, it

cannot be seen by the eye

The space between cornea and eye-lens is filled with a watery liquid called '**aqueous humour**'.

The space between eye-lens and retina is filled with a transparent jelly like substance called '**vitreous humour**' which supports the back of the eye.

WORKING OF EYES

1. The light rays coming from the object kept in front of us enter through the cornea of the eye, pass through the pupil of the eye and fall on the eye-lens.
2. The eye-lens is a convex lens, so it converges the light rays and produces a real and inverted image of the object on the retina.
3. The image formed on the retina is conveyed to the brain by the optic nerve and gives rise to the sensation of vision.
- 4.. The retina sends these electrical signals to the brain through the optic nerve and gives rise to the sensation of vision

FUNCTION OF IRIS AND PUPIL

1. The iris controls the amount of light entering the eyes.
2. If the amount of light received by the eye is large (as during the day time), then the iris contracts the pupil (makes the pupil small) and reduces the amount of light entering the eye
3. , if the amount of light received by the eye is small (as in a dark room or during night), the iris expands the pupil (makes the pupil large) so that more light may enter the eyes

Imp- The iris makes the pupil 'expand' or 'contract' according to the intensity of light around the eye.

If the intensity of the outside light is low, then the pupil expands to allow more light to enter the eye. On the other hand, if outside intensity of light is high, then the pupil contracts so that less light enters the eye

RODS AND CONES

Rods are the rod-shaped cells present in the retina of an eye which are sensitive to dim light.

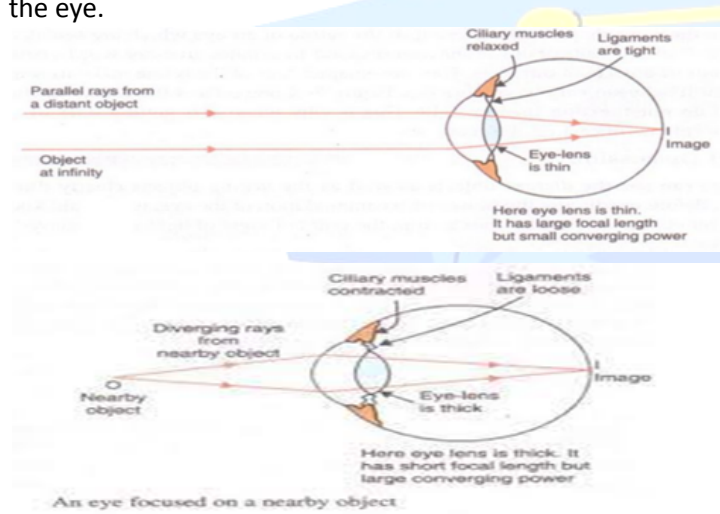
Cones are the cone-shaped cells present in the retina of an eye which are sensitive to bright light (or normal light) cone cells cause the sensation of colour of objects in our eyes.

POWER OF ACCOMMODATION

The ability of eye lens to adjust its focal length is called accommodation.

An eye can focus the images of the distant objects as well as the nearby objects on its retina by changing the focal length of its lens.

When the eye is looking at a distant object, the eye is said to be unaccommodated because it is the relaxed state of the eye.



. The farthest point from the eye at which an object can be seen clearly is known as the "far point" of the eye. The far point of a normal human eye is at infinity

. The nearest point up to which the eye can see an object clearly without any strain, is called the "near point" of the eye. The near point of a normal human eye is at a distance of 25 centimetres from the eye.

QUESTIONS

1.) Explain why, we cannot see our seats first when we enter a darkened cinema hall from bright light but gradually they become visible.? OR

Why does it take some time to see objects in a dim room when you enter the room from bright sunshine outside ?

2.) Describe the working of the human eye?

3. How is the amount of light entering the eye controlled ?

4. Why is a normal eye not able to see clearly the objects placed closer than 25 cm ?

5. What changes take place in the shape of eye-lens : (a) when the eye is focused on a near object ? (b) when the eye is focused on a distant object ?

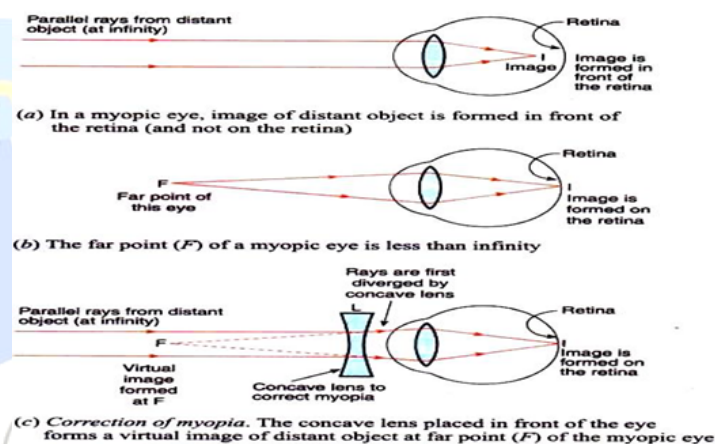
DEFECTS OF VISION AND THEIR CORRECTION

1. Myopia (Short-sightedness or Near-sightedness)
2. Hypermetropia (Long-sightedness or Far-sightedness)
3. Presbyopia.

MYOPIA- Myopia (or short-sightedness) is that defect of vision due to which a person cannot see the distant objects clearly (though he can see the nearby objects clearly).

CAUSE: (i) due to high converging power of eye-lens (because of its short focal length), or (ii) due to eye-ball being too long

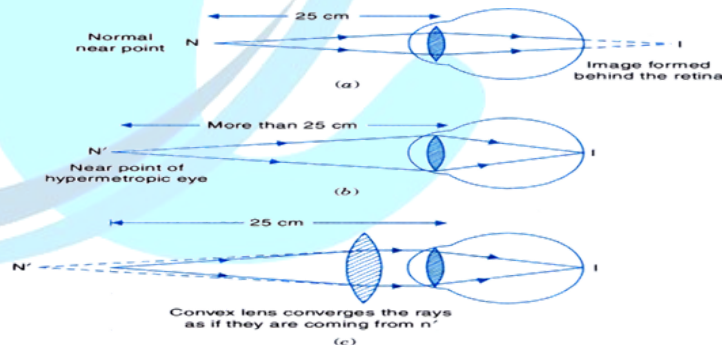
CORRECTION - Myopia (short-sightedness or near-sightedness) is corrected by using spectacles containing concave lenses.



HYPERMETROPIA - Hypermetropia (or long-sightedness) is that defect of vision due to which a person cannot see the nearby objects clearly (though he can see the distant objects clearly)

CAUSES - (i) due to low converging power of eye-lens (because of its large focal length) (ii) due to eye-ball being too short.

CORRECTION- Hypermetropia (long-sightedness or far-sightedness) is corrected by using spectacles containing convex lenses



PRESBYOPIA - Presbyopia is that 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.

CAUSE - Presbyopia occurs in old age due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye-lens.

CORRECTION - It can be corrected by using bifocal lens having both types of lens concave as well as convex lens.

CATARACT - The medical condition in which the lens of the eye of a person becomes progressively cloudy resulting in blurred vision is called cataract.

CORRECTION - It can be corrected by surgery - opaque lens is removed and new artificial lens is put.

WHY TWO EYES

1. Higher field of view.
2. better judgement of distance of object.

QUESTIONS

1. Differentiate between myopia and hypermetropia. What type of spectacles should be worn by a person having the defects of myopia as well as hypermetropia? How does it help?

2. What is presbyopia? Write two causes of this defect. Name the type of lens which can be used to correct presbyopia?

3. (a) What is short-sightedness? State the two causes of short-sightedness (or myopia). With the help of ray diagrams, show

(i) the eye-defect short-sightedness

(ii) correction of short-sightedness by using a lens.

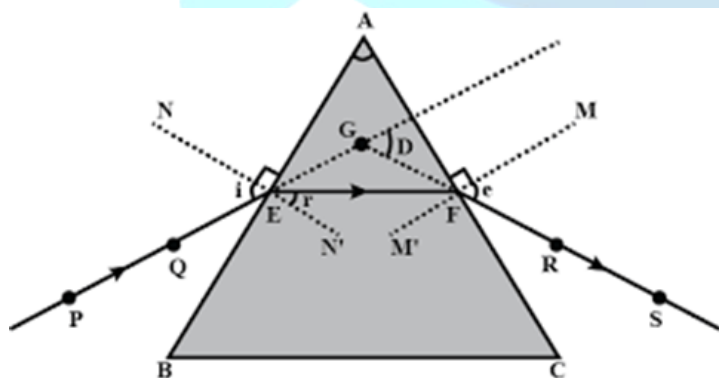
(b) A person having short-sight cannot see objects clearly beyond a distance of 1.5 m. What would be the nature and power of the corrective lens to restore proper vision?

4. (a) What is long-sightedness? State the two causes of long-sightedness (or hypermetropia). With the help of ray diagrams, show:

(i) the eye-defect long-sightedness.
(ii) correction of long-sightedness by using a lens. (b) An eye has a near point distance of 0.75 m. What sort of lens in spectacles would be needed to reduce the near point distance to 0.25 m? Also calculate the power of lens required. Is this eye long-sighted or shortsighted?

(c) An eye has a far point of 2 m. What type of lens in spectacles would be needed to increase the far point to infinity? Also calculate the power of lens required. Is this eye long-sighted or short-sighted?

REFRACTION OF LIGHT THROUGH A GLASS PRISM



when a ray of light passes through a prism, it bends towards the base of prism.

Angle of deviation - The angle between incident ray and emergent ray is called **angle of deviation**.

Angle of prism- The angle between two surface is known as

refracting angle or angle of prism.

NOTE— the emergent ray and incident ray are not parallel to one another in glass prism

The incident ray and emergent ray are parallel to one another in glass slab.

DISPERSION OF LIGHT

In the year 1665, NEWTON prove that white light is a mixture of lights of seven colours.

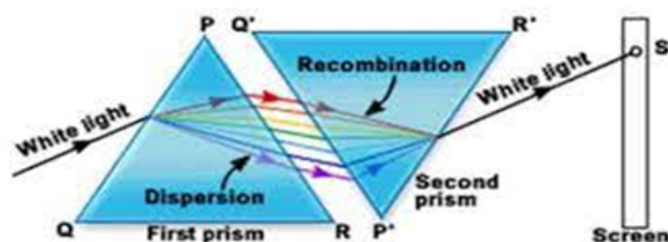
The band of seven colours formed on a white screen, when a beam of white light is passed through a glass prism, is called spectrum of white light.

The splitting up of white light into seven colours on passing through a transparent medium like a glass prism is called dispersion of light.

The dispersion of white light occurs because colours of white light travel at different speeds through the glass prism.

the red colour is deviated the least
the violet colour is deviated the maximum

Recombination White Light

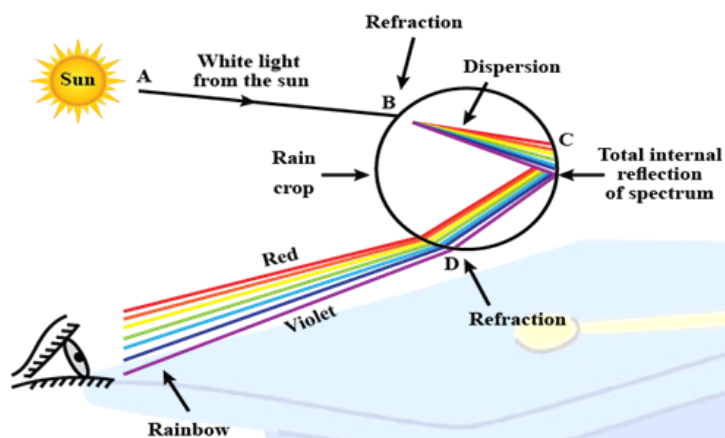


The first glass prism disperses (splits) the white light into seven coloured rays.

The second glass prism receives all the seven coloured rays from the first prism and recombines them into original white beam of light which falls on the screen

RAINBOW-The rainbow is an arch of seven colours visible in the sky which is produced by the dispersion of sun's light by raindrops in the atmosphere rainbow is always formed in a direction opposite to that of the sun

A rainbow is produced by the dispersion of white sunlight by raindrops (or water drops) in the atmosphere. Each raindrop acts as a tiny glass prism splitting the sunlight into a spectrum. The raindrops in the atmosphere act like many small prisms.



It is also due to atmospheric refraction that we can still see the sun for about 2 minutes even after the sun has set below horizon

The length of day increased by 4 minutes.

SCATTERING OF LIGHT

The light spreads in all directions by the dust particles, free water molecules and the molecules of the gases present in the atmosphere. This phenomenon is called scattering of light.

The colour of scattered light depends on the size of particles in the atmosphere.

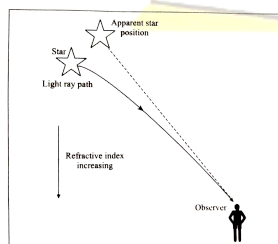
Blue colour scatter most and red colour scatter least.

The blue colour of white light having shorter wavelength is scattered much more than the red colour having longer wavelength.

Tyndall Effect-The scattering of light by particles in its path is called Tyndall effect

ATMOSPHERIC REFRACTION

The refraction of light caused by the earth's atmosphere (having air layers of varying optical densities) is called atmospheric refraction.



Actual position and apparent position of a star

Light from star undergoes continuous refraction as it enters the earth's atmosphere since the refracted ray bends towards the normal, the star appears at a different position and appears slightly higher than its actual position.

The apparent position of a star also changes gradually due to changes in the atmosphere. Therefore, the apparent position of the sky fluctuates. As a result, the path of light from the star varies.

Twinkling of Stars

The twinkling of a star is due to the atmospheric refraction of a star's light.

The star-light reaching our eyes increases and decreases continuously due to atmospheric refraction. And the star appears to twinkle at night.

WHY PLANETS DO NOT TWINKLE

It is close to earth and appears bigger than a star.

The continuously changing atmosphere is unable to cause variations in the light coming from a big-sized planet (due to refraction) because of which the planet does not twinkle at all.

Advance Sunrise and Delayed Sunset

We can see the sun about 2 minutes before the actual sunrise and 2 minutes after the actual sunset because of atmospheric refraction.