Human eye:

Least distance of distinct vision:-

→ It is 25cm for normal human eye.

→ The least distance which a normal human eye can see clearly is called least distance of distinct vision.

→ It is changing from person to person.

→ For children (below 10years) it is about 7 to 8cm.

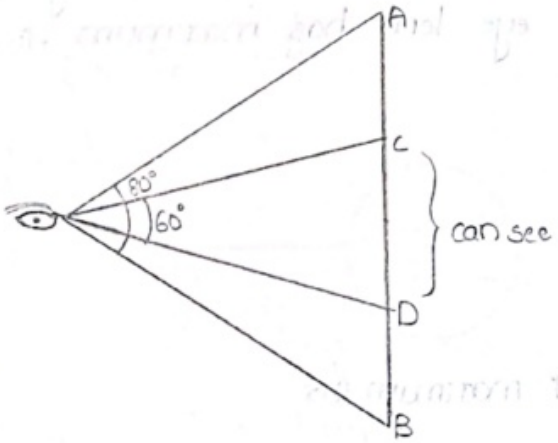
→ For old age people it is about 1 to 2m.

Angle of vision:-

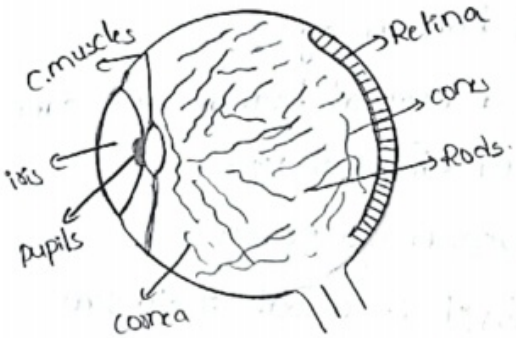
→ The angle of vision is 60°.

→ The angle where the normal human eye can see the whole the object at a time is called angle of vision.

→ This can change person to person.



Human Eye:-



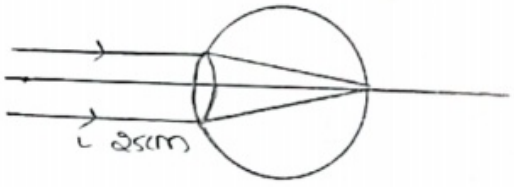
Ciliary muscles:-

Ciliary muscles can change the focal length of eye lens.

Accomodation of eye lens:-

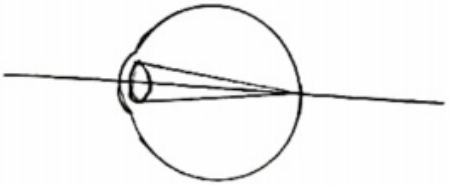
Adusting the focal length of eye lens is called Accomodation of eye.

① If we see far distance object the ciliary muscles can relax. in this case eye lens has maximum focal length i.e 2.5cm.



f maximum 2.5

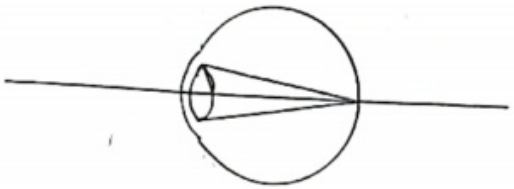
If we see near object (25cm) the ciliary muscles are strained in this case eye lens has minimum focal length i.e 2.27cm.



Note:-

If ciliary muscles not work properly. the person can't able to see all distant objects.

Derivation for maximum focal length:-



Given data.

Maximum focal length = 2.5cm

$u = -\infty$

$v = 2.5cm$

$f = ?$

Lens formula $= \frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

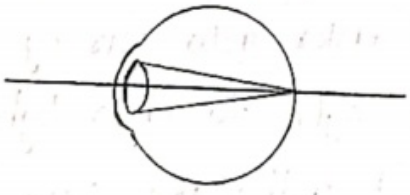
$\frac{1}{f} = \frac{1}{2.5} - \frac{1}{\infty}$ $\quad \frac{1}{\infty} = 0.$

$\frac{1}{f} = \frac{1}{2.5}$

$f = 2.5cm.$

∴ The maximum focal length is 2.5cm

Derivation for minimum focal length:-



Note:- When

Given data

$u = -25cm$

$V = 2.5cm$

$f = ?$

$\frac{1}{f} = \frac{1}{2.5} + \frac{1}{25}$

$\frac{1}{f} = \frac{10}{25} + \frac{1}{25}$

$\frac{1}{f} = \frac{11}{25}$

$f = \frac{25}{11} = 2.27$

Minimum focal length = 2.27cm.

Iris / Irish:-

→ Irish can change the size of the pupil.

→ Irish is a coloured part in the eye.

→ Irish is an opaque substance.

→ By changing the pupil it can control the amount of light entering into the eye.

→ When we ~~are~~ are in bright light pupil size decreased by Irish. so that less light enter into our eye.

→ When we are in dim light. the pupil size increased by Irish so that more light enter into our eye.

→ When we move from bright light to dim light the pupil size has to increase so it will take some time to increase.

→ During the time we can't see surrounding clearly.

Note:-

When we come out from cinema theater we cannot able to see surroundings clearly some time why?

Cones:-

→ cones can identify the intensity of colour.

→ Due to absence of cones the person may get colour blindness.

Note:-

cat has colour blindness.

Rods:-

→ Rods can identify the intensity of light.

→ Due to absence of rods the person may get night blindness

Note:-

Owl bird has more rods. so it can see clearly even in night times.

Retina:-

→ Retina acts as a screen.

→ On Retina eye lens can form real and inverted image.

Eye lens:-

→ Eye lens prepared by aqueous humus which is transparent material.

→ It is in the shape of convex lens.

→ The distance between eyelens to retina is 2.5cm.

If a persons eye lens not accomodate more that 2.4cm What will happen to the person when he see far Object?

2 If a persons eye lens minimum focal length is not 2.27 What will happen when he 25cm object

Ans:- He will not be able to see the far object when his eye lens not accomodate more than 2.4cm

The image forms infront of retina.

2. The person will not be able to see 25cm object when his eye lens minimum focal length is not 2.27cm.

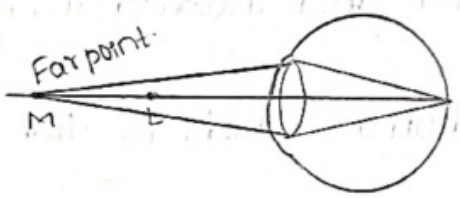
Vision Defects:-

1. Myopia
2. Hyper mitropia.
3. presmyopia.

1 Myopia:- negative sight

The person who can see near objects clearly but not far objects is called Myopia.

It is also called as short sightedness or near sightedness

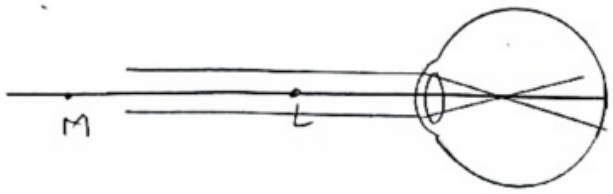


Reason (cause):-

Excessive or Increase size of eye ball.

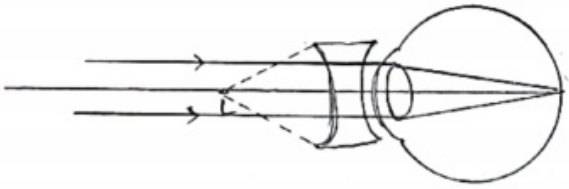
Decrease in maximum focal length is less than (2.5cm)

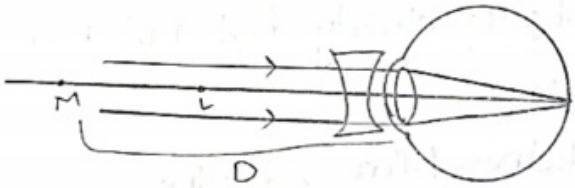
The image forms infront of the retina.



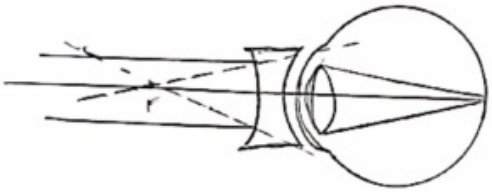
correction:-

We can correct myopia vision defect by using concave lens. Then person can see all distance objects.





Focal length:-



Given

Object distance (u) = $-\infty$

Image distance (v) = $-D$

Focal distance (f) = ?

Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{-D} - \frac{1}{-\infty}$$

$$\frac{1}{f} = \frac{1}{-D} - 0$$

$$\left[\frac{1}{\infty} = 0\right]$$

$$\frac{1}{f} = \frac{1}{-D}$$

Power

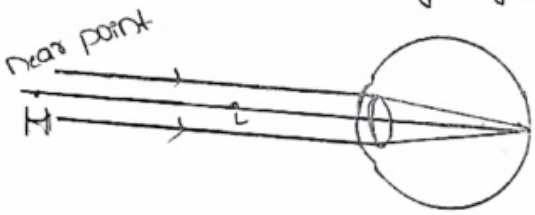
$$P = \frac{1}{f}$$

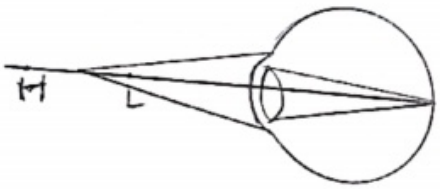
$$P = \frac{1}{-D}$$

② Hyper meteropia:- + positive sight

The person who can see far objects clearly but not near objects is called Hyper meteropia.

It is also called as long sightedness / far sightedness.



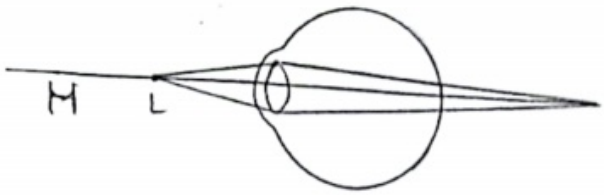


Reason (cause):-

The eye ball size decreased.

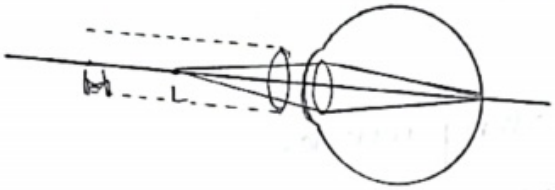
The minimum focal length is more than 2.27cm.

The image forms beyond the Retina

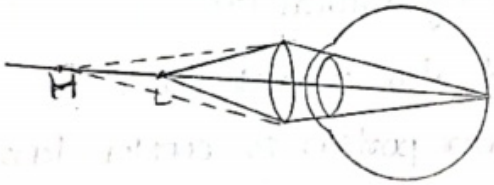


corrections:-

We can correct the hyper metropia by using convex lens.



Find the Focal length of convex lens:-



Given data

Object distance (u) = -25cm

Image distance (v) = -d

Focal distance (f) = ?

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{-d} - \frac{1}{-25}$$

$$\frac{1}{f} = \frac{1}{-d} + \frac{1}{25}$$

$$\frac{1}{f} = \frac{25+d}{25d}$$

$$\frac{1}{f} = \frac{d-25}{25d}$$

$$f = \frac{25d}{d-25}$$

Presbiopia:-

The person who can't see near objects as well as far object clearly is called press biopia.

pressbiopia Vision defect comes with age

Reason:-

The gradually weakining of ciliary muscles.

Diminishing power of eye lens.

Correction:-

pres biopia Vision defect corrected by bifocal lens.

This lens prepared by convex and also concave lens.

Upper portion is concave lens power portion is convex lens.

power:

The reciprocal of focal length is called power.

$$P = \frac{1}{f(m)} \text{ or } P = \frac{100}{f(cm)}$$

Units :- diapterss

Note:-

1. If focal length increases power decreases.
2. If focal length infinity power is zero.

Eg:- If focal length = -50cm find the power and nature of the lens.

$$P = \frac{100}{-50}$$

$$P = -2D$$

Nature is concalle lens

If power of the lens is 4 Diapeters find the focal length

$$\frac{4}{1} = \frac{100}{f}$$

$$4f = 100$$

$$f = 25cm.$$

If the focal length of concalle length is 2m. find power.

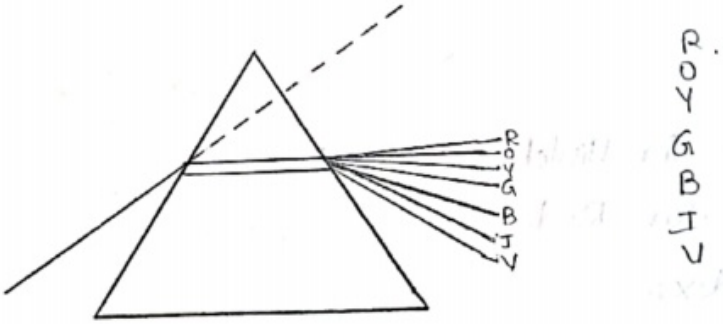
$$P = \frac{1}{2}$$

$$P = -0.5D.$$

Dispersion of Light:-

The spliting white light into seven colours (VIBGYOR) is called Dispersion of Light.

prism can deviate (dispers) white light into seven colours.



R.
O
Y
G
B
I
V

Dispersion of Light:-

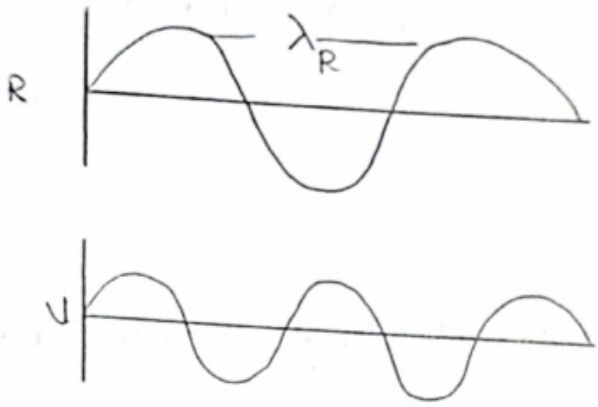
The splitting white light into seven

properties of colours:-

1. Wave length:-

Wave length is more for Red.

Wave length is less for Violet.



2. Wave Velocity:-

Velocity is more for Red.

Velocity is less for Violet.

3. Frequency:-

Frequency is more for Violet.

Frequency is less for Red.

4. Energy:-

Energy is more for Violet.

Energy is less for Red.

5. Refractive Index:-

Refractive Index is more for Violet.

Refractive Index is less for Red

Scattering/bending:-

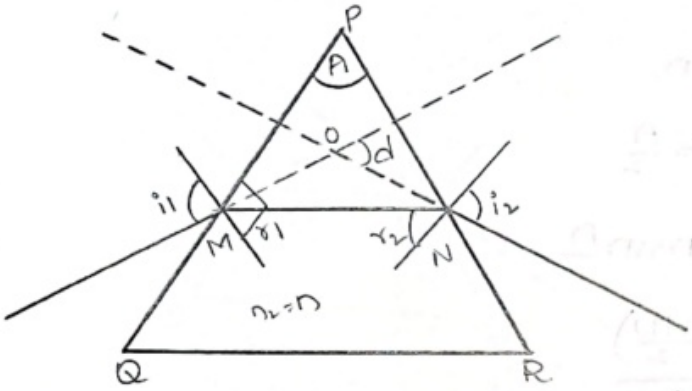
Scattering is more for Violet.

Scattering is less for Red.

Why we use red colour as a danger signal.

We use red colour as a danger signal because wave length is more and velocity is also more so we can see from a long distance also.

Prism Refractive Index:-



ΔMNO

$d = (i_1 - r_1) + (i_2 - r_2)$

$d = (i_1 + i_2) - (r_1 + r_2)$ — ①

ΔPMN

$A + (90 - r_1) + (90 - r_2) = 180$

$A = r_1 + r_2$ — ②

At minimum deviation

$d = D$

$d_1 = i_1 + i_2 - A$

$i_1 = i_2, \quad r_1 = r_2$

$d = i_1 + i_2 - A$

$d + A = i_1 + i_2$

$D + A = 2i$

$$i_1 = \frac{D+A}{2} \quad \text{— (3)}$$

$A = 2r_1$

$$r_1 = \frac{A}{2} \quad \text{— (4)}$$

Snells law

$n_1 \sin i = n_2 \sin r$

$n_1 = 1 \quad n_2 = n$

$$i_1 = \left(\frac{A+D}{2}\right) \quad r_1 = \frac{A}{2}$$

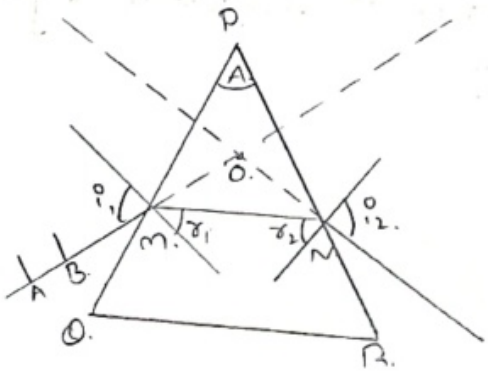
$$1 \sin\left(\frac{A+D}{2}\right) = n \sin\frac{A}{2}$$

$$n = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\frac{A}{2}}$$

Experiment :-

Aim :- To find Refractive Index of prism.

materials required :- 1. prism
2. White sheet
3. Scale
4. protractor
5. Pins
6. Pencil.



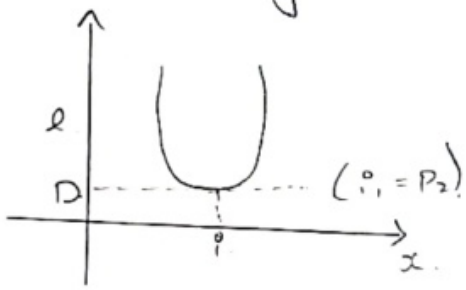
Procedure :-

1. Take a prism and place it on a white chart.
Draw the outline of the prism. Remove the prism and Name the vertices as P, Q and R.
2. PQ and PR are two refracting surfaces.
3. The angle between PQ and PR is called Angle of prism.
4. On PQ Draw a Incident ray at point M and place to pins vertically on this line (A and B)
5. Place the prism again and observe the pin (A and B) from PR refracting surface.

6. fix two more pins (C and D) such that all the pins should lie on the same line.
7. Add C and D, M and N.
8. Extend the incident ray and emergent ray they meet at point 'O'
9. The angle between them is deviation angle.

Graph:-

Draw the graph between Incident angle i and deviation angle "d".



If Incident angle (i_1) increasing deviation angle first decrease then increase.

The shape of the graph is parabola.

The minimum value of small d is called minim-um value deviation angle (D).

At D incident angle = Emergent angle ($i_1 = i_2$)

Conclusion:-

By using the formula $n = \dfrac{\sin\left(\frac{A+D}{2}\right)}{\sin A/2}$.

Rainbow:

Rainbow is the natural spectrum of sunlight formed in the sky.

Conditions to form rainbow:

1. Sunlight must be present.
2. During the rain or soon after the rain (waterdroplets)
3. Always rain bow will form opposite to the sun.

Phenomenons in the formation of rainbow:

1. Refraction
2. Dispersion
3. Total Internal Reflection (TIR)

formation of Rainbow:

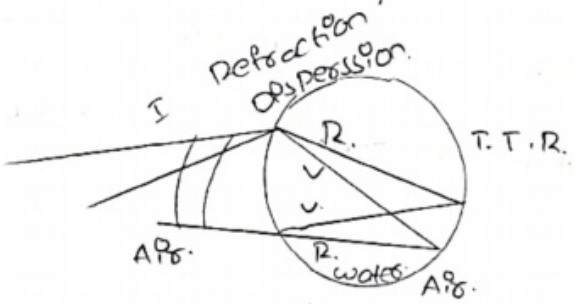
* Soon after the rain or during the rain. some water droplets will stop on the dust particles of atmosphere.
* When sunlight falls on water drop. At first surface sunlight undergoes refraction and dispersion.
* So it divides into 7 colours
* At 2nd surface these 7 colours undergoes total internal reflection and come back to 1st surface.
* Again in 1st surface these seven colours refracted to atmosphere and forms rainbow.
* If the angle between incident ray and refracted

is 40° it forms violet colour.

* If the angle is 42° forms red colour. If the angle is blw 40° and 42° all colours will form.

Note :-

Rainbow formed is in circular shape but it appears as bow shape.



Note :-

When we see the rainbow from aeroplane it appears in circular shape.

The shadow of aeroplane falls in the circle.

* A prism with an angle $A = 60°$ produces an angle of minimum deviation $D = 30°$ find the refractive index of the prism.

Given

Angle of prism $(A) = 60°$

minimum deviation $= (D) = 30°$

Refractive Index $(n) = ?$

$$n = \frac{\sin \frac{A+D}{2}}{\sin A/2.}$$

$$\frac{\sin 90/2}{\sin 60/2} = \frac{\sin 45}{\sin 30}$$

$$= \frac{1/\sqrt{2}}{1/2}$$

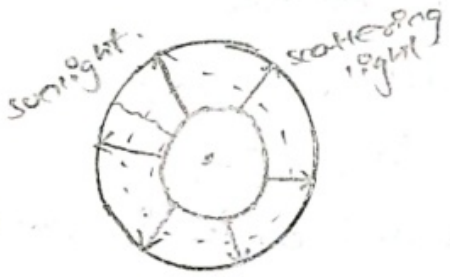
$$= \frac{1}{\sqrt{2}} \times \frac{2}{1}$$

$$= \frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$$

$$= \frac{2\sqrt{2}}{2} = \sqrt{2}.$$

Scattering of light :

The process of reemission of absorbed light in all directions with different intensities by atoms or molecules is called scattering.



Explanation :

* Consider a atom or molecule in space.
* When sunlight falls on these particle this particle absorbed the light.
* If the size of particle compared to wave length of the absorbed light.
* It can reemmit certain freqency light in all directions.

* If the size of particle is more it can remit (scatter) more wave length colours.
* If the size of particle is less it can scatter less wavelength colours.
* These particles (molecules, atoms) are called scattering agents.
* This remission of light is called scattering.

Note :-

* Scattering angle is 90°
* The scattering colour depends on size of the Particle.

Applications of scattering :-

Sky appears in blue colour.

Sun appears in red colour.

Sky appears white in colour.

Sometimes sun appears white in colour.

Why sky appears in blue in colour :-

Due to scattering of light the sky will appear blue in colour.

Explanations :-

→ In the atmosphere more no. of nitrogen and oxygen Particles are there.

→ When sunlight falls on these particles these can re-emit only blue colours.

Because

→ Because the size of the nitrogen and oxygen particles approximately equal to wave length of blue colour.

→ So, the sky appears as blue in colour.

NOTE:

Nitrogen & oxygen particles can acts as a scattering agents for blue sky.

2. Why sun appears red in colour during sun rise and sun set?

Due to the scattering of light sun appears red in colour.

Explanation:-

* During sun rise and sunset the distance between sun and observer is more.
* The sun rise has to travel more distance to reach the observer.
* While travelling it can scatter all colours but due to more wavelength and less scattering red colour can reach the observer.
* So, the sun appears red in colour during morning and evening.

3. Why sky appears white in colours?

Due to scattering of light sky appears white in colours.

Explanation:-

* During that day due to more temperature water will Evaporate on the earth.
* Abundant water vapours present in the Atmosphe-re with different sizes.
* When sunlight falls on these water vapours this can Emit all the colours.

4. Why sun appears white in colours?

Due to scattering of light sun appears white in colours.

Explanation:

* If the distance between sun and observer is less. sunlight has to travel less distance to reach the observer.
* While travelling it can Emmit all colours these all colours can reach the observer.
* Due to all colours mixture it appears as white in colors.

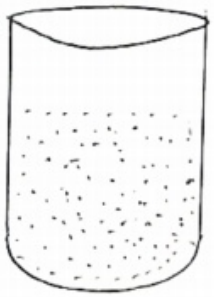
Note:

universe appears black in colours because no atmosphere and NO scattering.

Experiment :-

Aim :- To show that scattering of light.

materials required :- 1. Beakers
2. Sodiumthisulphate
3. Sulphuric Acid
4. water.



Procedure :-

* Take the solution of sodiumthia sulphate with sulph -uric acid in a glass beaker.
* watch the formation of grains of sulphur.
* Place the beaker in which reaction is taking place in an open place where abundant sunlight is available.

Observations :-

* You will Notice that sulphur precipitates as the reaction in progress.
* At the begining the grains of sulphur are smaller in size as the reaction progress. their size increases due to precipitation.

* Sulphur grains appear blue in colour at the beginning and slowly their colour becomes white as their size Increases.

Reason :

* As the size of grains Increases their size becomes compareable to wavelength of colours
* The combination of all these colours appear as white.

Questions

priyas grand father unable to read the Newspaper

i) What is his vision defect?

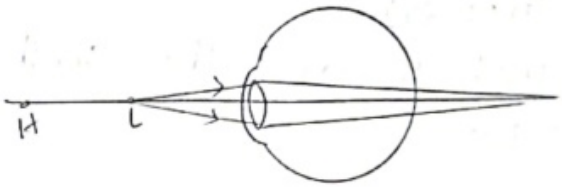
ii Draw the diagram for defect?

iii) which lens we halle to use to correct this defect?

iv) Draw the ray diagram for corrections?

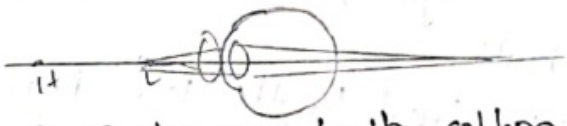
? His vision defect is hypermetropia

ii)



iii) convex lens are used to correct this defect.

iv)



Seetha and Geetha are both sitting in a class. Seetha can't read the black board from the last bench so she taken the permission to sit in the front or first bench. Geetha unable to see the black board clearly from the first bench so she taken the permission to sit in the last bench

a) what are their vision defects?

b) Draw the ray diagrams. for seethas vision defect?

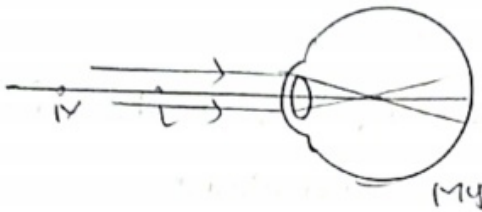
c) What type of lens should we use to correct their vision defects?

d) Explain the causes of their vision defects?

e) Draw the correction Ray diagrams for both the vision defects

a) Seethas vision defect is myopia whereas Geethas vision defect is hypermetropia

b)



Myopic

c) Concave lens should be used to correct the Seethas vision defect (myopia)

Convex lens should be used to correct the Geethas vision defect (hypermetropia.

d) causes

Seethas vision defect :-(myopia)

Excessive size of eye ball

Decrease in maximum focal length less than 2.5

The Image forms infront of Retina.

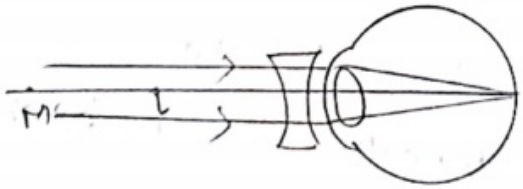
Geethas vision defect :- (Hypermetropia)

The eyeball size decreased

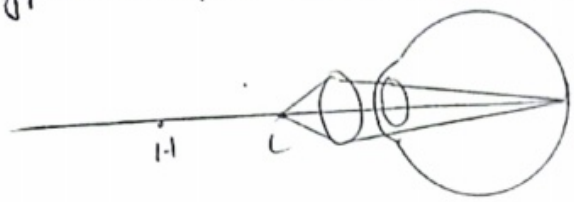
The minimum focal length is more than 2.27cm

The image forms beyond the Retina

myopia :- [Seethas vision defect]



Hypermetropia :-[Geethas vision defect]



The myopic person cant see clearly beyond 2m find the corrected lens's power

$$f = -D$$

$$f = -200cm$$

$$P = \frac{100}{f}$$

$$P = \frac{100}{-200}$$

$$P = -0.5D$$

A person can't see the objects clearly below 1m which lens we have to use to correct this defect and also calculate the power of lens

convex lens is used to correct this defect

[Hypermetropia]

$$f = -100cm \frac{2.5d}{D.25}$$

$$f = \frac{2500}{75} 33.3$$

$$f = 33.3cm \text{ or } \frac{100}{3}$$

$$P = \frac{100}{33.3} = \frac{100}{\frac{100}{3}}$$

$$100 \times \frac{3}{100}$$

$$P = 3D$$