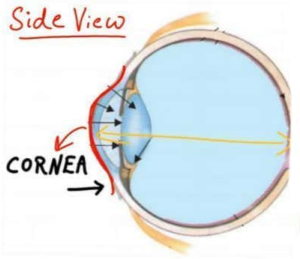
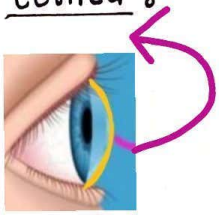
HUMAN EYE AND COLOURFUL WORLD

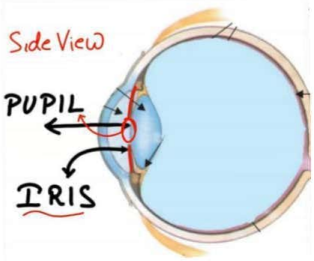
(1) Eyeball :- Approximately spherical, Diameter 2.3cm



(2) Cornea :-
- Thin transparent bulging membrane
- Most of the refraction happens
- Protects from dust, germs

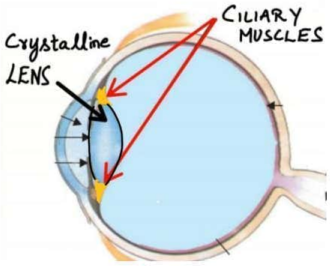


(3) Iris :- Controls the size of pupil. (shutter)



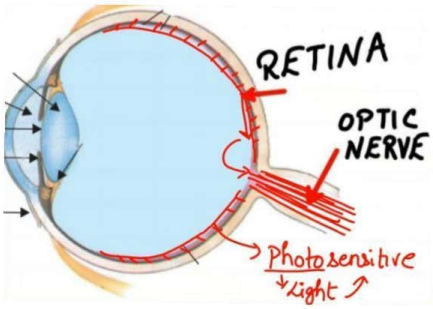
(4) Pupil :- Regulates and controls the amount of light entering the eye.

(5) Crystalline lens :-
- convex lens.
- flexible focal length.
- forms Real and Inverted image



(6) Ciliary Muscles :- Adjust the focal length of eye lens.

(7) Retina :- Screen



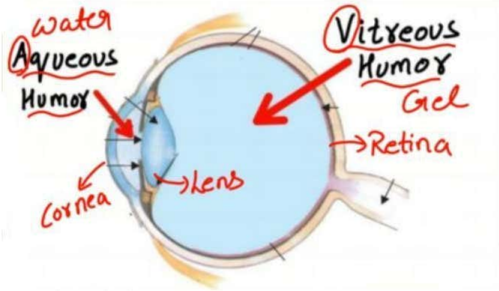
- Real Inverted Image is formed on Retina.
- has lots of light sensitive cells.
- Rods - vision in low light (light Intensity)
- Cones - vision in high light + colour vision.
- Cells get activated when light falls on them and generates electrical signal.

(8) optical nerve :- sends electrical signal to the brain.

Light — Nerve fibre

(9) Aqueous Humor
- water like fluid.
- it is present between lens and Cornea.
- Nutrition.

Vitreous Humor
- Gel like substance.
- present between lens and Retina.
- Support and strength helps the eye to keep its shape.



Thick Lens

Focal length ⇒ Lens small

Thin Lens

More large

Power of Accomodation :- $P=\frac{1}{f}$

The ability of eye lens to adjust/change its focal length.

To View closer objects

Ciliary muscle Contract

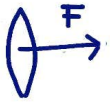
lens become thick (Curvature increases)

focal Length decreases P↑

To view distant (far) objects.

Ciliary muscle relaxes $P=\frac{1}{f}$

lens becomes thin (curvature decreases)



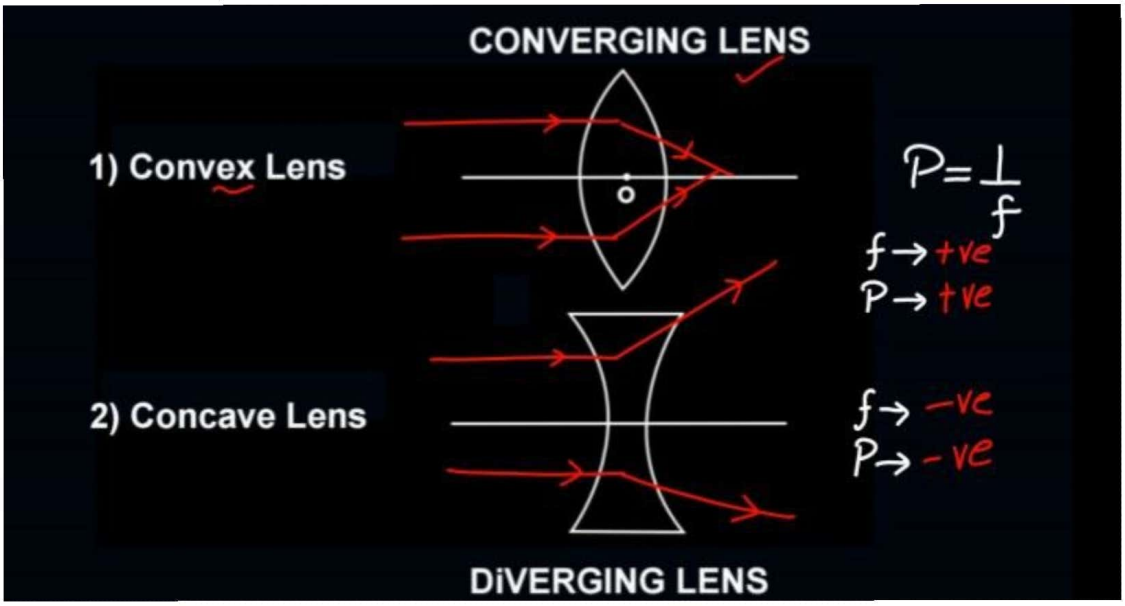
focal length Increases F↑ P↓

Near Point :- The minimum distance from eye at which an object can be seen clearly and distinctly.

- It is also called least Distance of Distinct Vision.
- For normal vision (young Adults) ⟶ 25cm.

far Point :- The farthest (sabse dooor) point upto which the eye can see objects clearly.

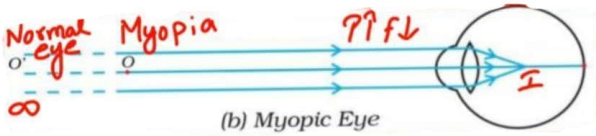
for Normal eyes ⟶ ∞ infinity



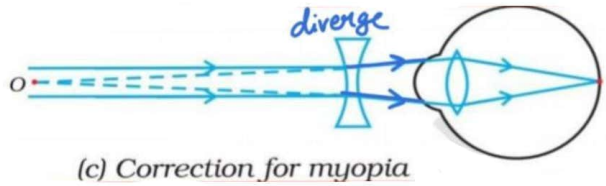
DEFECTS in HUMAN EYE
And
Corrections

(1) Myopia :-
(Near Sightedness)

- Can see nearby objects clearly.
- Cannot see distant object distinctly(clearly).
- Far point is less than infinity.



(b) Myopic Eye



(c) Correction for myopia

- Image of distant object is formed infront (before) of Retina.

Reasons :-
(1) Excessive curvature of eyelens.
(2) lens thick → focal length decreases.
(3) Elongation of eye ball.

Negative power lens

CORRECTION – CONCAVE LENS

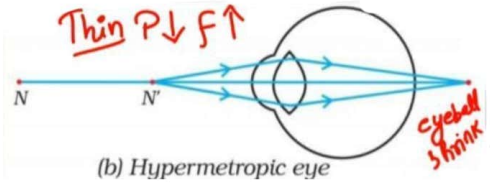
Trick:-

Myo Ni makes Elon Thick (fat), went CAVE

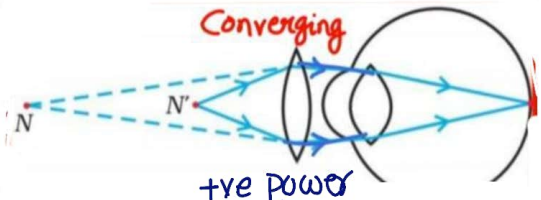
- Myo → Myopia
- Ni → Near Sightedness
- Elon → Elongation of eyeball
- Thick (fat) → lens thick fat F → lens
- CAVE → Concave lens f → -ve p → -ve

(2) Hypermetropia :-
(far-sightedness)

- Can see distant (far) objects clearly.
- Cannot see nearby objects distinctly (clearly)
- Near point is more than 25cm.



(b) Hypermetropic eye



+ve power lens

Image of nearby object is formed at a point behind Retina.

Reasons :-
(1) Focal length of eye lens is too long (lens cannot get thick enough).
(2) Eyeball has become too small.

CORRECTION – CONVEX LENS

Trick:-

FaST Metro makes eye small, face large like Wax

- FaST → far Sightedness
- Metro → Hyper Metropia
- eye → eyeball small shrink
- face large → focal length large, thin
- Wax → convex lens

(3) **Presbyopia** :– With ageing, people find it difficult to see nearby object distinctly (Clearly)

Reasons :– (i) Weakening of ciliary muscle.
(ii) less flexibility of eye lens.

→ far object problem
Myopia + Hyper-Metropia

(4) **Cataract** :– (lens becomes opaque)

- Sometimes at old ages
  Crystalline lens becomes milky and cloudy
  ↓
  Partial or complete loss of vision

Correction → COTARACT SURGERY

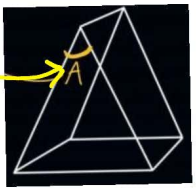
Bi-Polar Lenses

for person suffering with both Myopia and hypermetropia

Refraction through a PRISM

A glass Prism is a transparent refracting medium.
it has → 2 Triangular + 3 Rectangular surfaces

Angle of Prism (A)

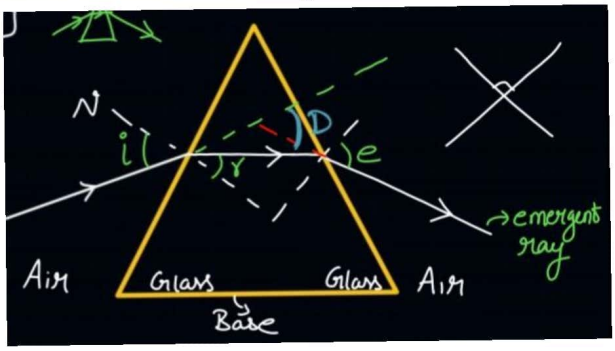


Refraction of light and Deviation through a Prism

(Monochromatic light)
single colour

White ×

∠i → incidence
∠r → Refraction
∠e → emergence
∠D → Deviation



✡ A prism bends ray of light towards Base.

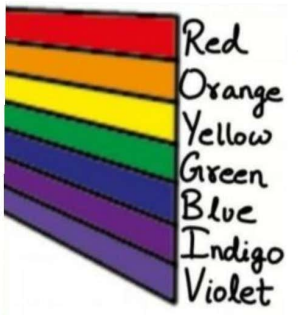
(sunlight)

(1) We know that white light is made up of seven colours.

(2) A prism bends a ray of light → Angle of Deviation (∠D) sunlight

(3) ∠D is different for different colours of light → some colours bends more than other.

Violet Bends Most
Red Bends Least



VIBGYOR

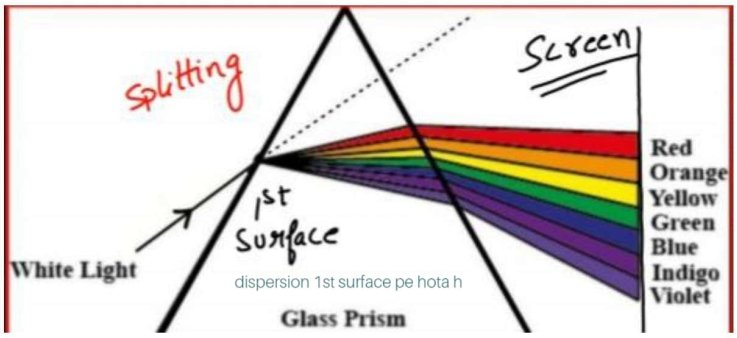
Refraction of white light (sunlight) through a PRISM

Dispersion :-

The splitting of white light into its component colours (7 colours).

Spectrum :-

The band of colour components of light (obtained on screen)

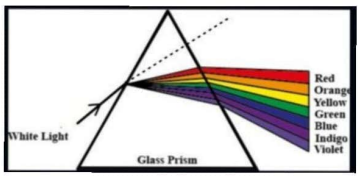


Q- Why does Dispersion occurs ?

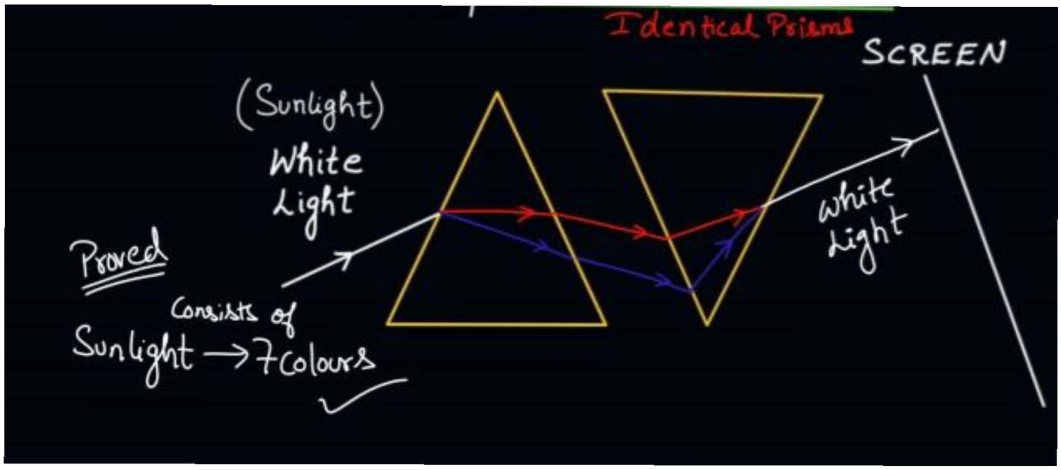
Ans :- A prism bends a ray of light. Different colours of light bends through different angle.

Red Bends the least, Violet Bends the most.

∠D ⟶ Most Violet

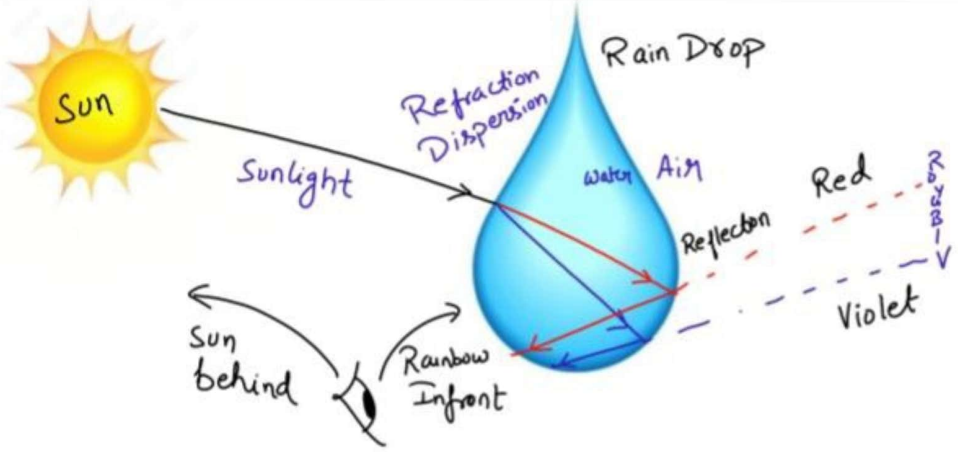


Newton's Prism Experiment (inverted Prisms)

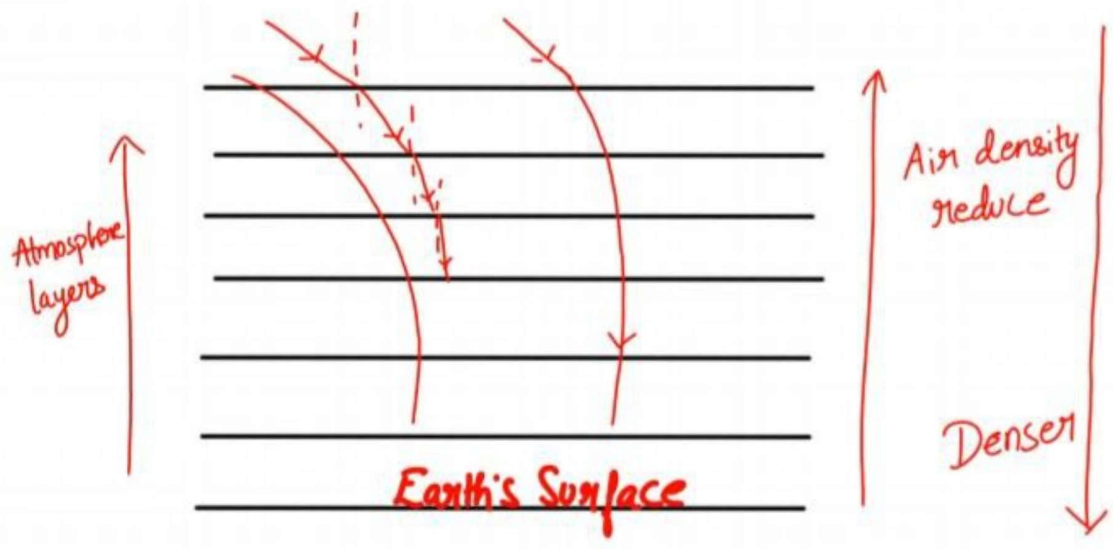


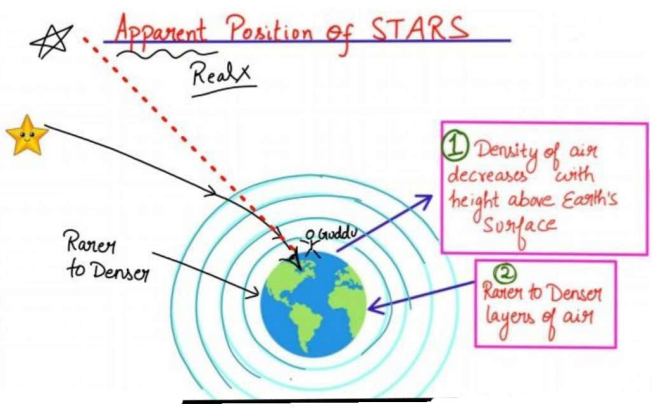
RAINBOW FORMATION

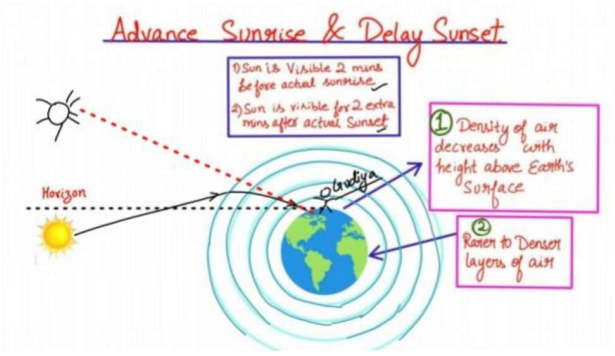
Dispersion + Refraction + Reflection
(special tarh ka reflection)

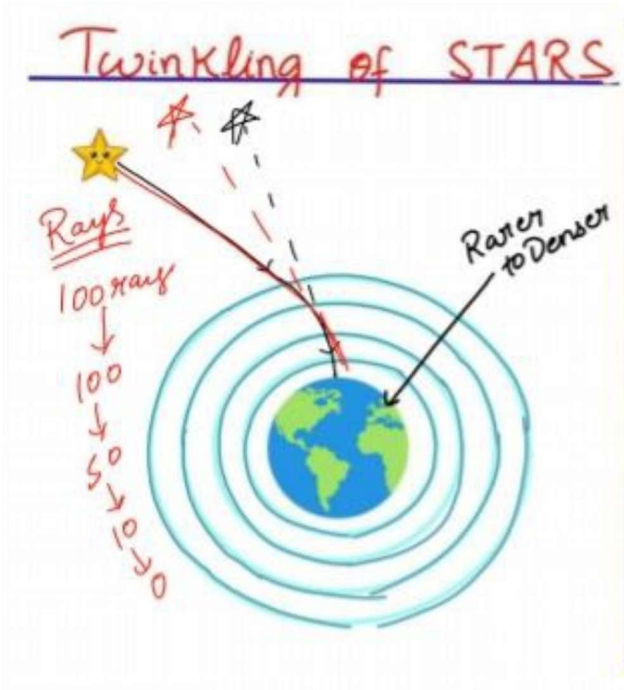


ATMOSPHERIC REACTION









1) The physical conditions like Temperature, Pressure of Earth's atmosphere keeps on varying.

2) Due to this density of layers also keep changing

3) Stars are very far so they behave like point source of light.

4) The path of ray of light coming from star keeps changing & Amount of starlight entering eyes flickers

Why Planets do not twinkle ?

(1) Planets are near to Earth as compared to stars.

(2) Planets behave as Extended Source of light.

(3) Extended Source can be Imagined as collection of millions of point source of light.

(4) Now, the total variation in the amount of light entering our eye from all the individual point sized sources Averages out to zero and intensity of light entering eye remains almost same.

SCATTERING OF LIGHT

Tyndall Effect :- The phenomenon of scattering of light by the colloidal particles.

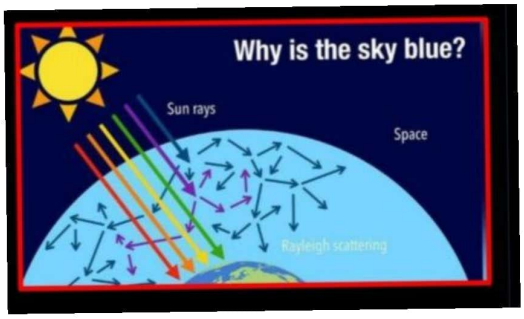
- A colloid is a heterogenous mixture. The size of particles of a colloidal is too small to be individually seen with naked eyes.
  Example :- Milk, Smoke, Dust in air.
- The path of a beam of light passing through a true solution is not visible. But in colloidal solutions, colloids are big enough to scatter a beam of light passing through it and make its path visible.
- The colour of the scattered light depends on the size of the scattering particles –
  1) very small particles scatter mainly blue light (smallest wavelength)
  2) very large particles scatter all colors of light equally.

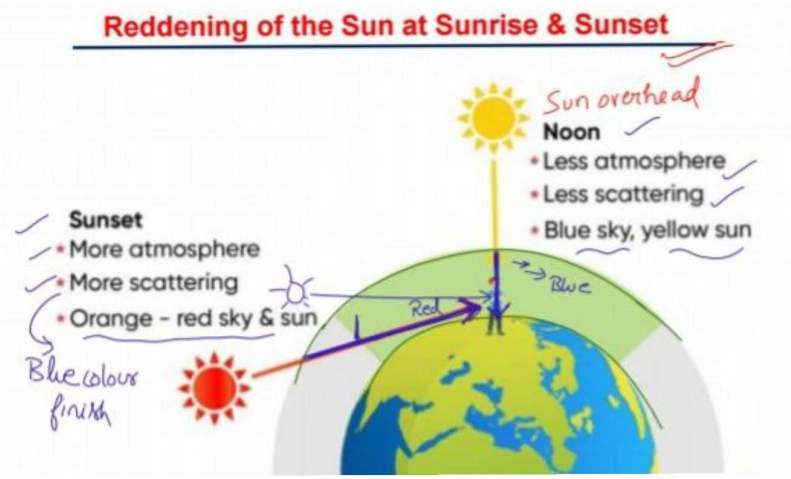
* Beam of sunlight enters a smoke filled room through a small hole.

* Sunlight passes through a canopy of a dense forest. Tiny water droplets in the mist scatter light.

Blue colour of sky :-

(1) The molecules of air and other fine particles in the atmosphere have size smaller than the wavelength of visible light.
(2) Scattering is more for light of shorter wavelength. Hence Blue colour scatters more strongly than Red colour.
(3) Thus, scattered blue light enters our eyes and sky appears blue.





(4) if the earth had no atmosphere, there would not have been any scattering. Then the sky would have looked dark.

(5) The sky appears dark to passengers flying at very high altitudes. Explain

At high altitudes due to the absence of atmosphere, scattering of light do not take place and hence sky appears dark to passengers flying at high altitude.

(6) Danger signal lights are red in colour. Explain

Red light is least scattered by fog or smoke. Therefore, it can be seen in the same colour at a distance.