

Human Eye & Colourful World

**One Shot ✗
GUN-SHOT ✓**



**100% Paper
Yahi se Aayega !!**

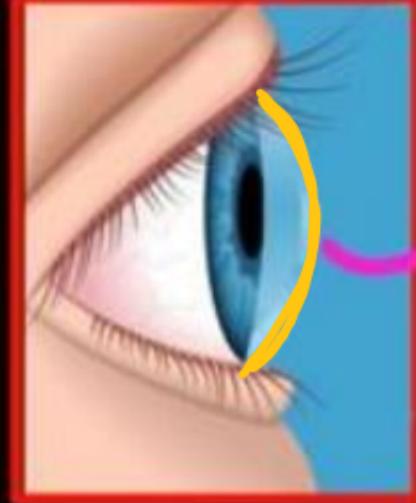
Kya Kya Padhenge?

- 1) Human Eye ✓**
- 2) Defects in Human Eye & Corrections ✓**
- 3) Refraction through a Prism ✓**
- 4) Dispersion, Spectrum & Rainbow formation ✓**
- 5) Atmospheric Refraction ✓**

1) Eyeball → Approximately Spherical ; Diameter → 2.3 cm

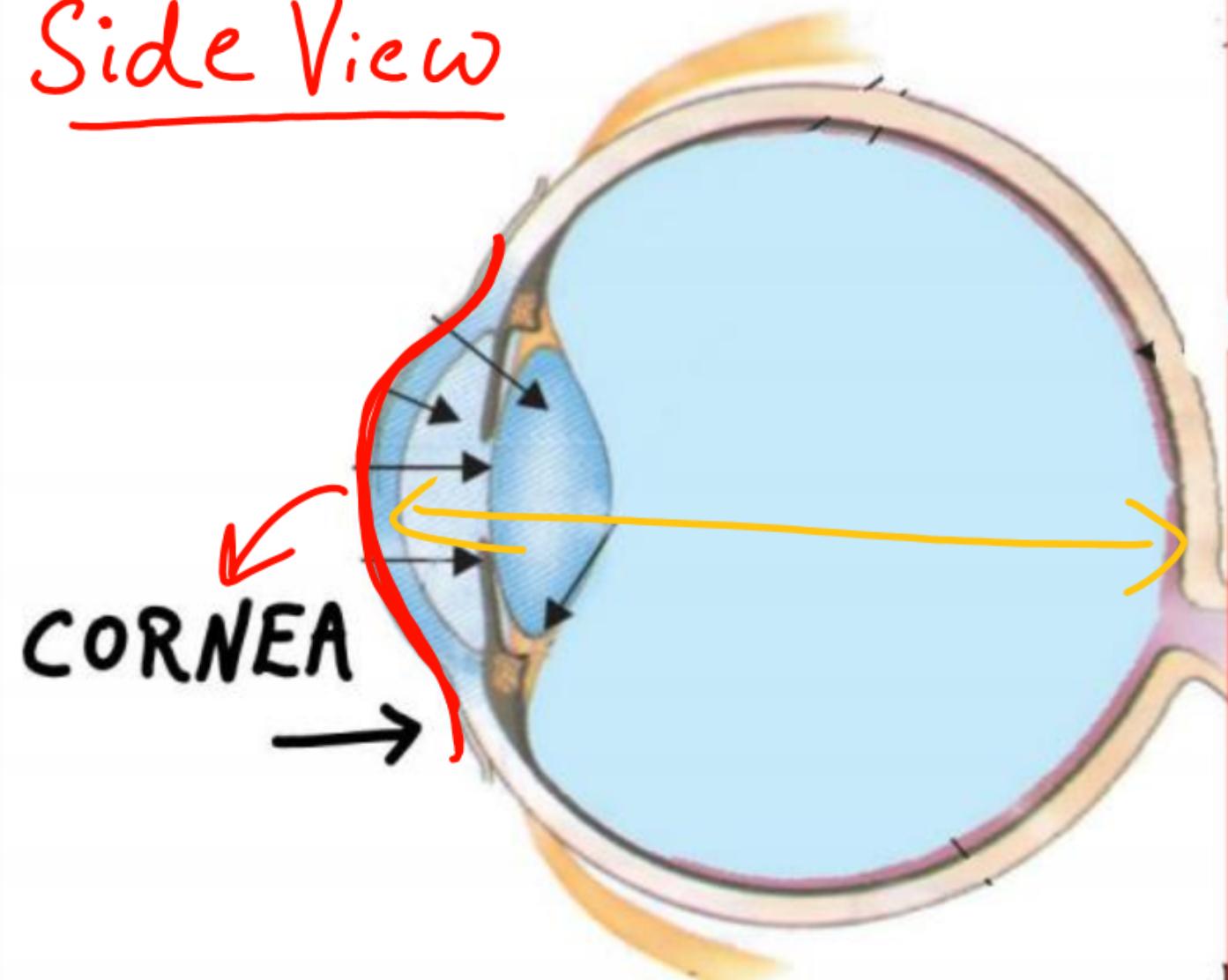
2) Cornea → • Thin transparent

bulging membrane

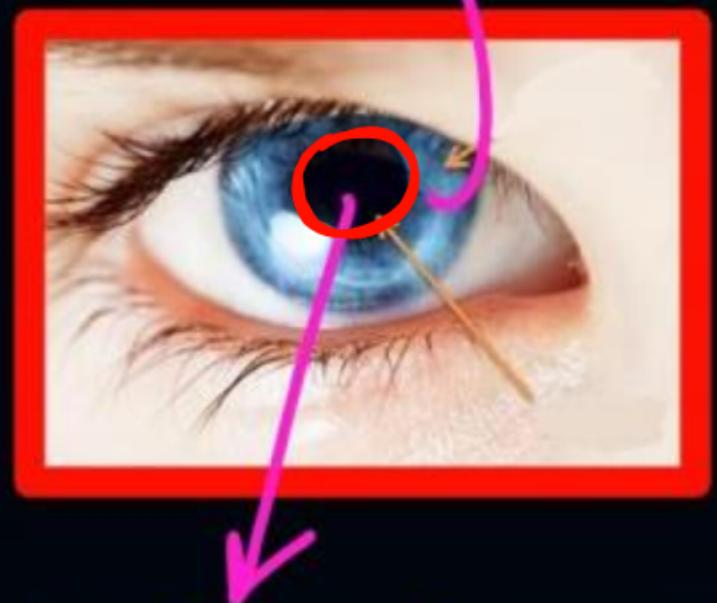


- Most of the refraction happens {Lens का काम}
- Protects from dust, germs.

Side View



3) Iris → Controls the size of Pupil



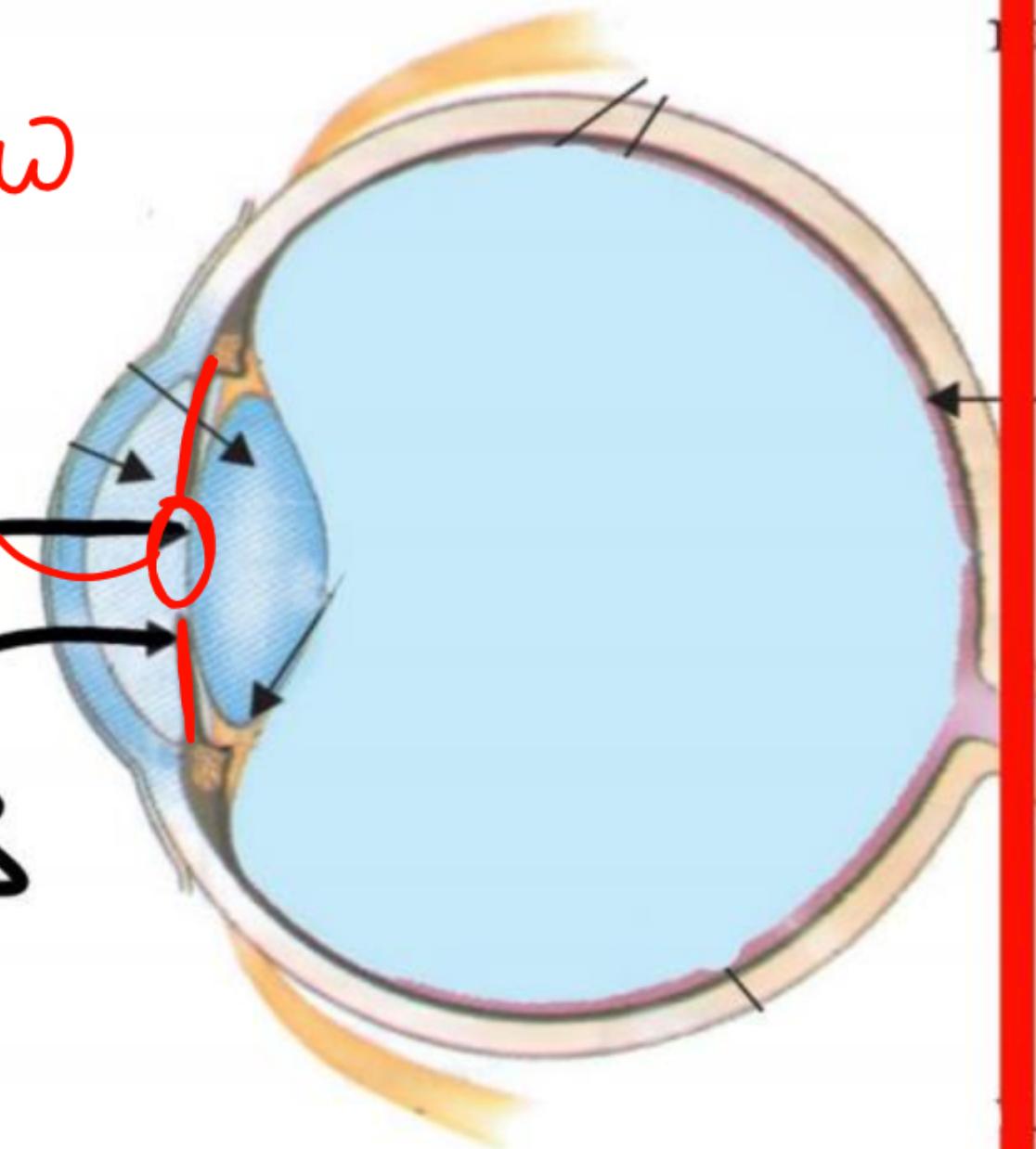
Shutter

4) Pupil → Regulates & Controls the amount of light entering the eye!!

Side View

PUPIL

IRIS

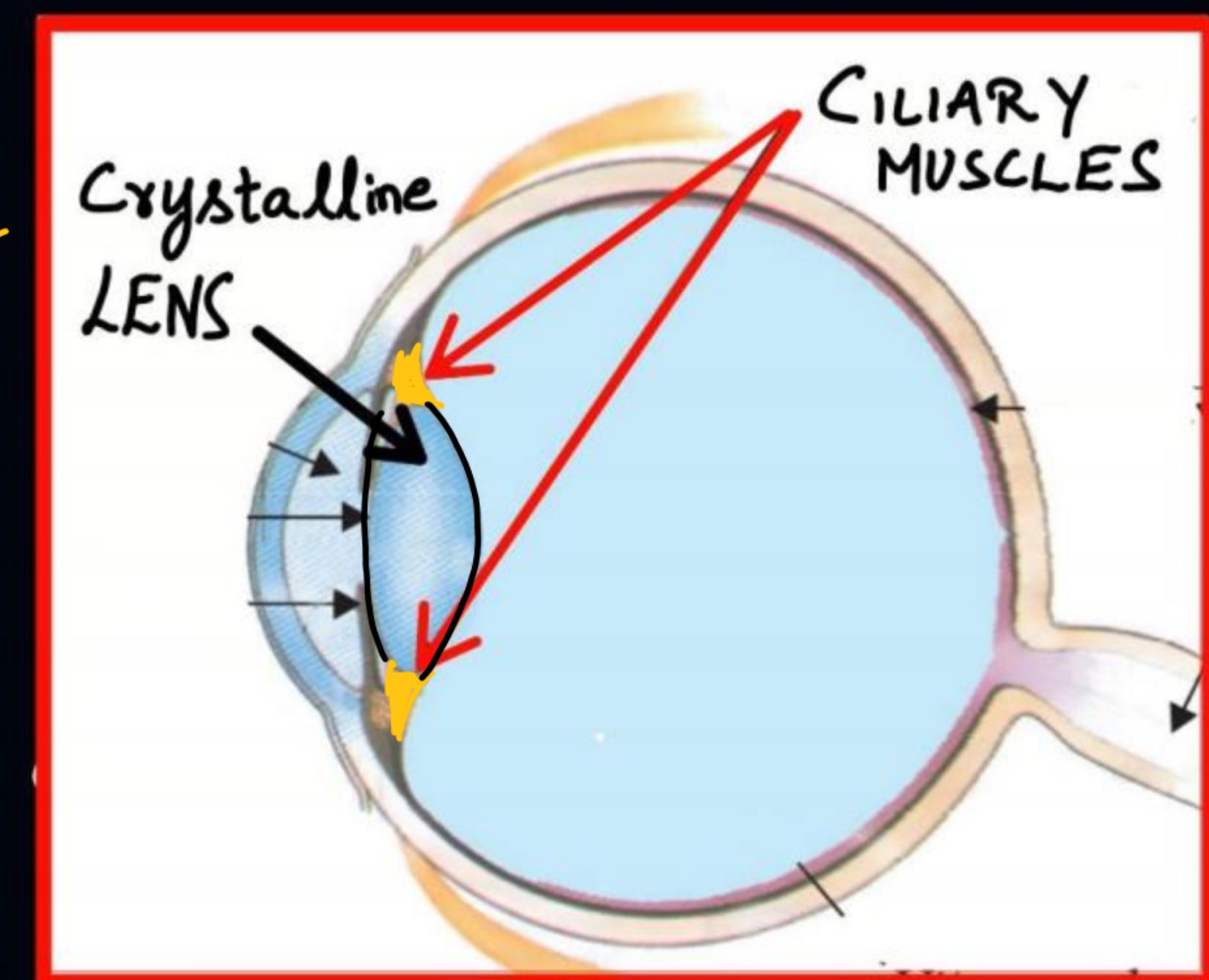


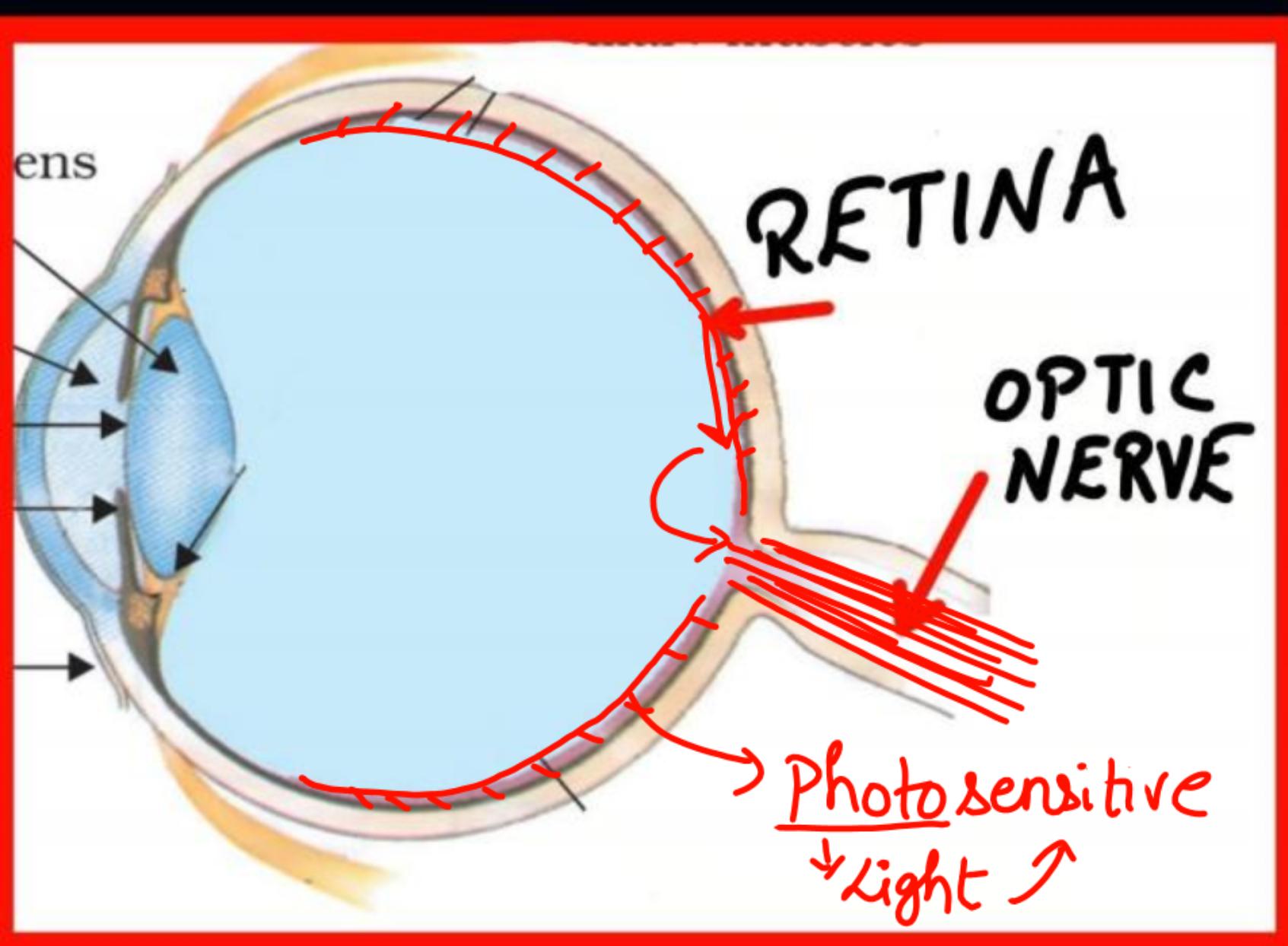
5) Crystalline LENS →

- Convex Lens.
- Flexible focal length! *Gudiya*
- Forms Real & Inverted Image

6) Ciliary Muscles →

- Adjust the focal length of eye lens





8) Optic Nerve →

• Sends ^{electrical} signal to the brain.

Light → Nerve fibre

- 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 gets activated when light falls on them & generates electrical signal.

g)

Aqueous Humor

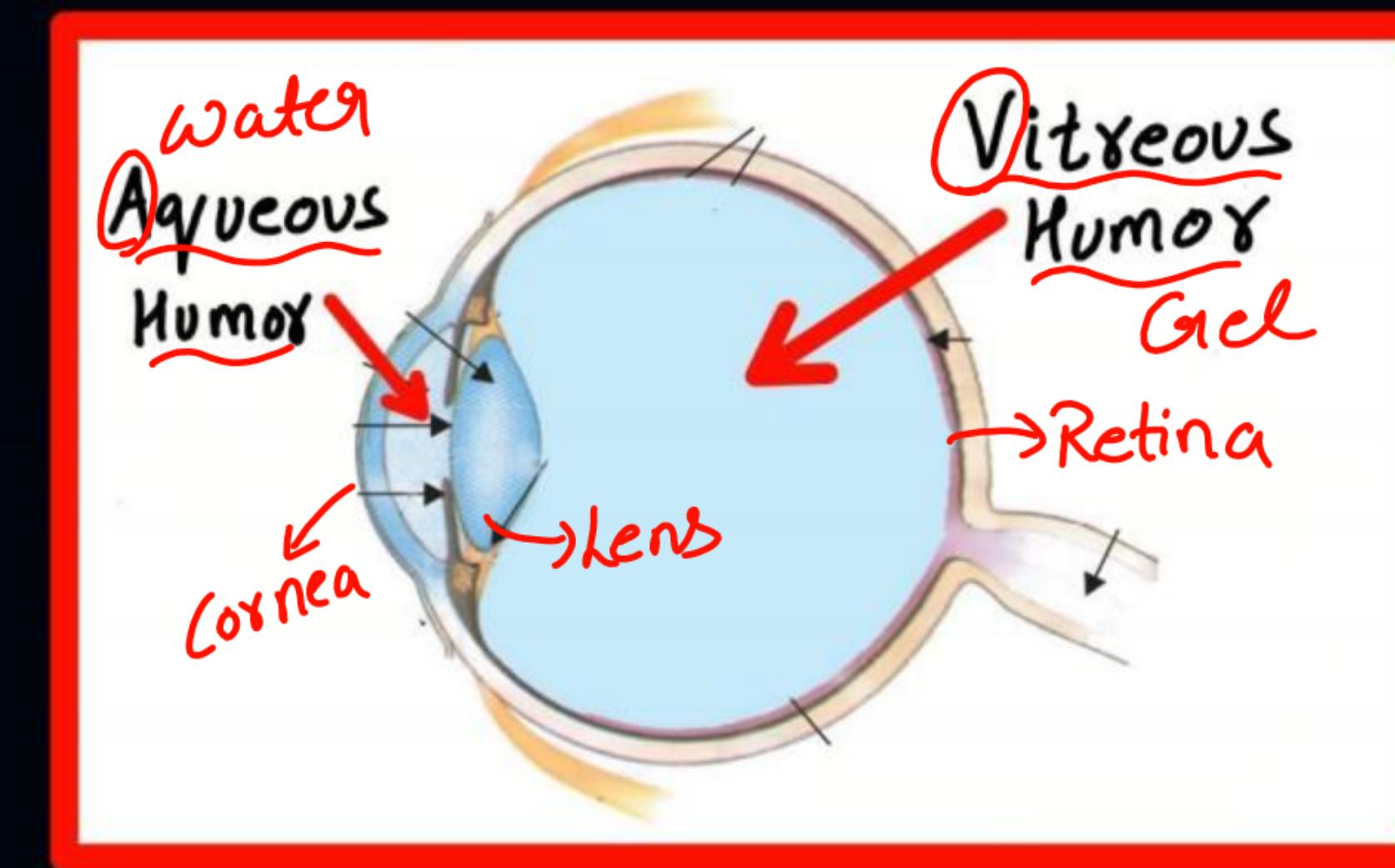
- Water like fluid
- It is present between lens & Cornea

Nutrition

Vitreous Humor

- Gel like substance
- Present between lens & Retina

• Support & Strength helps the eye to keep its shape !



Q. The lens system of human eye forms an image on a light sensitive screen, which is called as

- (a) cornea
- (b) ciliary muscles
- (c) optic nerves
- ~~(d) retina~~

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Q. In human eye the part which allows light to enter into the eye is

- ~~(a) Retina~~
- ~~(b) Pupil~~
- ~~(c) Eye lens~~
- (d) Cornea

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Thick
Lens



Thin Lens



focal length → Less
Small

More
Large

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

POWER OF ACCOMODATION

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

① To View Closer Objects

$$P \uparrow$$

Ciliary Muscles Contract



Lens becomes thick
{Curvature Increases}



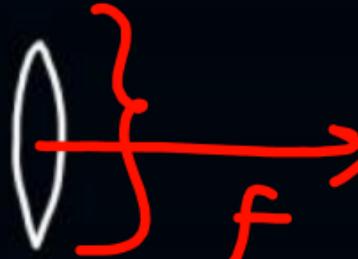
{Focal length decreases} $P \uparrow$

To View distant (far) objects

Ciliary Muscles relaxes



Lens becomes thin
{Curvature decreases}



focal length Increases

$$f \uparrow P \downarrow$$

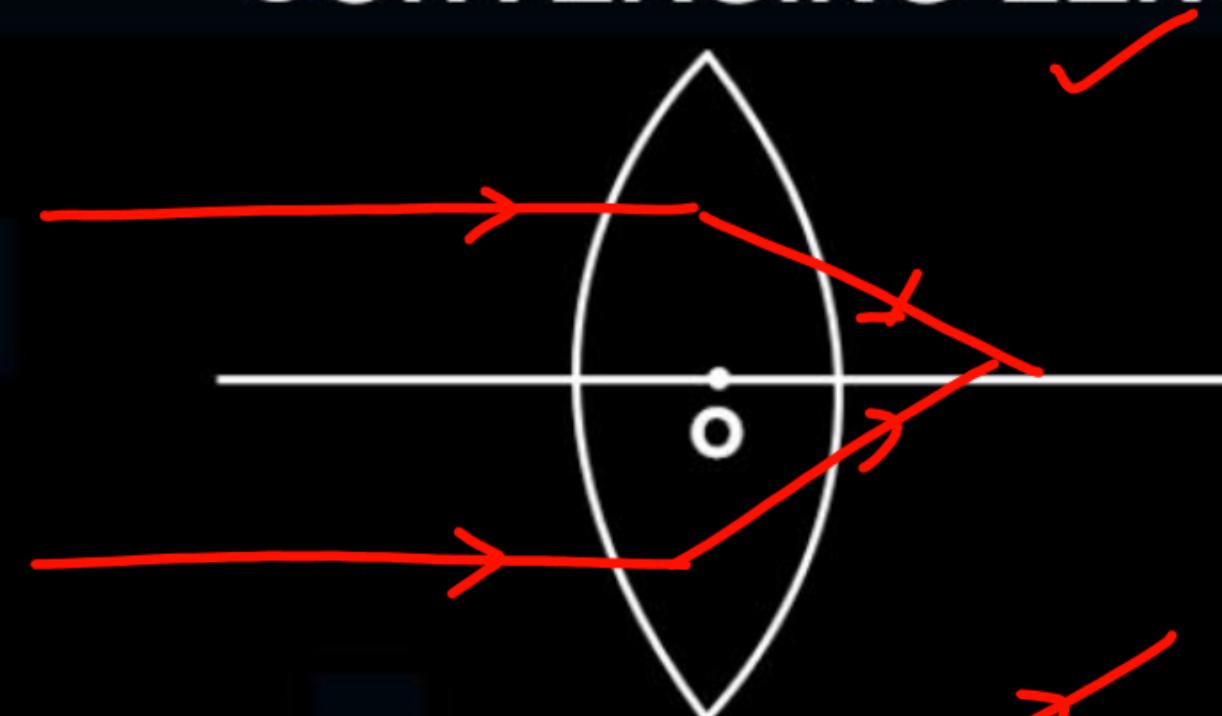
$$P = \frac{1}{f}$$

- 1) Near Point . The minimum distance from eye at which an object can be seen clearly & distinctly ✓
- It is also called Least Distance of Distinct Vision
 - For normal vision (Young Adults) → 25cm

- 2) Far Point ∞ ✓
- The farthest (sabse doooy) point upto which the eyes can see objects clearly ✓
- For normal eyes → ∞ infinity ✓

CONVERGING LENS

1) Convex Lens

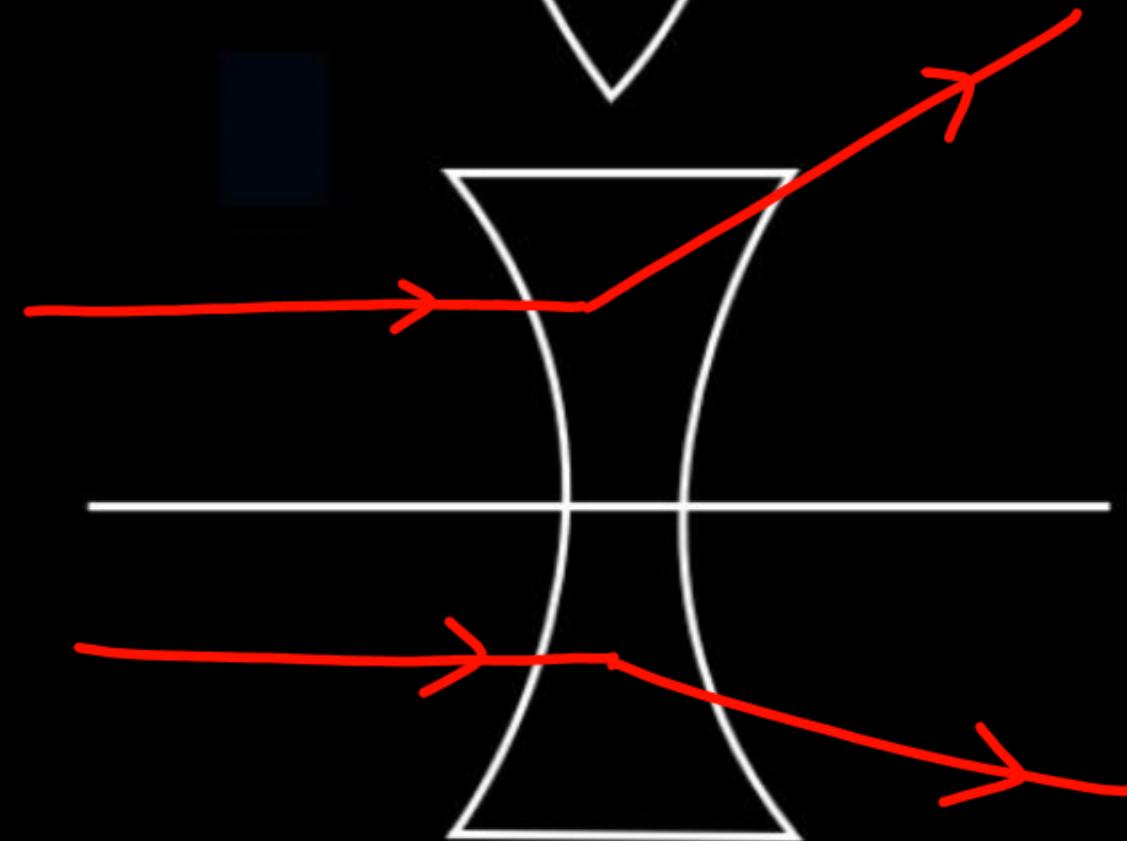


$$P = \frac{1}{f}$$

$f \rightarrow +ve$

$P \rightarrow +ve$

2) Concave Lens



$f \rightarrow -ve$

$P \rightarrow -ve$

DIVERGING LENS

**DEFECTS
in
Human EYE
&
Corrections**

- 1) Myopia : \rightarrow {Near-Sightedness}
- Can see nearby objects clearly ✓
 - Cannot see distant objects distinctly (clearly) ✓
 - Far point is less than infinity ✓

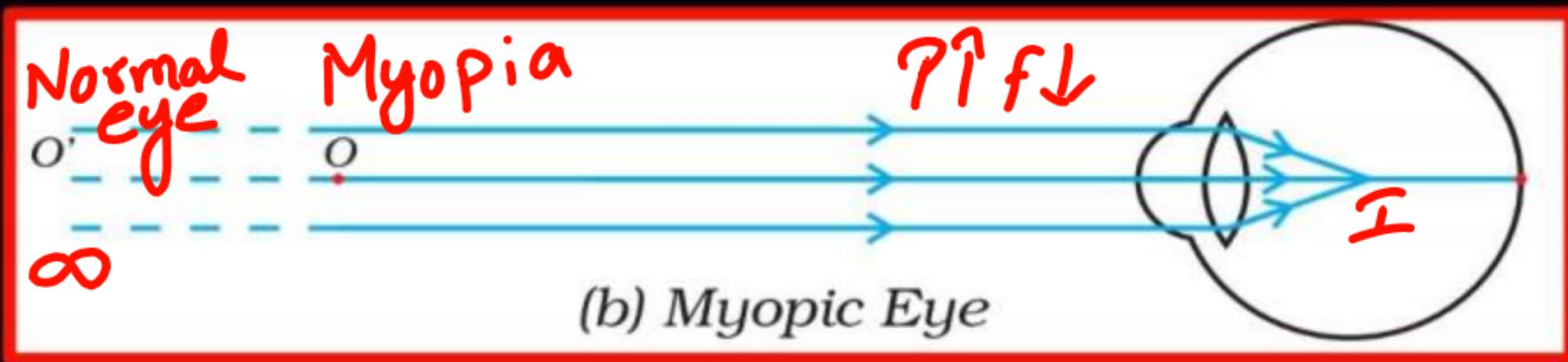
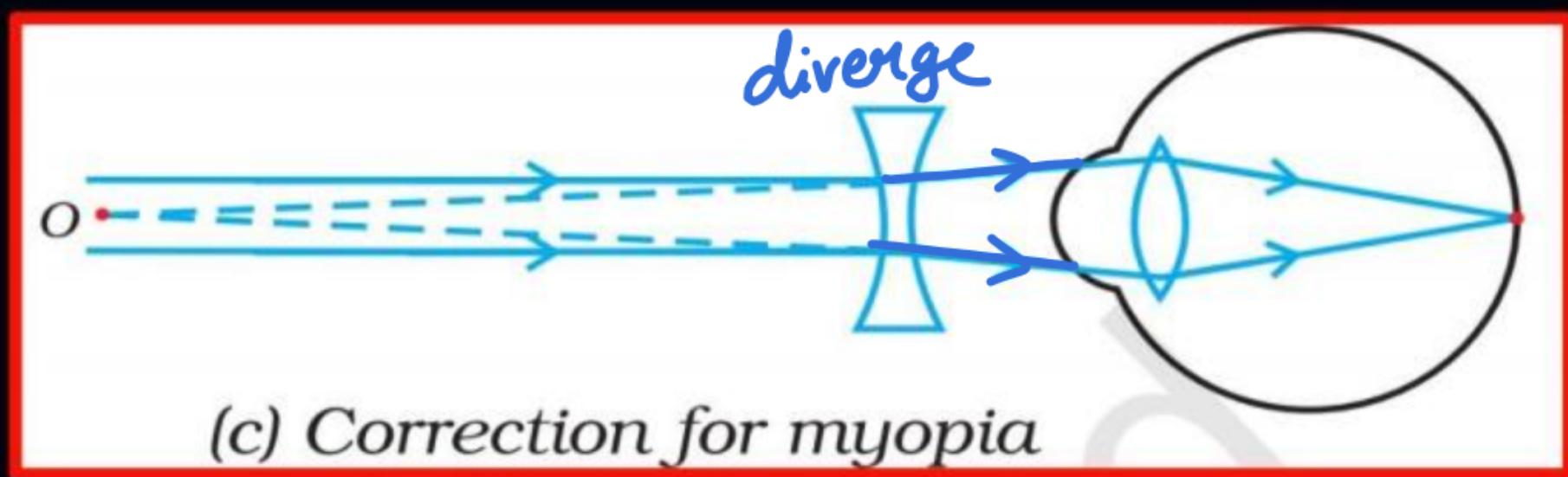


Image of distant object is formed in front (before) of Retina

Reasons \rightarrow

- 1) Excessive Curvature of eye lens
{lens thick \rightarrow focal length decreases}
- 2) Elongation of eye ball



Negative Power Lens

CORRECTION \rightarrow CONCAVE LENS



MyoNi makes Elon Thick, went CAVE.

Myopia Near Sightedness

Elongation of eyeball (Fat) Lens

Thick fat $f \rightarrow \text{less}$

Concave lens

$f \rightarrow -ve$

$P \rightarrow -ve$

Diagram: A handwritten diagram showing the relationship between Myopia/Near Sightedness and the eye's physical characteristics. It starts with 'MyoNi' at the top left, with red arrows pointing down to 'Myopia' and 'Near Sightedness'. From 'Myopia', an arrow points right to 'Elongation of eyeball'. Another arrow from 'MyoNi' points right to '(Fat)', which then has an arrow pointing down to 'Thick fat'. Below 'Thick fat' is the equation $f \rightarrow \text{less}$. To the right of 'Thick fat' is 'Concave lens'. Below 'Concave lens' are two equations: $f \rightarrow -ve$ and $P \rightarrow -ve$. The word 'Lens' is written vertically between 'Thick fat' and 'Concave lens'.

2) Hypermetropia • Can see distant (far) objects clearly ✓

{Far-Sightedness} • Cannot see nearby objects distinctly (clearly) ✓
Dada Dadi • Near point is more than 25 cm ✓

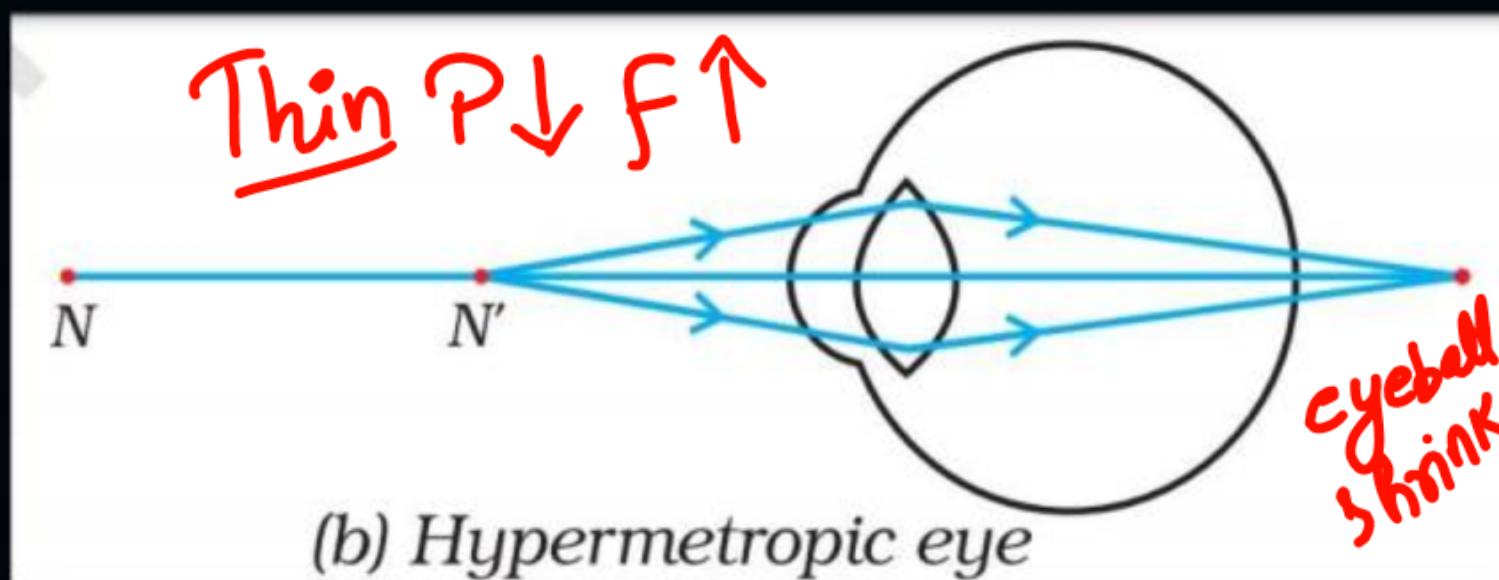
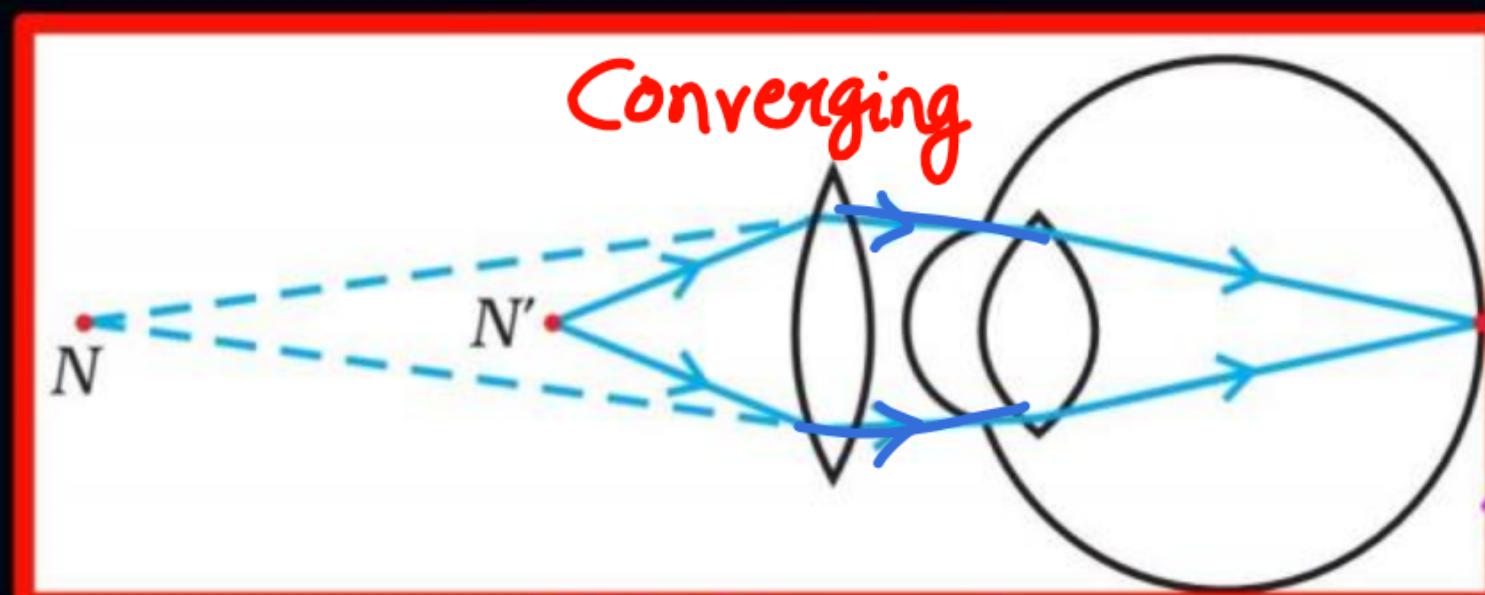


Image of nearby object is formed
at a point behind Retina. ✓

Reasons →

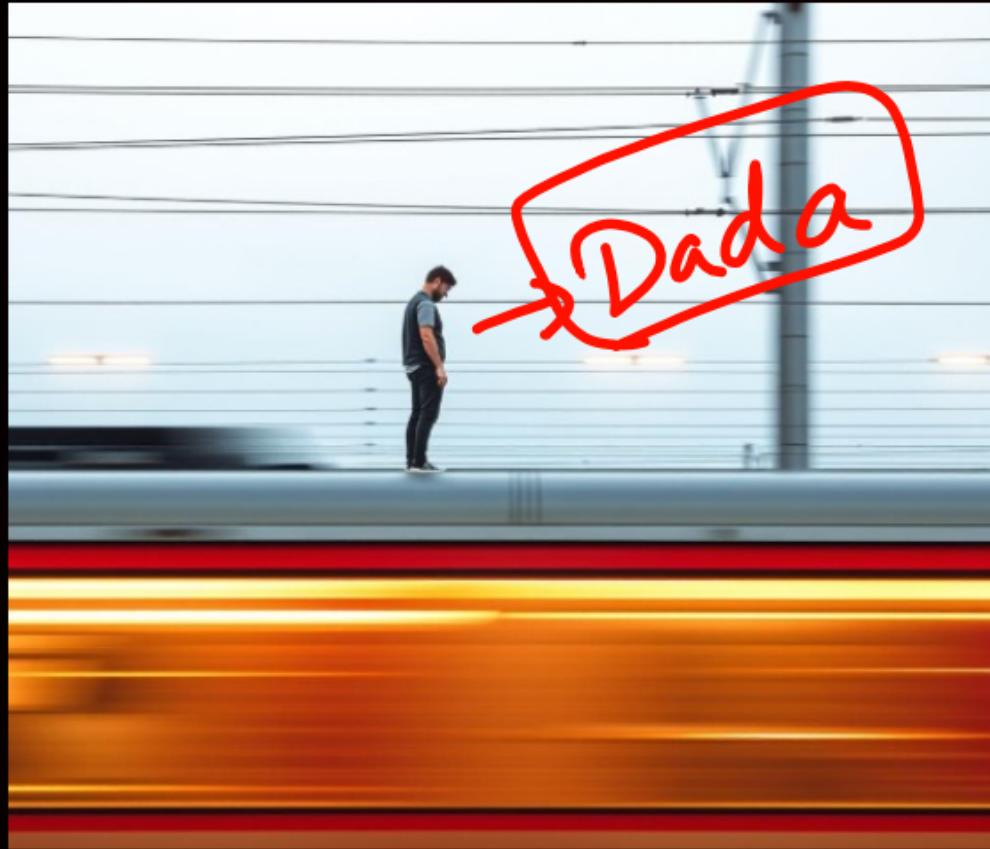
1) Focal length of eye lens is too long
{lens cannot get thick enough} ✓

2) Eyeball has become too small. ✓



CORRECTION → CONVEX LENS

+VE Power lens



FaST Metro makes eye small, Face large like Wax
 Far Sightedness → eyeball small shrank
 ↓
 Hyper Metropia Focal length large; thin
 ↓
 Convex lens

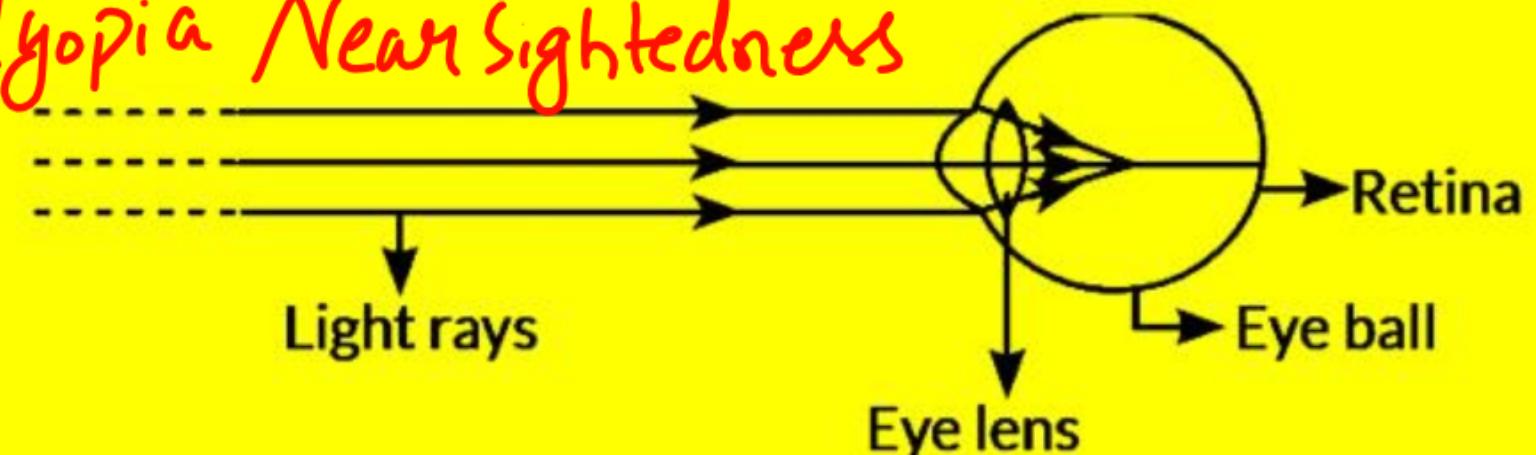
Q. Observe the following diagram and answer the questions following it:

(i) Identify the defect of vision shown.

(ii) List its two causes.

(iii) Name the type of lens used for the correction of this defect.

Myopia Near Sightedness



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Q. Study the diagram given below and answer the questions that follow :

(i) Name the defect of vision depicted in this diagram stating the part of the eye responsible for this condition.

(ii) List two causes of this defect.

(iii) Name the type of lens used to correct this defect and state its role in this case.

Far Sight Hyper Metropia



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3) Presbyopia With ageing , people find it difficult to see nearby objects distinctly (Clearly).

Far objects problem → Reason → i) weakening of ciliary muscles
Myopia ii) Less flexibility of eye lens
+ Hyper Metropia

4) Cataract → {Lens becomes Opaque}

- Sometimes at old Ages, light rays X
Crystalline Lens becomes milky and cloudy. → Partial or Complete Loss of Vision.

CORRECTION → CATARACT SURGERY

Bi-Polar Lenses

For person suffering with both Myopia & hypermetropia.



Q. Person suffering from cataract has

- (a) elongated eyeball ✗
- (b) excessive curvature of eye lens ✗
- (c) weakened ciliary muscles ✗
- (d) ~~opaque eye lens.~~

(CBSE 2020)



Q. It is observed that the power of an eye to see nearby objects as well as far off objects diminishes with age.

(i) Give reason for the above statement.

→ ① Ciliary muscles weak
② flexibility of lens ↓

(ii) Name the defect that is likely to arise in the eyes

in such a condition. ✓ *Presbyopia*

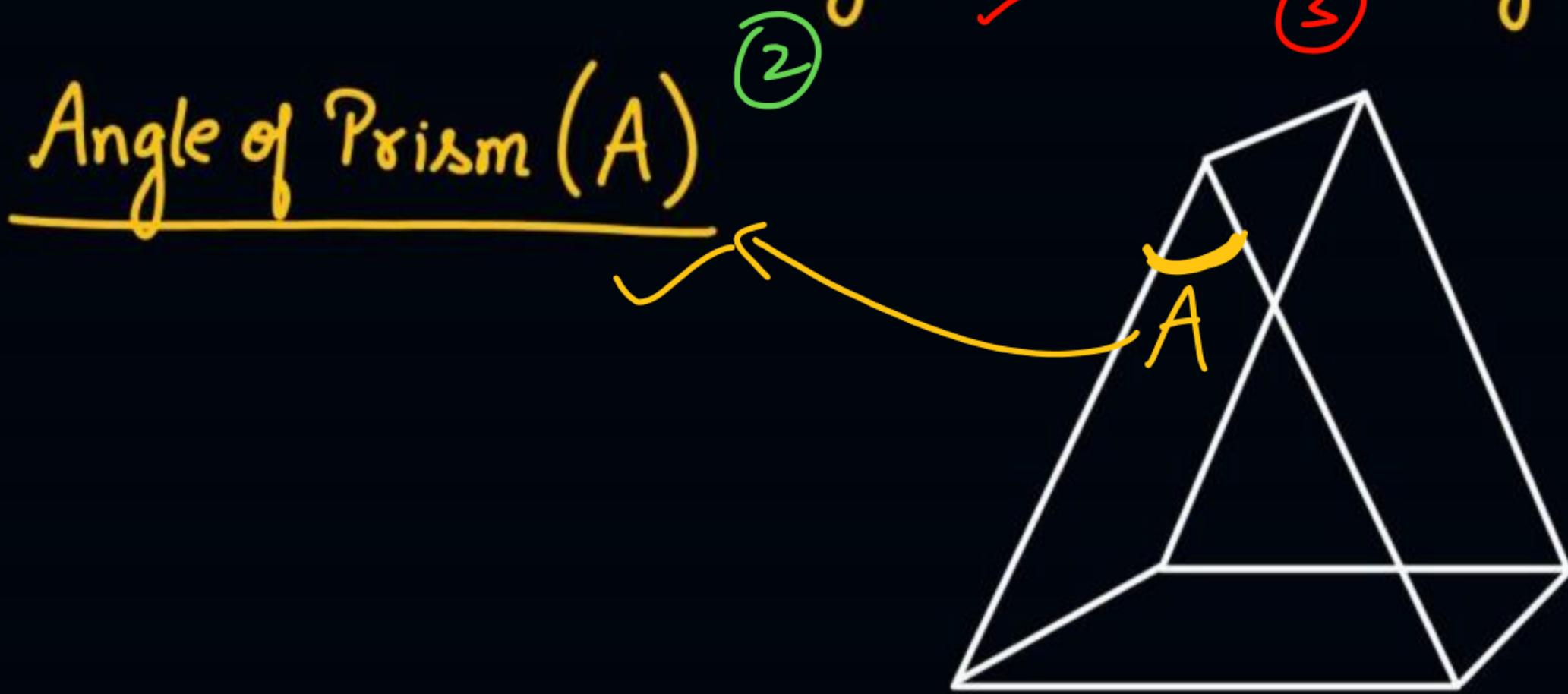


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Refraction through a PRISM

A glass Prism is a transparent refracting medium

It has → 2 Triangular + 3 Rectangular Surfaces



Refraction of Light & Deviation through a PRISM

{Monochromatic Light}

Single

Colour

white X

L_i → incidence

L_r → refraction

L_e → emergence

L_D → Deviation



A prism bends a ray of light towards Base.

- 1) We Know that White Light is made up of Seven Colours.
{Sunlight}
- 2) A Prism bends a ray of light \Rightarrow Angle of Deviation ($\angle D$)
- 3) $\angle D$ is different for different Colours of Light. \Rightarrow Some Colours bends more than other.

Violet Bends Most.

Red Bends Least.

{Learn}



Sunlight \uparrow
Bending order

VIBGYOR

Refraction of WHITE Light through a PRISM

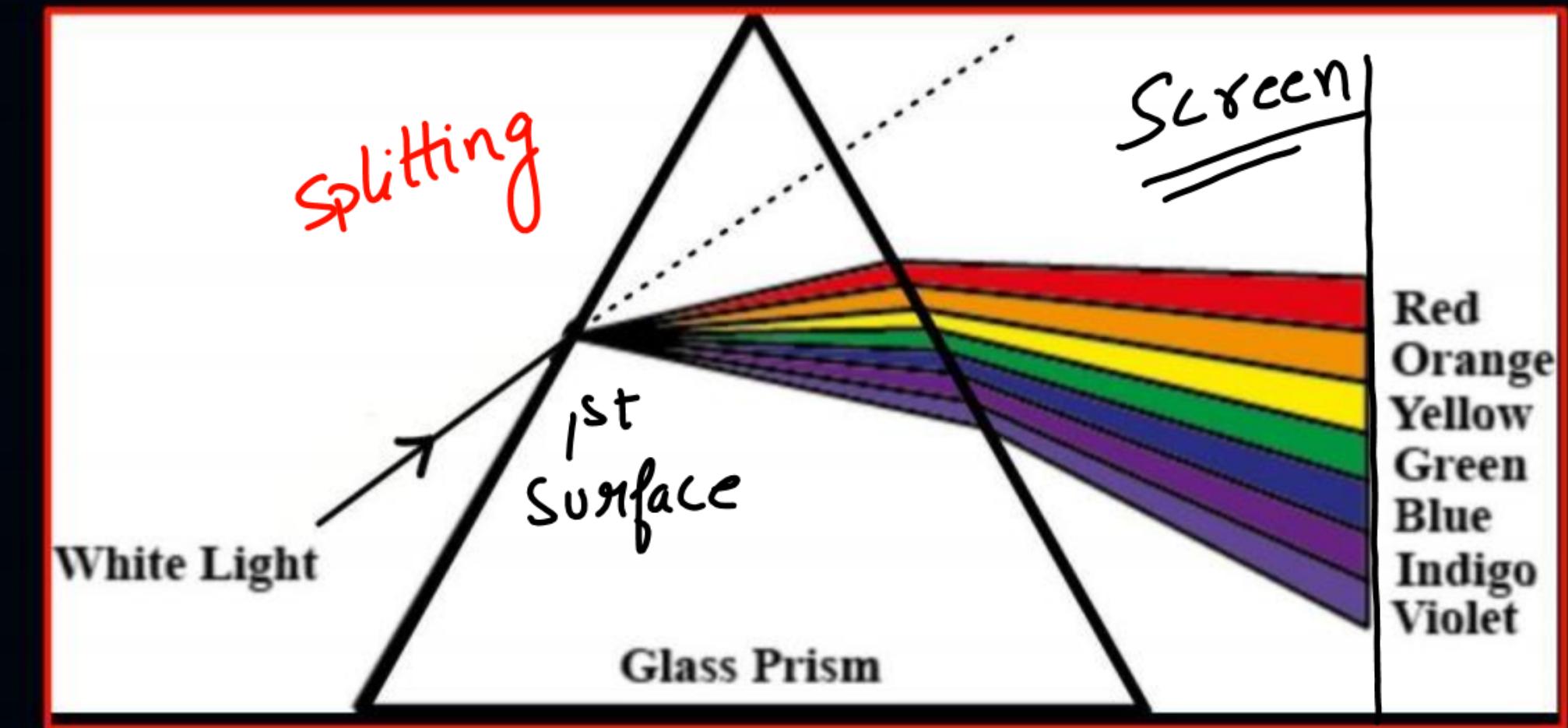
{Sunlight}

Dispersion

✓ The splitting of White Light into it's component colours. { 7 Colours }

Spectrum =

The band of Colour Components of Light. (Obtained on Screen)



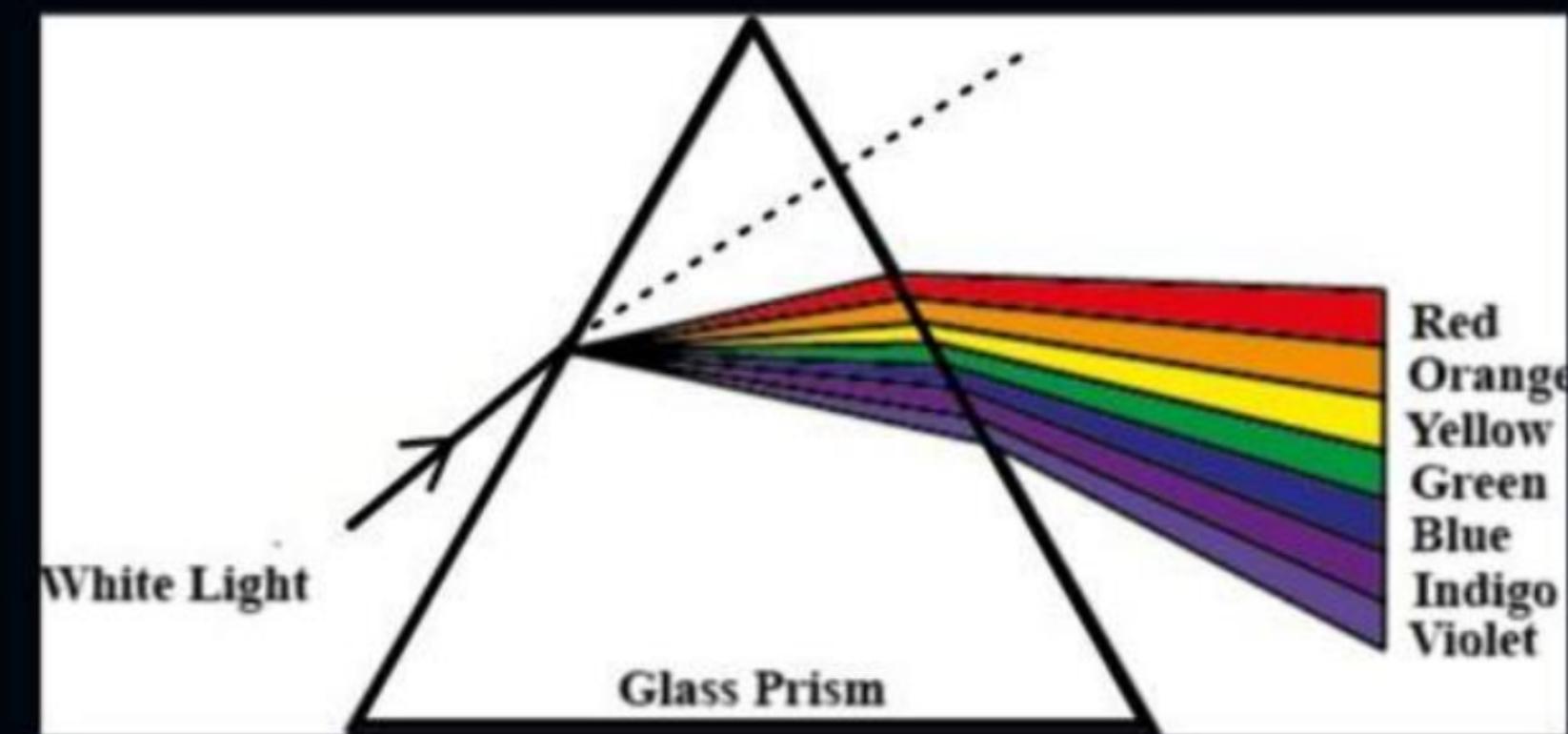
— bends Least.
— bends Most.

Q) Why does Dispersion Occurs?

Ans: A prism bends a ray of light. Different Colours of Light bends through different Angle.

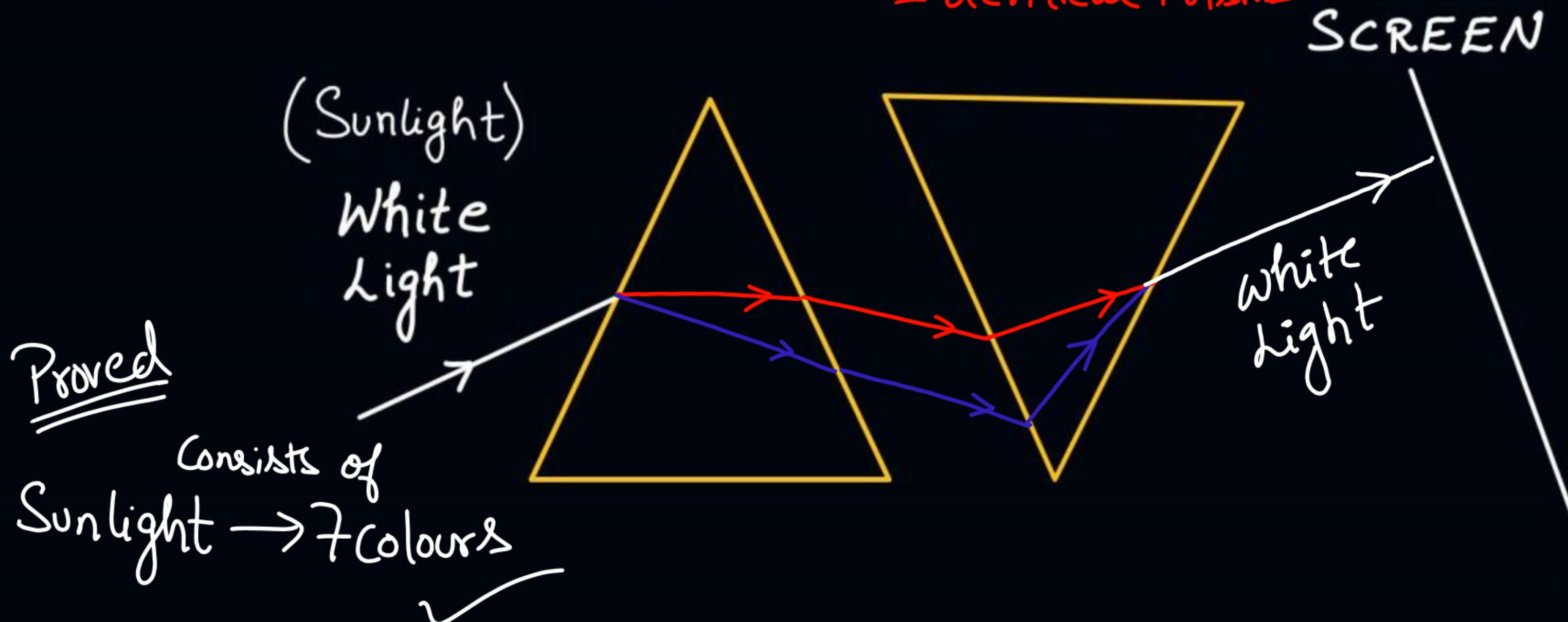
Red Bends the Least , Violet Bends the Most .

$\angle D \rightarrow$ Most
Violet



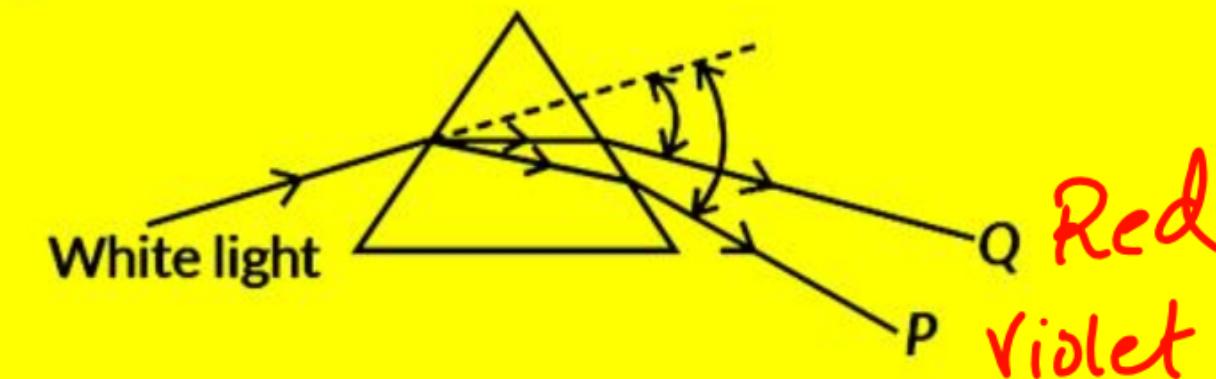
Newton's PRISM Experiment {Inverted Prisms}

Identical Prisms



Q. In the following diagram showing dispersion of white light by a glass prism, the colours 'P' and 'Q' respectively are

- (a) red and violet (b) ~~violet and red~~
- (c) red and blue (d) orange and green.



✓ (CBSE 2024)

Q. How can the coloured components of white light be recombined after a prism has separated them? Draw a labelled diagram to justify your answer.



✓ (CBSE 2023)

Q. What is dispersion of white light? State its cause. Draw a diagram to show dispersion of a Q beam of white light by a glass prism.

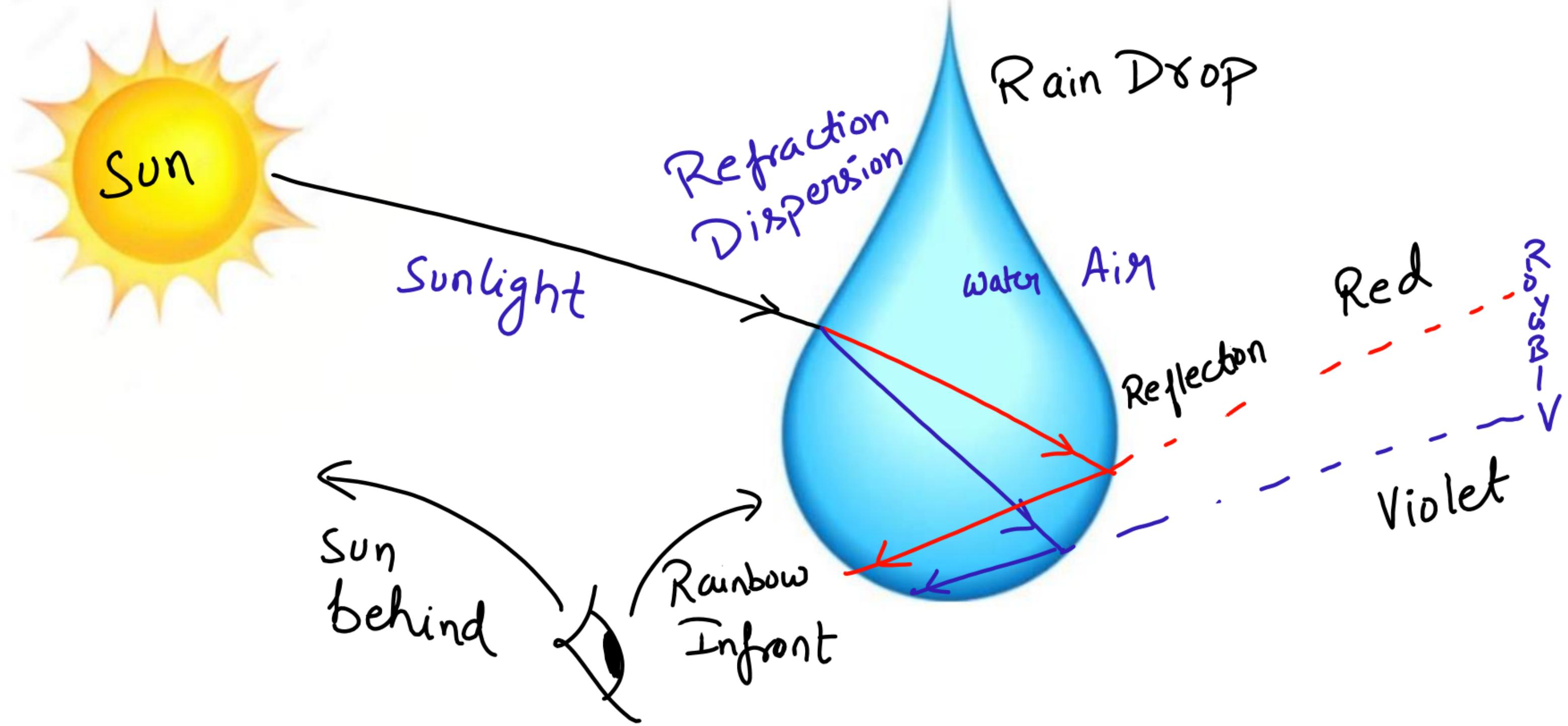


✓ (CBSE 2024)

RAINBOW FORMATION



Dispersion + Refraction + Reflection
Special



Q. Assertion (A) : The rainbow is a natural spectrum of sunlight in the sky.

Reason (R) : Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

(CBSE 2024)

Q. Draw a labelled diagram to show (i) dispersion of a 'beam of white light and (ii) formation of a rainbow.

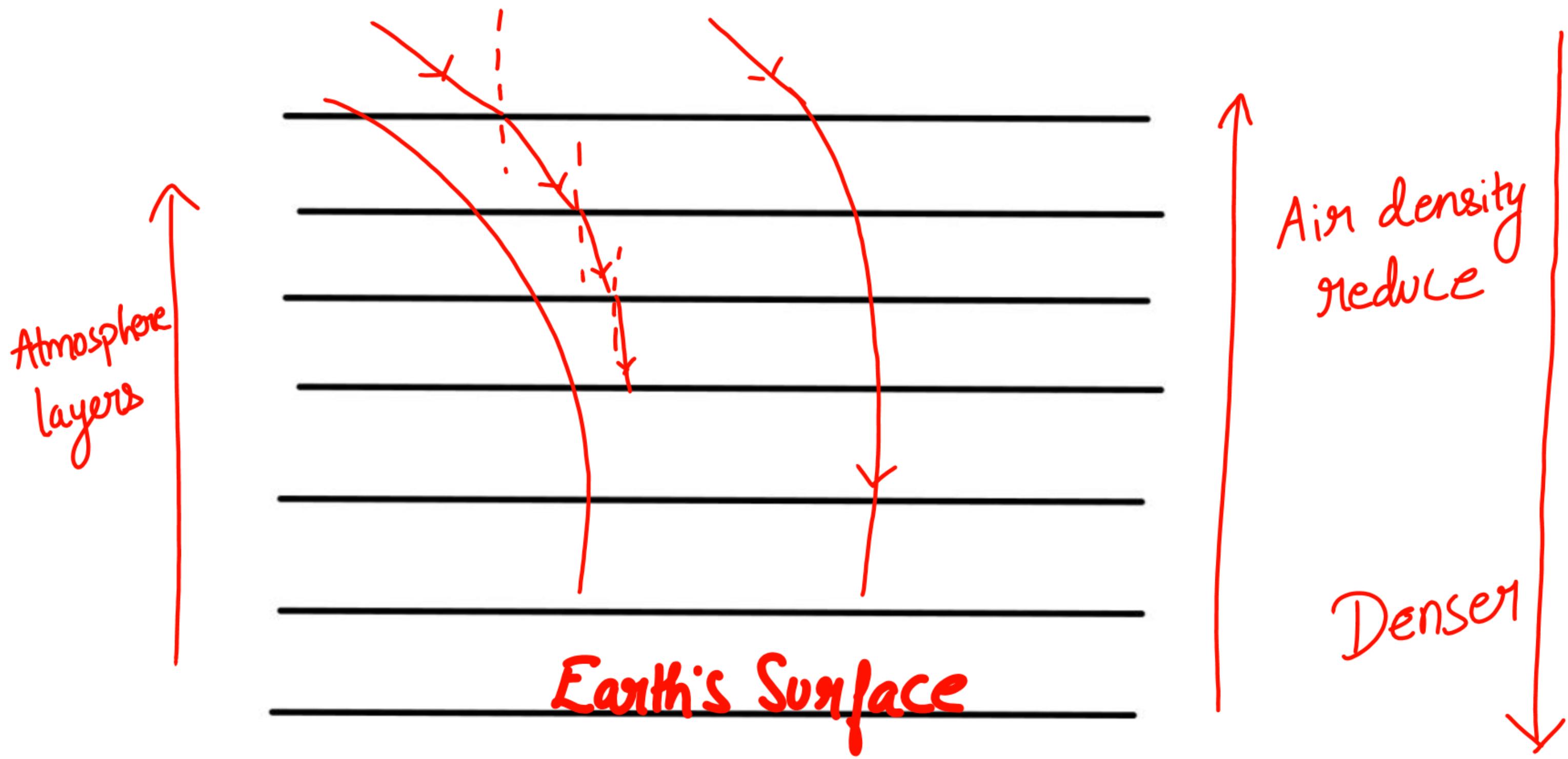
✓(CBSE 2023)

Q. The phenomena of light involved in the formation of rainbow are

- (a) refraction, reflection and dispersion
- ~~(b) refraction, dispersion and internal reflection~~
- (c) reflection, dispersion and internal reflection ~~x~~
- (d) refraction, dispersion, scattering and total internal reflection.

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ATMOSPHERIC REFRACTION

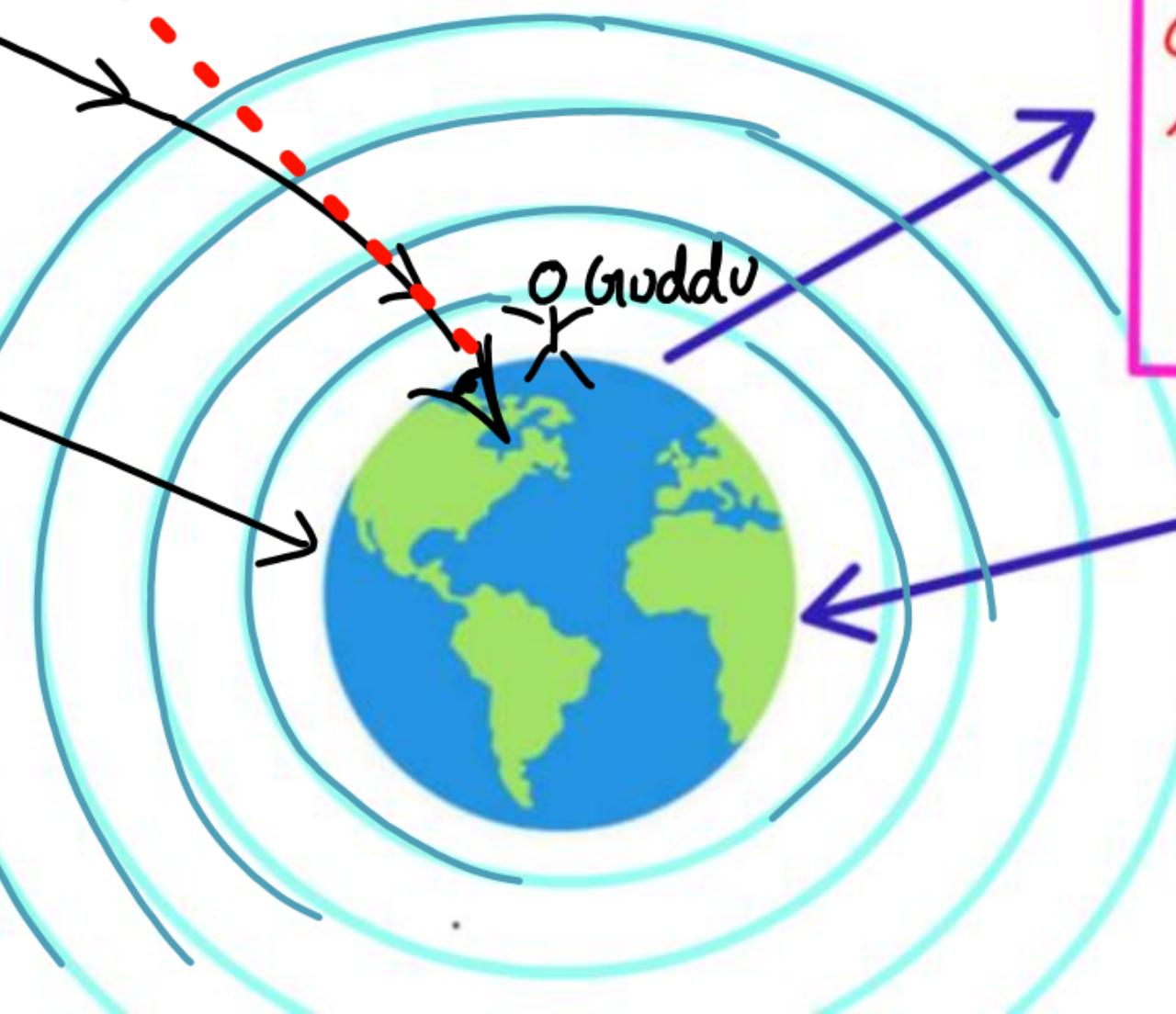


Apparent Position of STARS

Real X



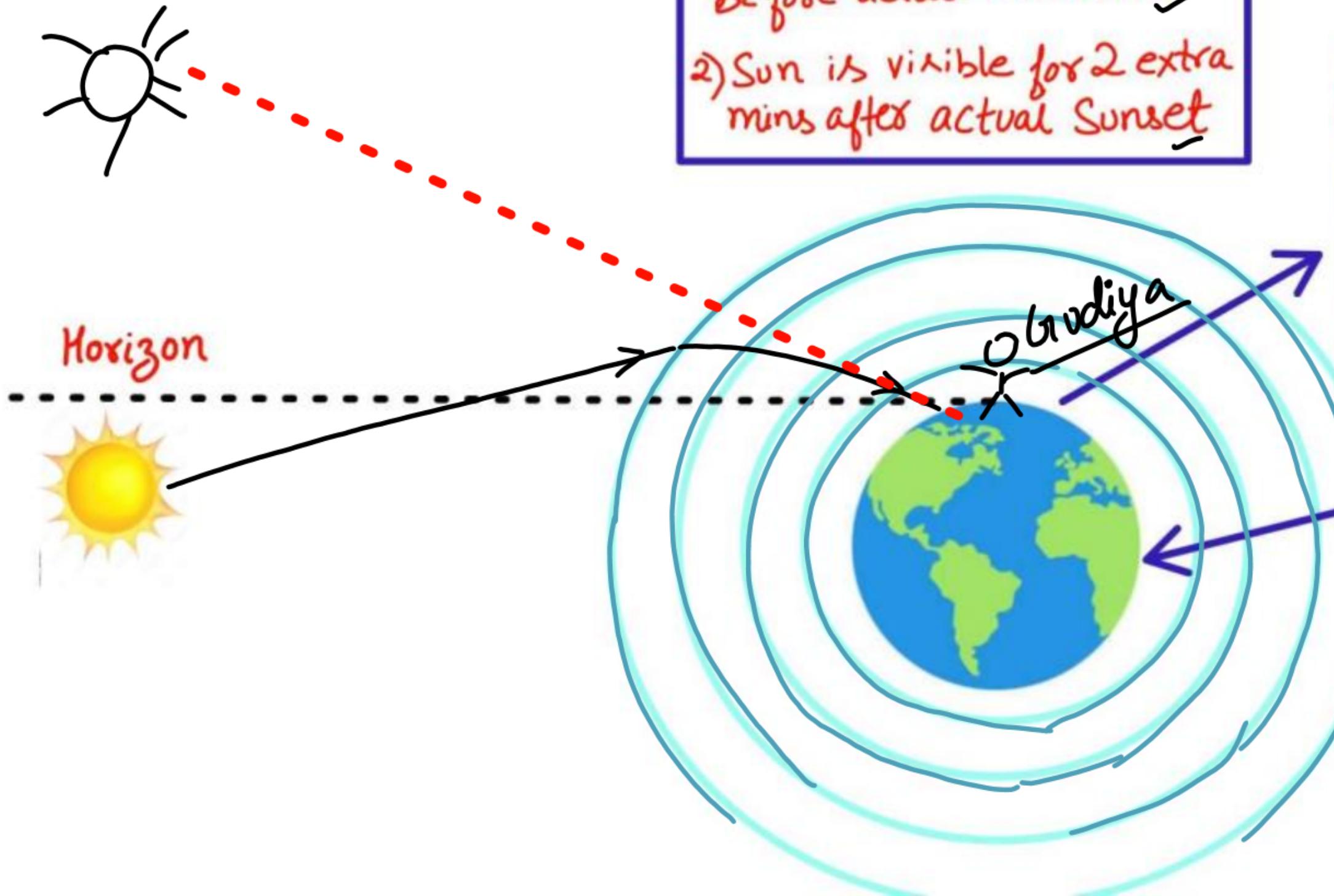
Rarer
to Denser



① Density of air decreases with height above Earth's Surface

② Rarer to Denser layers of air

Advance Sunrise & Delay Sunset

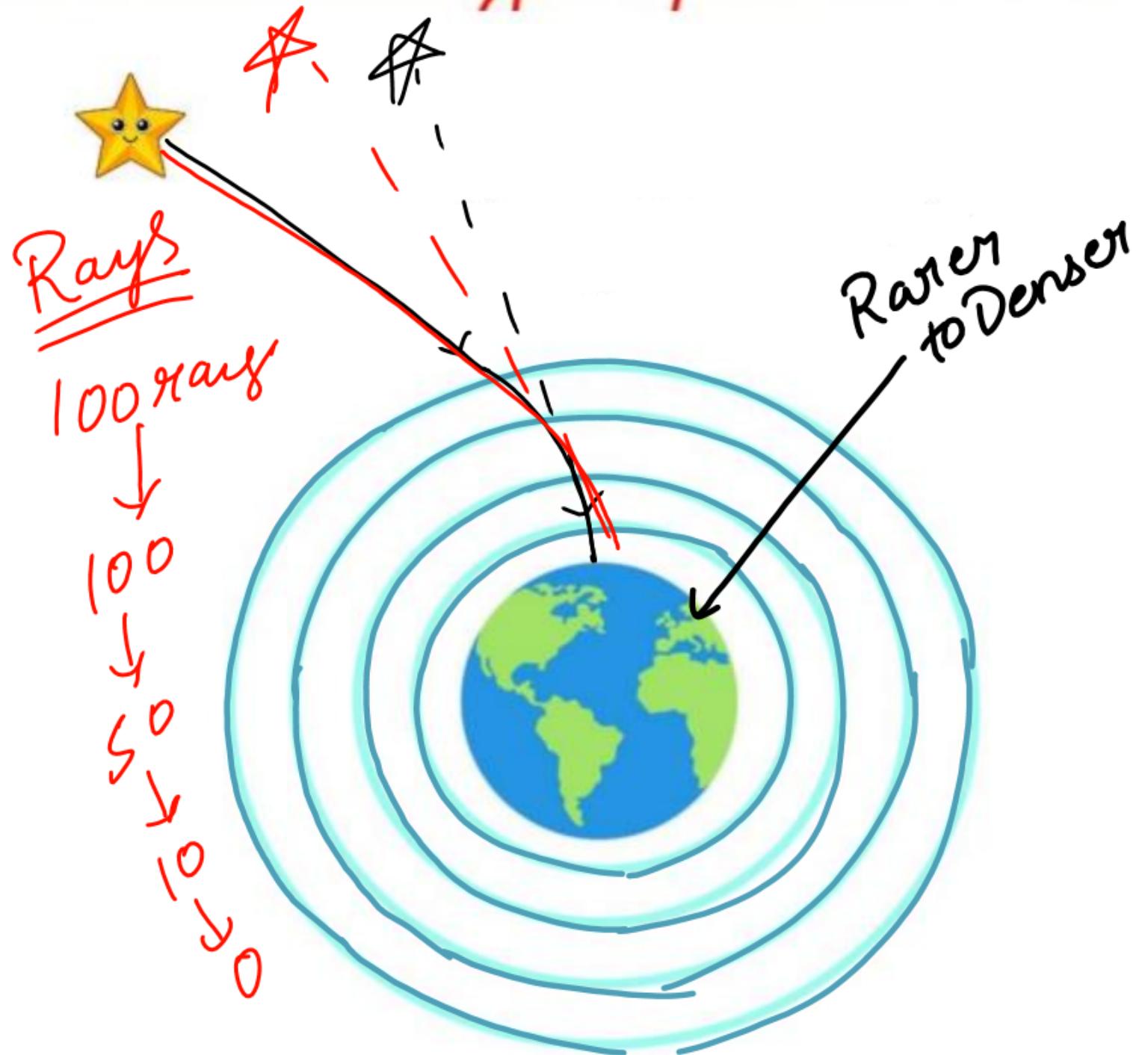


- 1) Sun is Visible 2 mins before actual sunrise
- 2) Sun is visible for 2 extra mins after actual sunset

① Density of air decreases with height above Earth's Surface

② Rarer to Denser layers of air

Twinkling of STARS



- 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

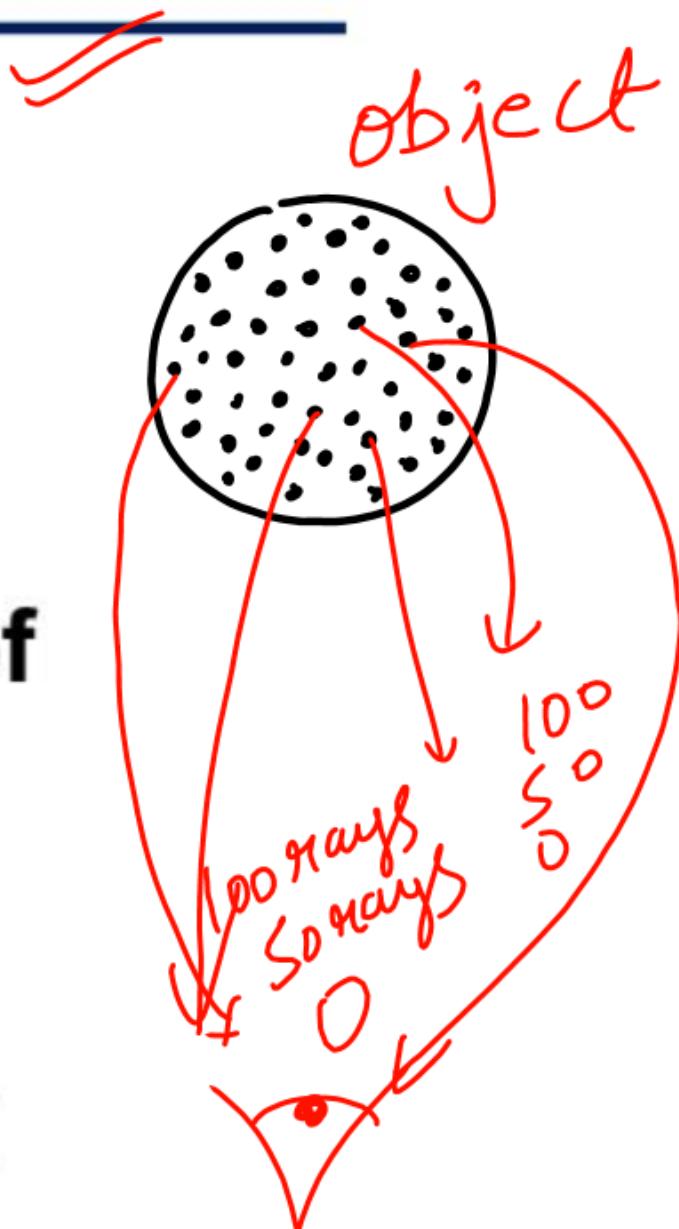
Why Planets do not twinkle

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 & 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 heterogeneous mixture. The size of particles of a colloid is too small to be individually seen with naked eyes.)

Example - Milk ; Smoke ; Dust in air

VIBGYOR
Wavelength ↑

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

white light

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.



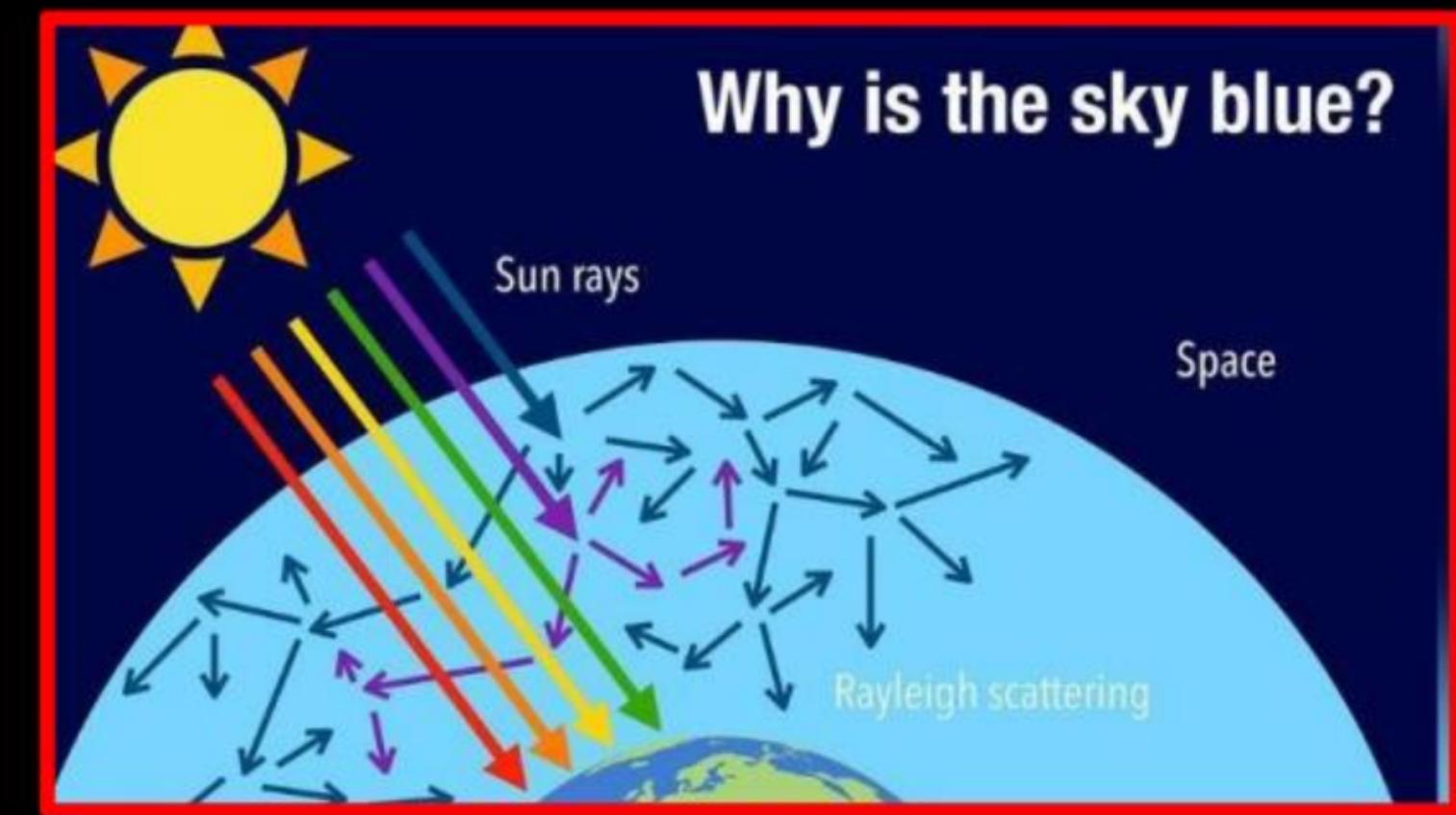
Blue Colour Of Sky

1) The **molecules of air** and other fine particles in the atmosphere have size smaller than the wavelength of visible light

very small ✓ particle

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



Reddening of the Sun at Sunrise & Sunset

Sunset

- More atmosphere

- More scattering

- Orange - red sky & sun

Blue colour
finish

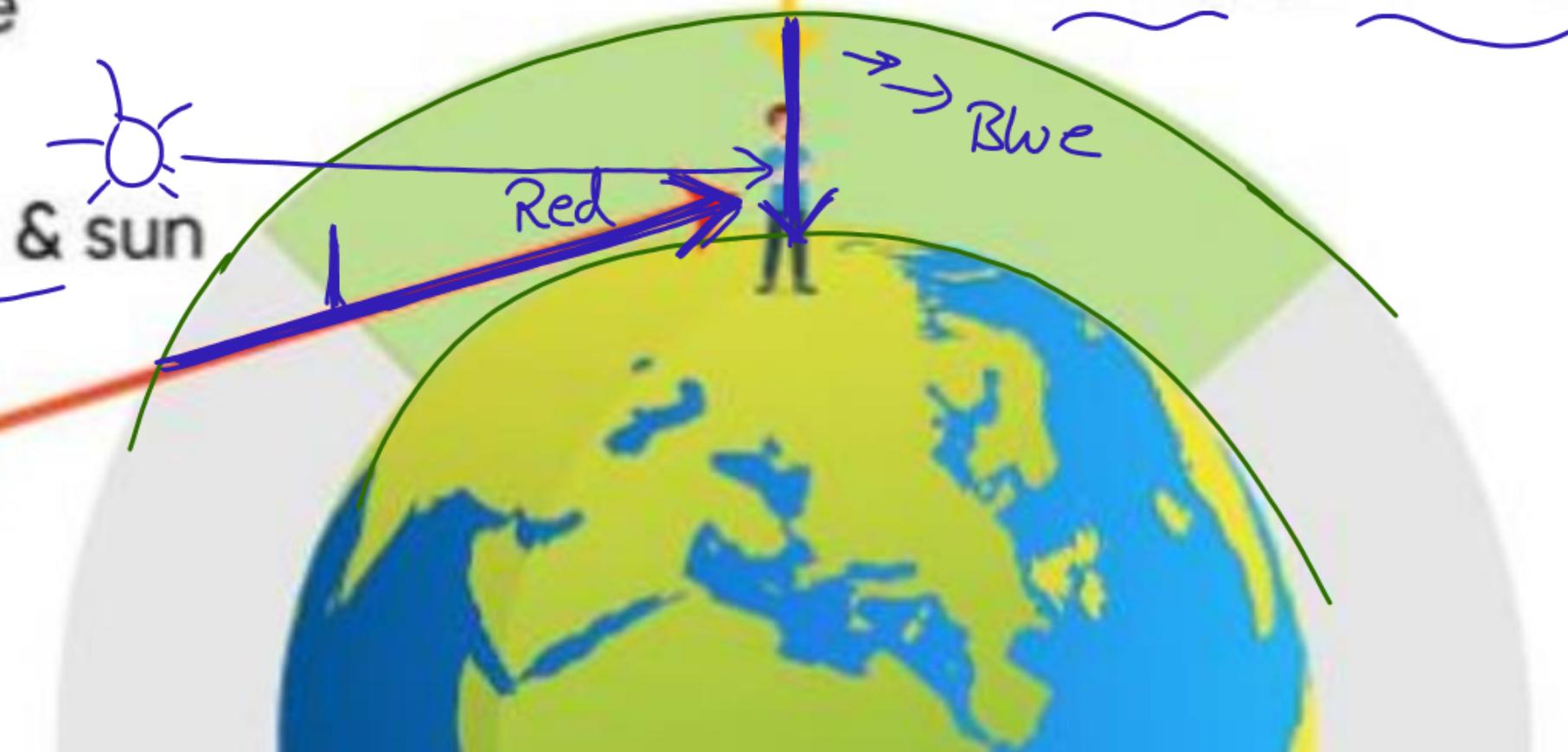
Sun overhead

Noon

- Less atmosphere

- Less scattering

- Blue sky, yellow sun



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

Astronauts → Dark Atmospheric Scattering



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

At high altitude 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



Q. When a beam of white light passes through a region having very fine dust particles, the colour of light 'mainly scattered in that region is

- (a) red
- (b) orange
- (c) blue
- (d) yellow.

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Q. Give reasons :

- (a) Red colour is selected for danger signals.
- (b) The sky appears dark in space.
- (c) The time difference between actual sunset and apparent sunset is about 2 minutes.

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