

UPDAAN



2025

Human Eye and The Colorful World

PHYSICS

Lecture - 02

By - ER. RAKSHAK SIR



Topics to be covered



1

REFRACTION THROUGH PRISM ✓

2

ATMOSPHERIC REFRACTION ✓

3

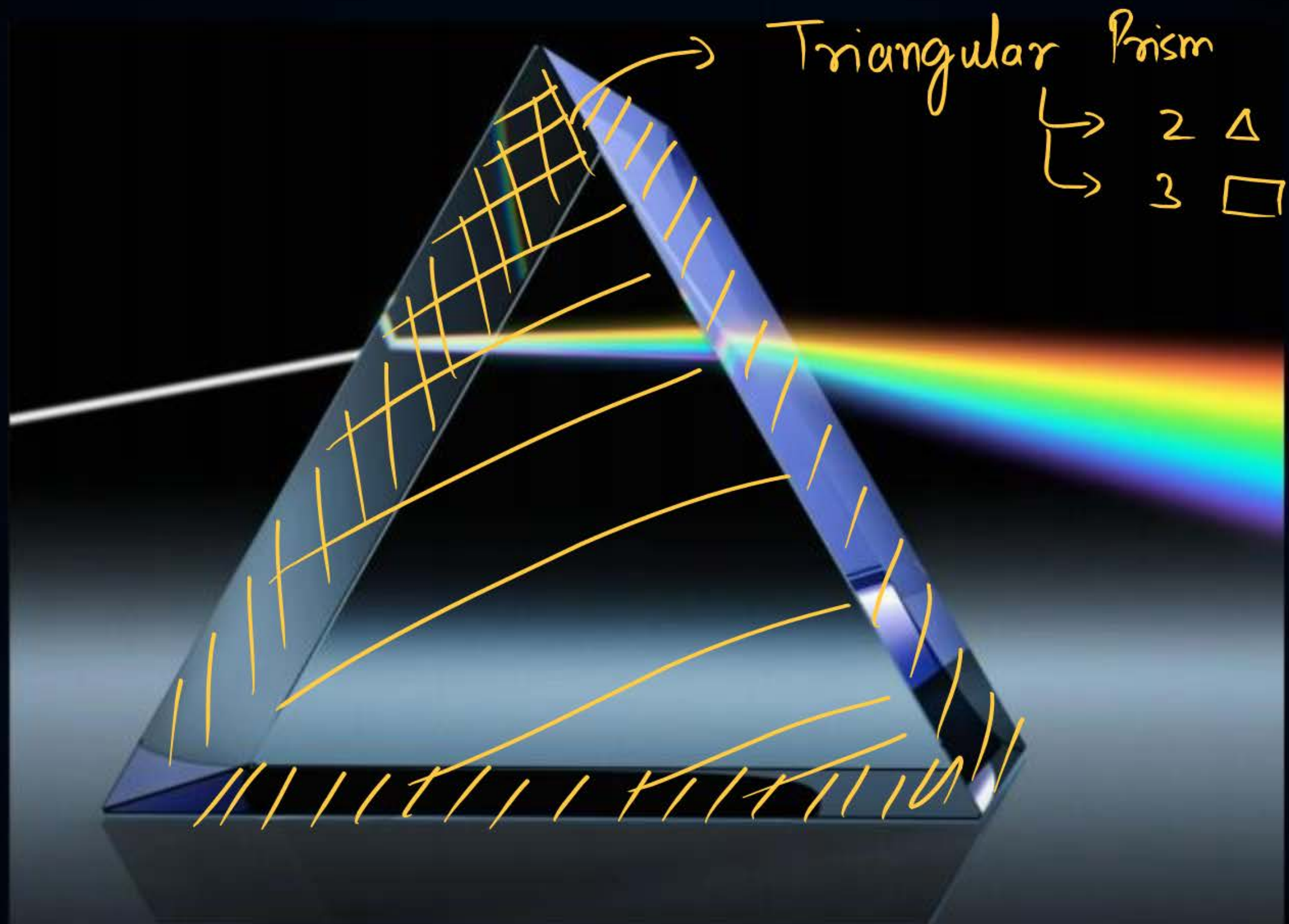
SCATTERING ✓

4

NCERT Questions in one shot ✓

5







REFRACTION THROUGH PRISM

Δ or δ

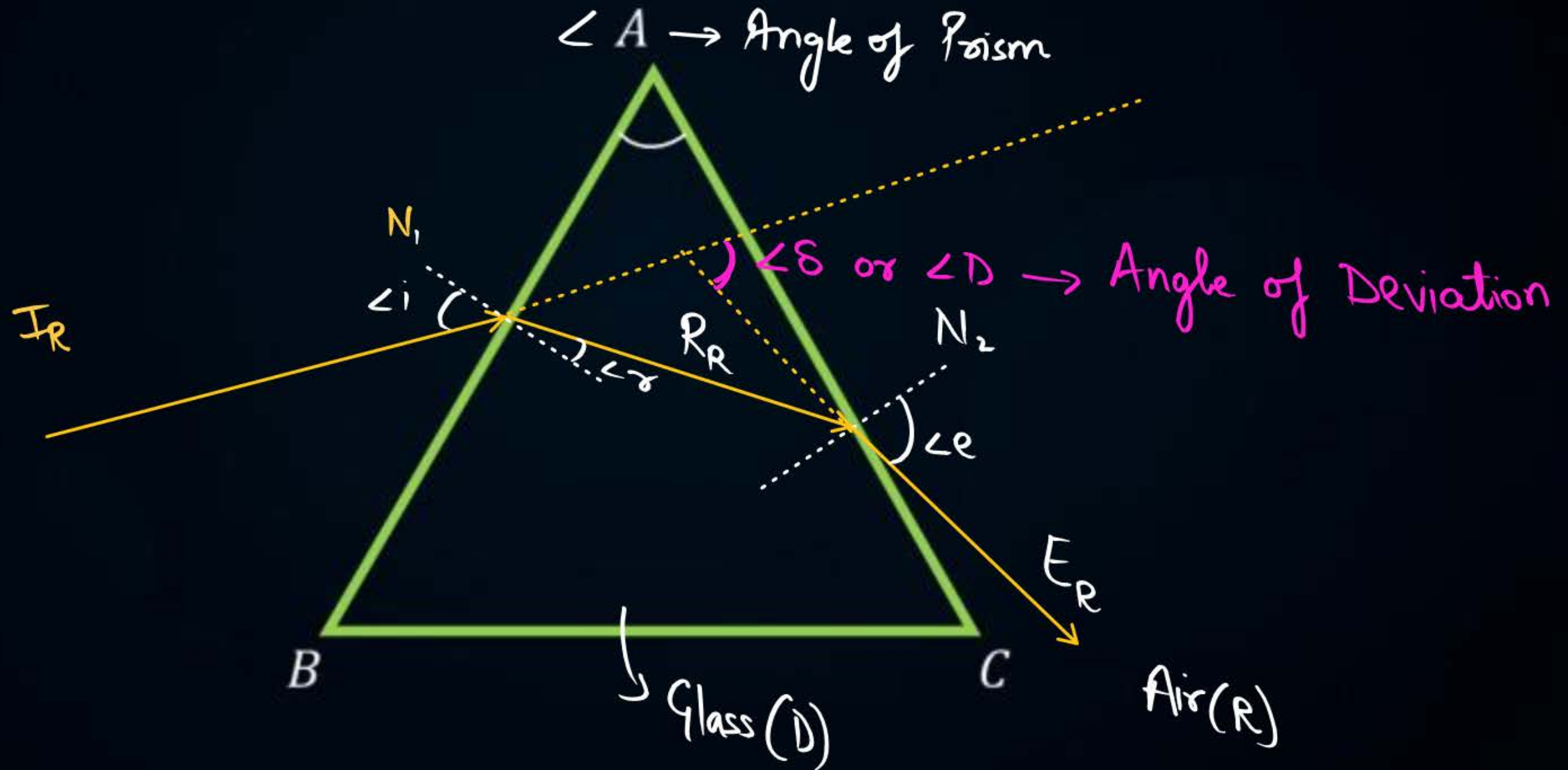


(Single-color)

Using monochromatic Light:

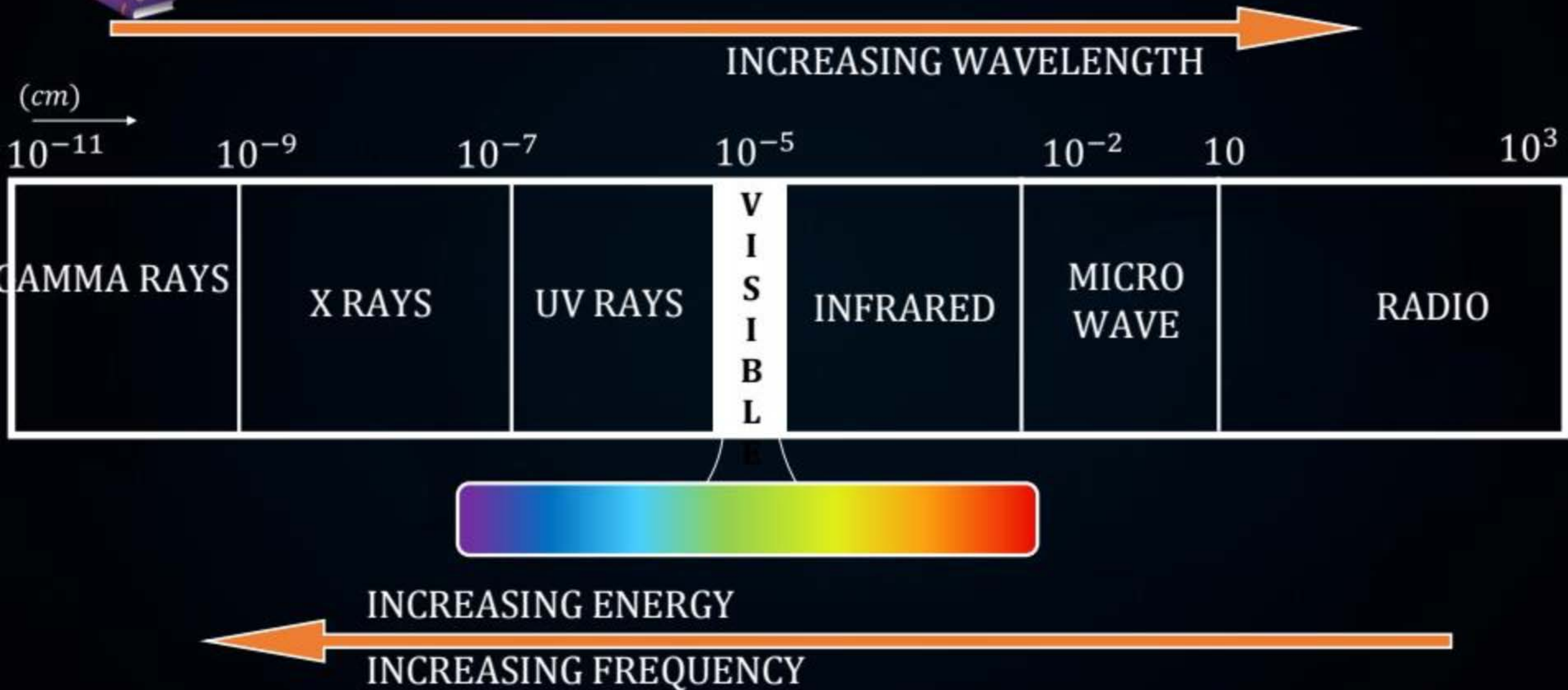
I_R
 R_R
 E_R
 N_1
 N_2
 $\angle i$
 $\angle r$
 $\angle A$
 $\angle \delta$
 N_1
 N_2

Air (R)





ELECTROMAGNETIC SPECTRUM



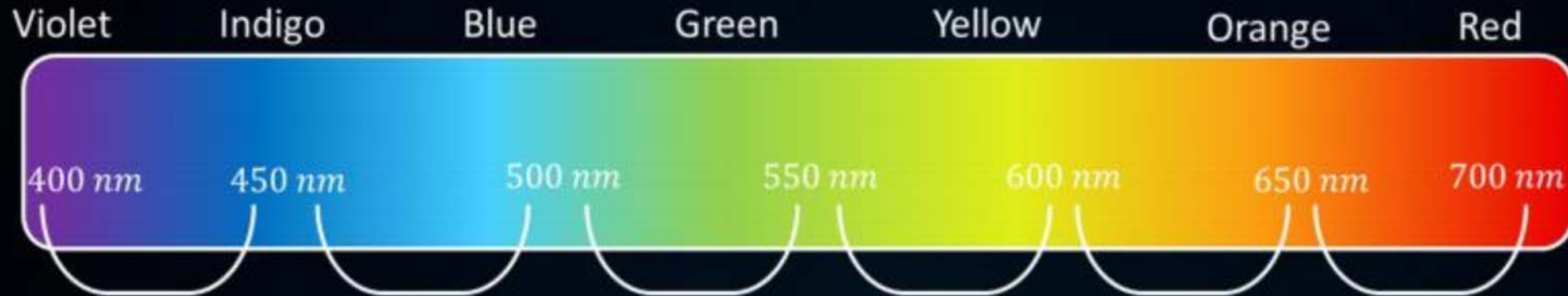


Sunlight = White light = All 7 colors
- VIBGYOR



VISIBLE REGION :

400nm — 700nm



$$1 \text{ nm} = 10^{-9} \text{ m}$$

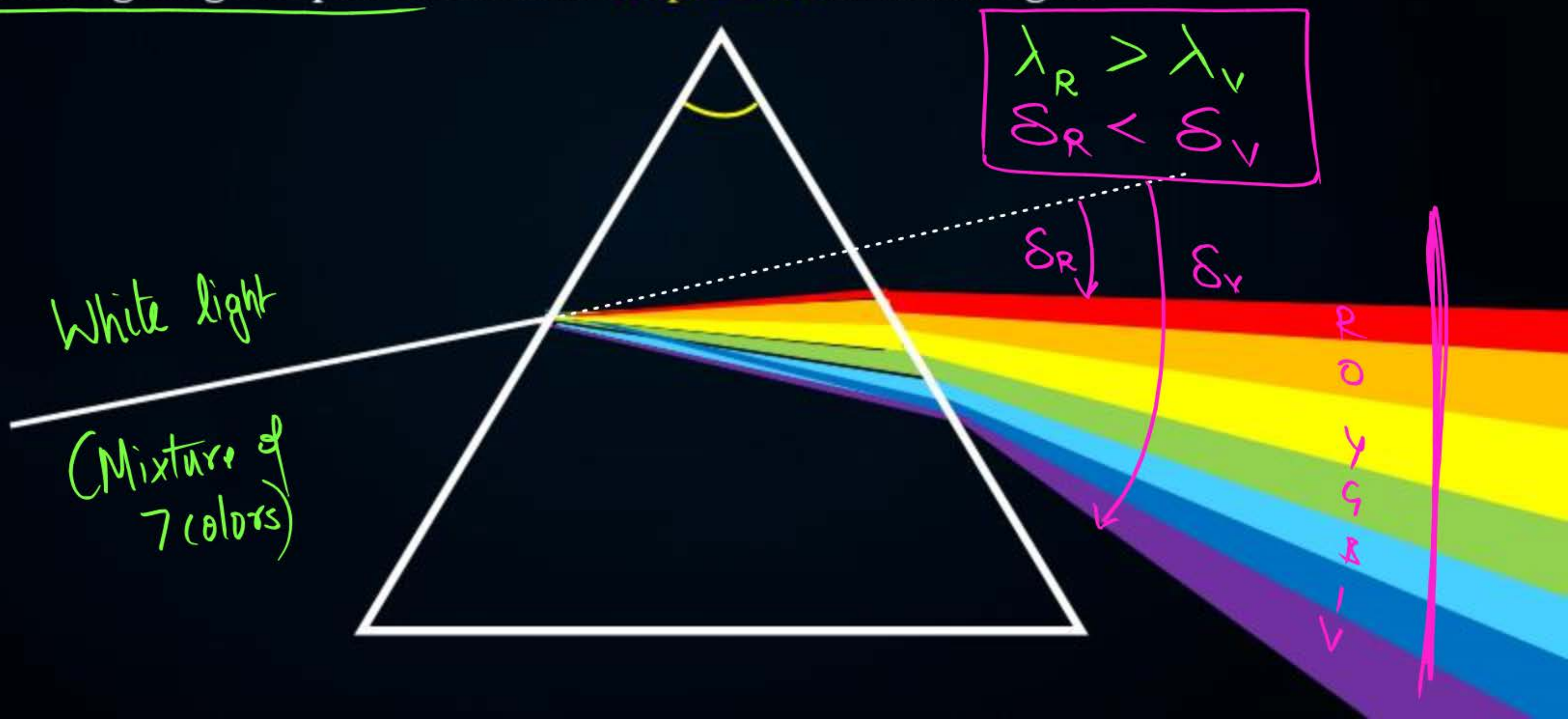


DISPERSION OF LIGHT THROUGH PRISM



$$\delta \downarrow \quad \lambda \uparrow$$

The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism is called **dispersion** of white light.





SPECTRUM



Visible

- ❖ The band of seven colors is called the spectrum.
- ❖ The sequence of colors remembers as VIBGYOR.

V - Violet

I - Indigo

B - Blue

G - Green

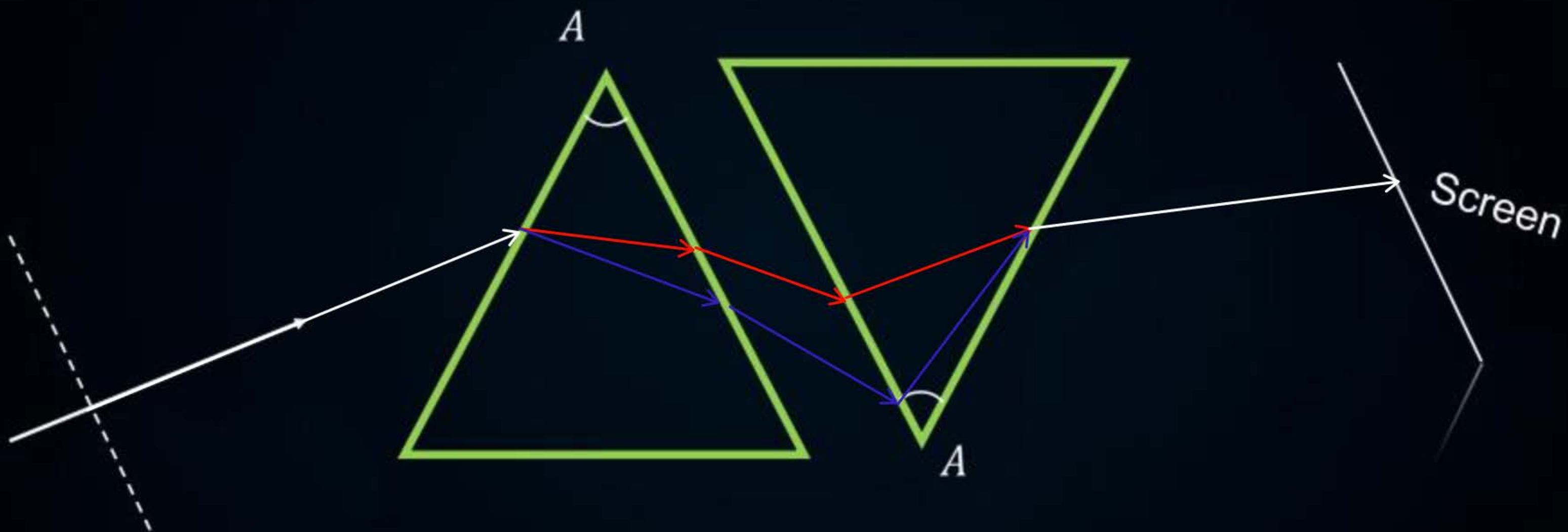
Y - Yellow

O - Orange

R - Red



RECOMBINATION OF DISPERSED LIGHT





RAINBOW

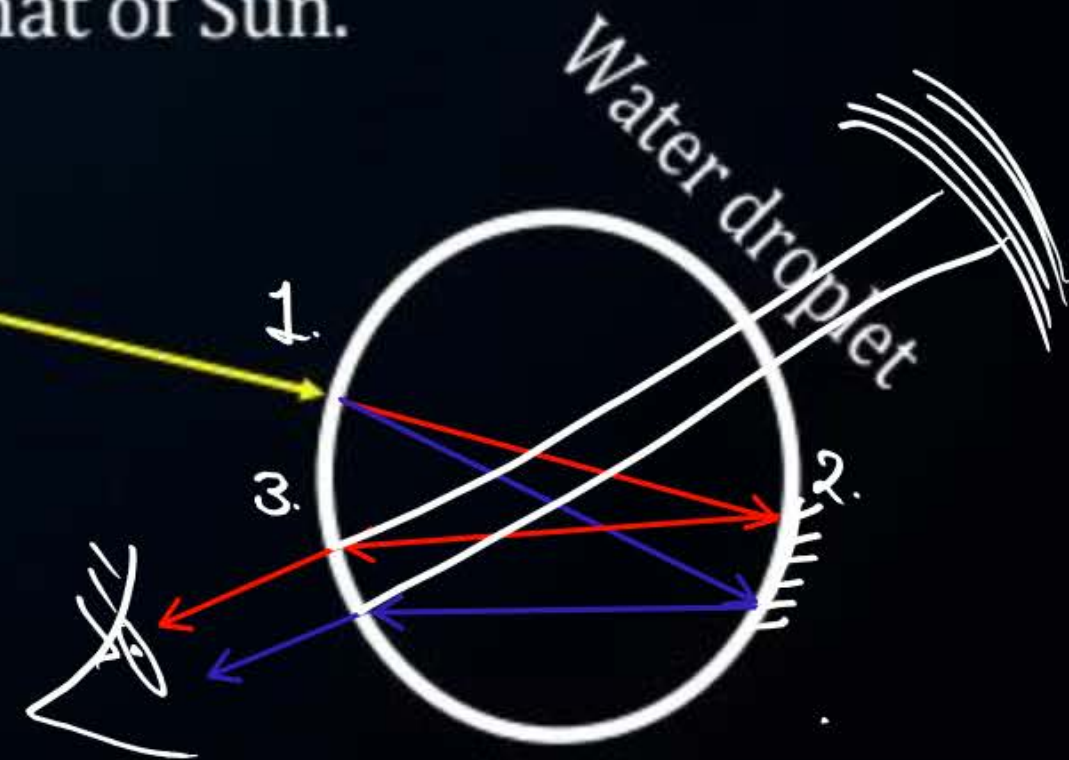


- ❖ The water droplets act like small prism.
- ❖ They refract and disperse the incident sunlight, then reflect it internally and refract it again when it comes out of the raindrop.
- ❖ Due to the dispersion of light and internal reflection, different colors reach the observer's eye.
- ❖ Red color appears on top and violet at the bottom of rainbow.
- ❖ A rainbow is always formed in a direction opposite to that of Sun.

1. Dispersion

2. Internal Reflection (IR)

3. Refraction





ATMOSPHERIC REFRACTION

$$(R) \text{ Vacuum} = 1$$
$$(D) \text{ Air} = 1.003$$



The refraction of light caused by the Earth's atmosphere (having air layers of varying optical densities) is called **Atmospheric Refraction**.

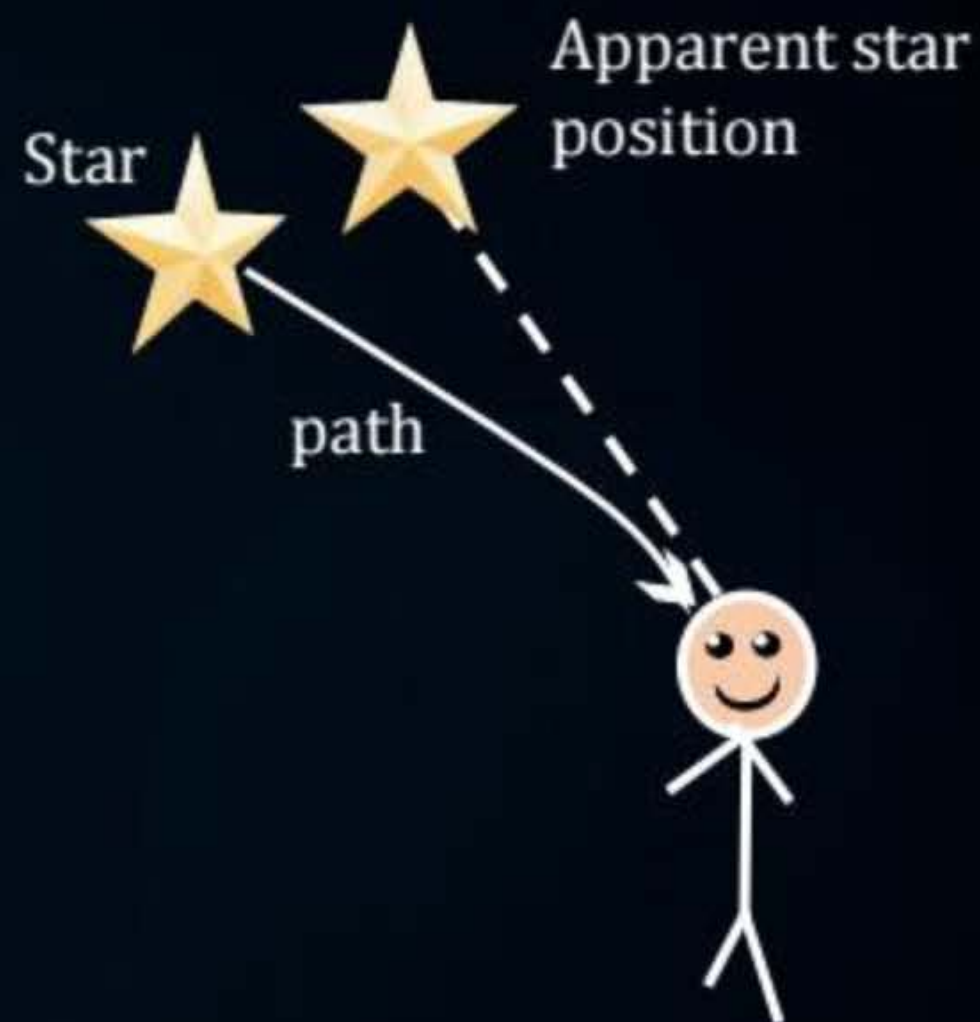




Why do stars twinkle?

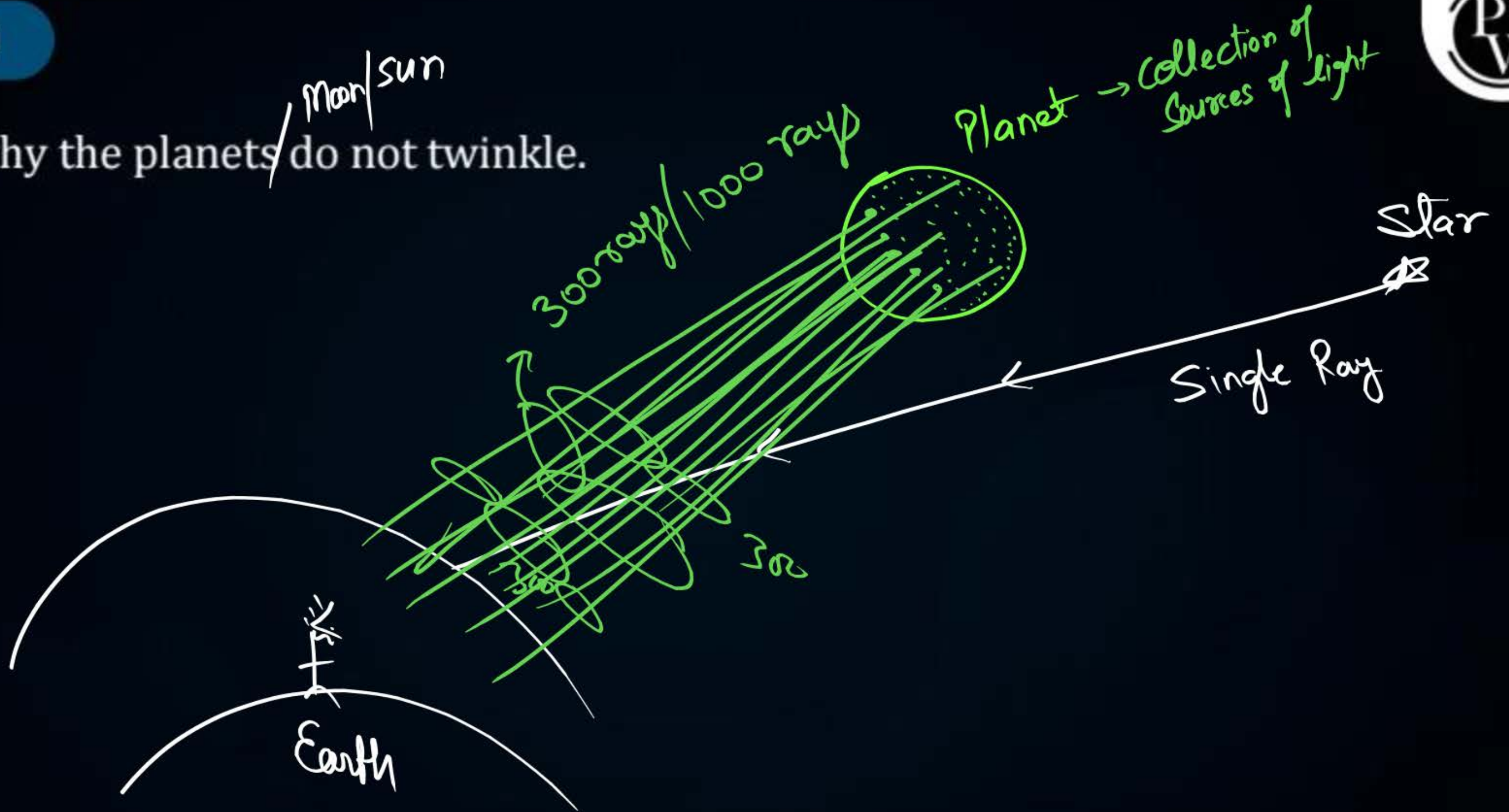


It is due to **atmospheric refraction**. Distant stars act like a point source of light. As the beam of starlight keeps deviating from its path, the apparent position of star keeps on changing because physical condition of earth's atmosphere is not stationary. Hence, the amount of light enters our eyes fluctuate sometimes **bright** and sometime **dim**. This is the "**Twinkling effect of star**"



QUESTION

Explain why the planets ^{moon/sun} do not twinkle.



ADVANCED SUNRISE & DELAYED SUNSET

ASDS

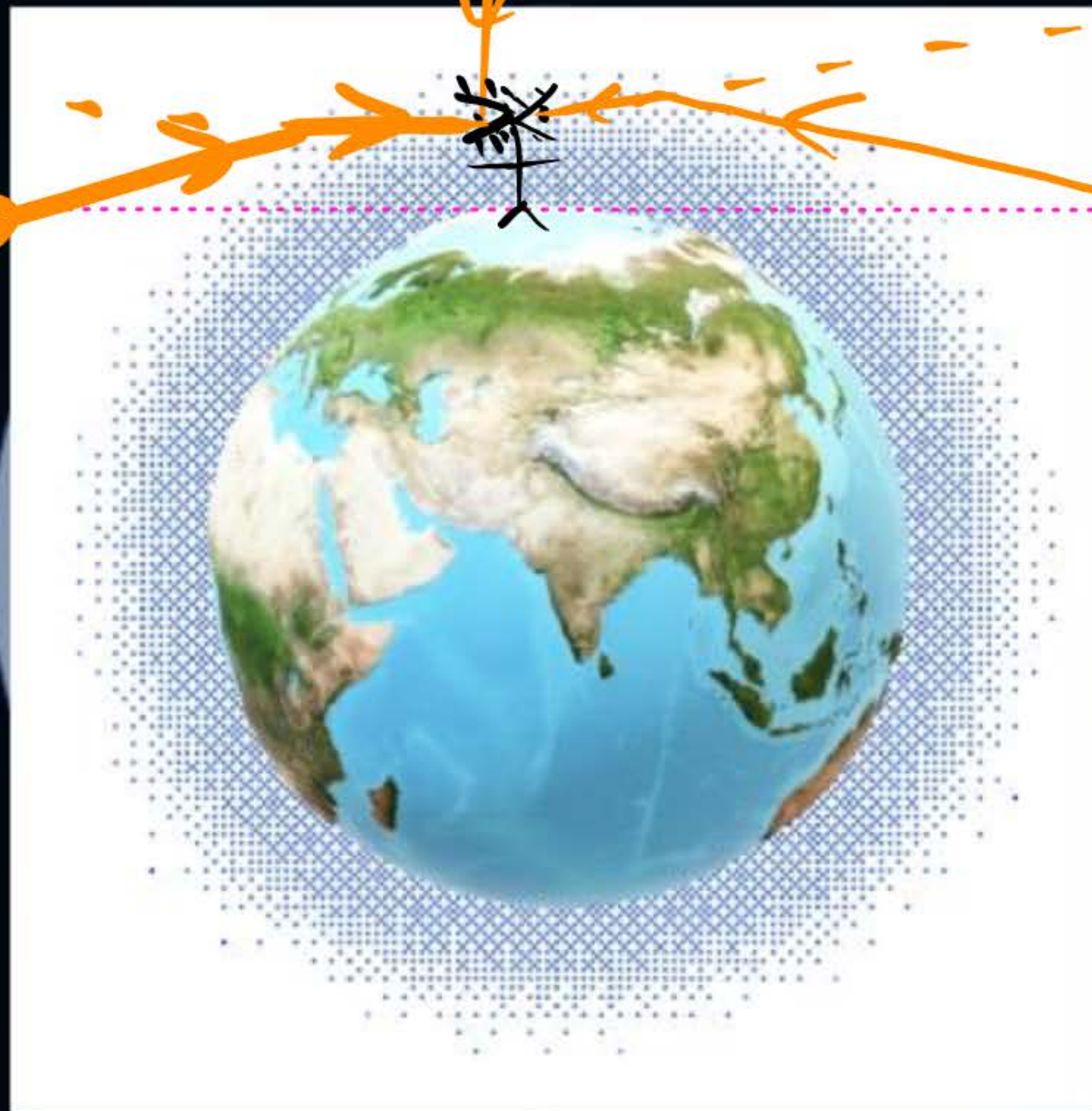


Apparant

Sun

2min

Actual
Sun



Apparant
Sun

2min

Horizon

Actual
Sun



SCATTERING OF LIGHT



This happens because light is absorbed by the particles in the form of energy. Then the particles reflect and emit the light again in all directions. This phenomenon is called the **scattering of light**.

For examples :-

- ❖ The **blue** color of the sky, color of water in deep sea, the **reddening** of the sun at sunrise and the sunset are some of the wonderful phenomena we are familiar with
- ❖ The path of a beam of light passing through a true solution is not visible. However, its path becomes visible through a colloidal solution where the size of the particles is relatively larger.



Why does the sky appear blue at daylight?



Because of the phenomenon of scattering. Sunlight gets scattered by small air molecules and other fine particles in the atmosphere during its passage. Scattering is inversely proportional to wavelength, i.e. Blue with the shortest wavelength will scatter more compared to the red. Therefore, this greater scattering of blue light by the air molecules in all directions make the atmosphere appear blue during cloudless daytime.

$\lambda \downarrow$ Scatter \uparrow



What is meant by power of accommodation of the eye?

↓
Refer Notes

A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of the corrective lens used to restore proper vision?



Myopia : Concave lens
or
(Diverging Nature)

What is the far point and near point of the human eye with normal vision?

∞

25 cm

A student has difficulty reading the blackboard while sitting in the last row. What could be the defect the child is suffering from? How can it be corrected?



Myopia or Near-sightedness

Concave lens or Diverging lens

The human eye can focus objects at different distances by adjusting the focal length of the eye lens. This is due to \rightarrow P.O.A.

A Iris

B Crystalline lens

☒ **C** Ciliary Muscles

D Retina

The human eye forms the image of an object at its

A cornea

B iris

C pupil

D retina

Near point (LDDV)

The least distance of distinct vision for a young adult with normal vision is about

- A** 25 m
- B** 2.5 cm
- C** 25 cm
- D** 2.5 m



The change in focal length of an eye lens is caused by the action of the

- A** pupil
- B** retina
- C** ciliary muscles
- D** iris

A person needs a lens of power -5.5 dioptres for correcting his distant vision. For correcting his near vision he needs a lens of power $+1.5$ dioptre. What is the focal length of the lens required for correcting (i) distant vision, and (ii) near vision?

$$i) \quad P = -5.5 \text{ D}$$

$$f = ?$$

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

$$-5.5 = \frac{100}{f}$$

$$\rightarrow f = -\frac{100 \text{ cm}}{5.5}$$

$$ii) \quad P = +1.5 \text{ D}$$

$$f = ?$$

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

$$f = +\frac{100 \text{ cm}}{1.5}$$

→ 'Notes' → Numerical

The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?

Jugad

$$u = -\infty$$

$$v = -80 \text{ cm}$$

$$f = ?$$

$$P = ?$$

'Notes'

Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.

$$u = -25 \text{ cm}$$

$$v = -100 \text{ cm}$$

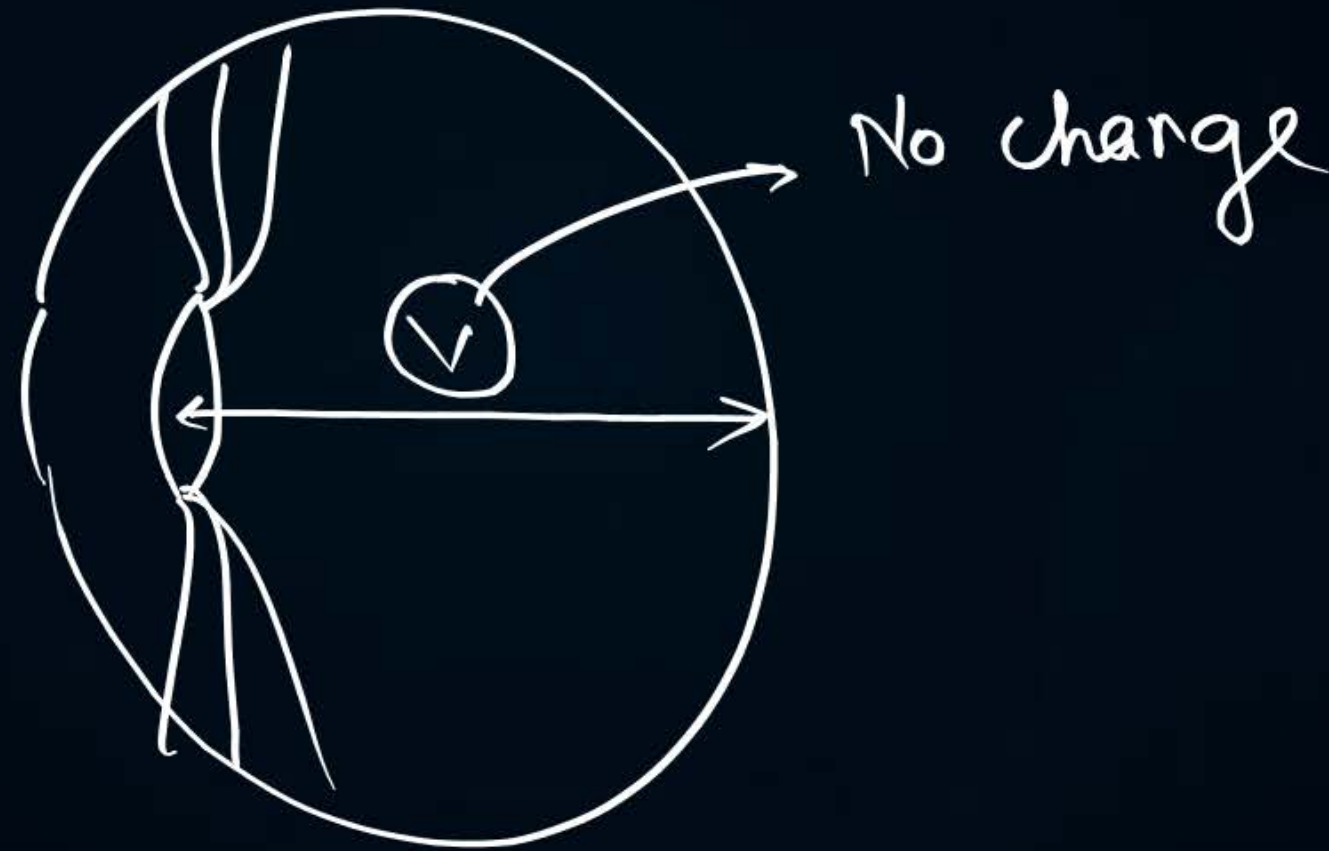
$$f = ?$$

$$P = ?$$

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

↳ Due to Power of Accommodation
↓
Definite

✓
What happens to the image distance in the eye when we increase the distance of an object from the eye?





Why do stars twinkle?

↳ Refer Notes



Explain why the planets do not twinkle.

↳ Notes

Why does the sky appear dark instead of blue to an astronaut?

↳ in outer space,

due to lack of particles

there is less or no

Scattering in the sky,

so sky appears dark.



THANK
YOU

