

THE HUMAN EYE

Sense organ that helps us to see.

- Located in eye sockets in skull
- Diameter of Eye is 2.3 cm (Size of eye remains same throughout our whole life)

Advantages of eyes in front of the face

- It gives a wider field of view
- It gives three-dimensional view

* Parts of Human Eye

1

CORNEA

The outermost, transparent part. It provides most of the refraction of light.

IRIS

It is a dark muscular diaphragm that controls the size of the pupil.

Lens

It is composed of a fibrous, jelly like material. Provides the focused real inverted image of the object on the Retina. This is convex lens that converges light at Retina.

PUPIL

It is the window of the eye. It is the central aperture in Iris. It regulates and controls the amount of light entering the eye.

Ciliary Muscles

They hold the lens in position and help in modifying the curvature of lens

RETINA

It is a delicate membrane having enormous numbers of light sensitive cells.

OPTIC NERVE

It transmits visual information from retina to Brain

BLIND SPOT

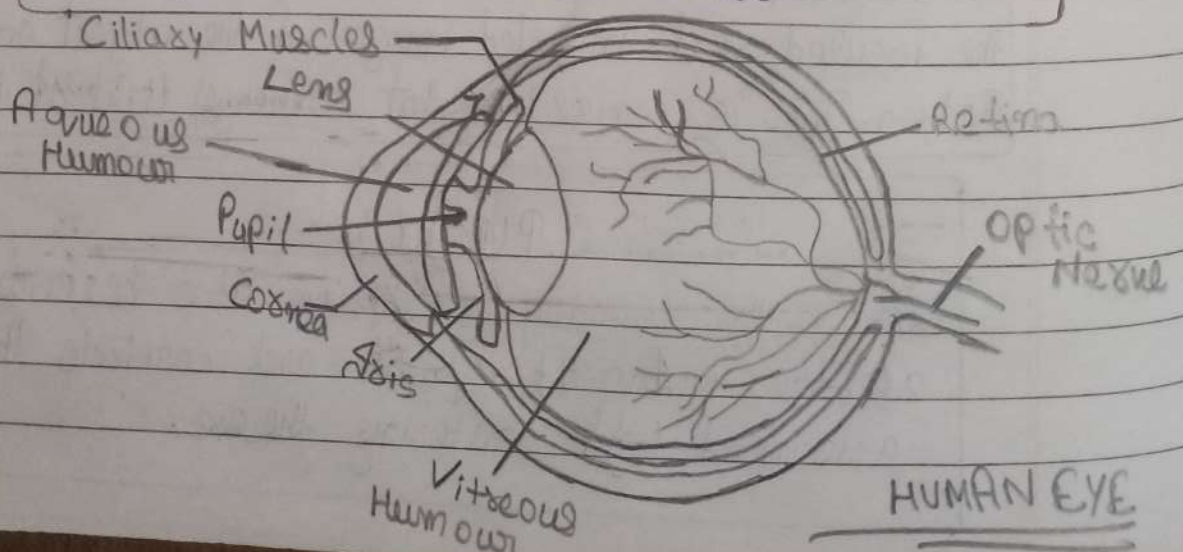
The point at which the optic nerve leaves the eye

AQUEOUS HUMOUR

Between the cornea and eye lens, there is a space filled with transparent liquid is called the aqueous humour which helps the refracted light to be focused on retina. It also provides nutrition to eye

Vitreous Humour

Space between eye lens and retina is filled with a liquid called Vitreous Humour



* POWER OF ACCOMMODATION

The process by which certain muscles (called ciliary muscles) function to change the focal length of the eyes so that the image is clearly formed on the retina is called accommodation of the eye.

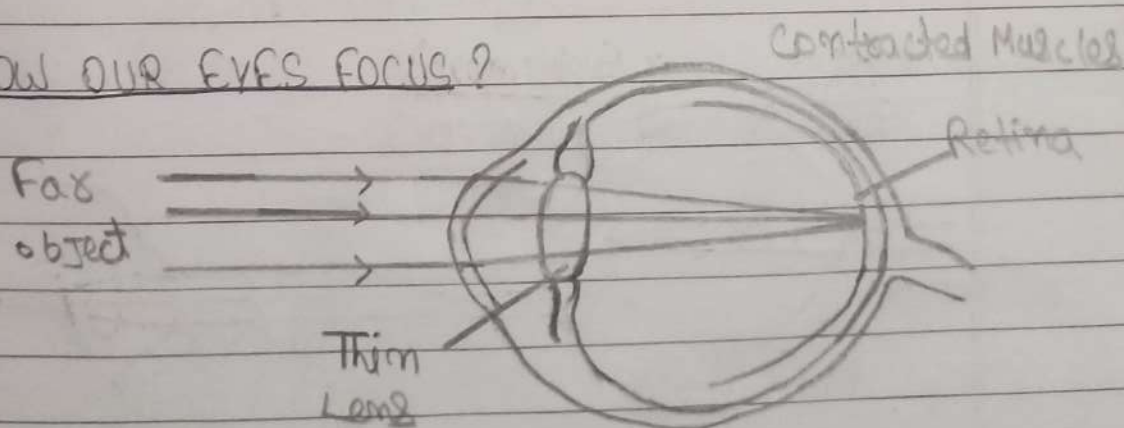
→ If the object in consideration is at a distance, for the image to form at the retina, the focal length has to be large. Here, the ciliary muscles relax, thereby thinning the eye lens. The focal length increases and the image is formed perfectly on the retina.

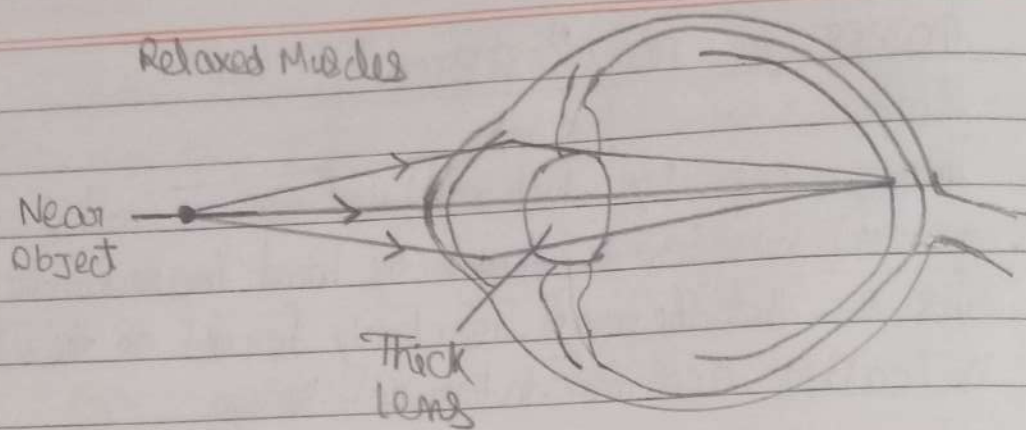
FIDAU

→ Similarly, in the case of near-lying objects, the ciliary muscles contract and thereby thickening the lens. This causes a reduction in the focal length for ideal image formation.

Range of human vision is from 25cm to infinity.

* HOW OUR EYES FOCUS?





Case 1 (To see far objects)

Ciliary Muscles - Relaxed

Eye lens - Thin

Focal Length - Increase

Case 2 (To see near objects)

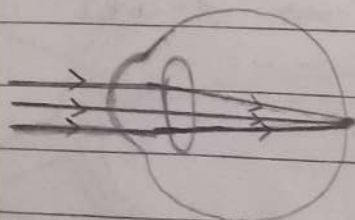
Ciliary Muscles - Contract

Eye lens - Thick

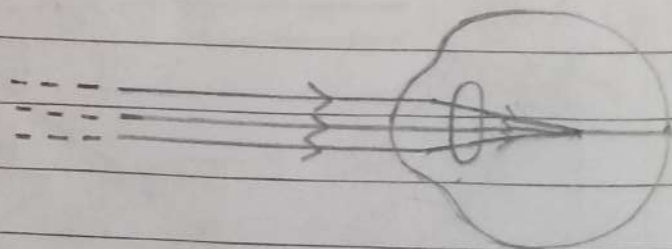
Focal Length - Decrease

DEFECTS OF VISION AND THEIR CORRECTION

Myopia (Near Sightedness)



Normal eye
Vision



MYOPIC EYE

- A myopic person can see nearby objects clearly but cannot see distant objects clearly.
- Image is formed in front of Retina.

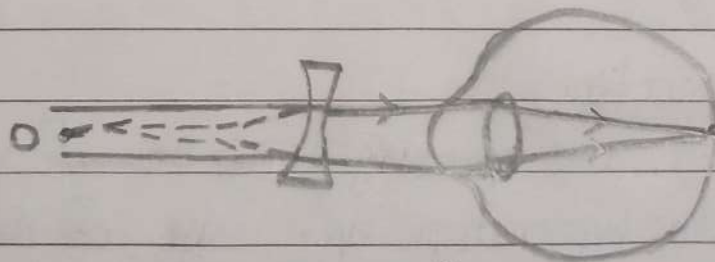
Causes of Myopia

- Excessive curvature of eye lens.
- Stretching of eye ball.

Correction

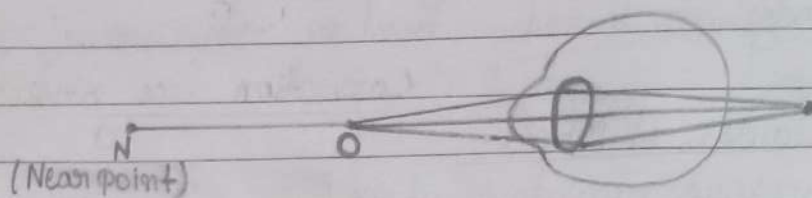
It is done by using concave lens of appropriate power.

- In a myopic eye, image of distant object is formed in front of the retina (not on retina).
- The far point (F) of a myopic eye is less than infinity.
- The concave lens placed in front of eye forms a virtual image of distant object at far point (F) of the myopic eye.



Correction for Myopia

Hypermetropia (Far sightedness)



Hyperopia

- Affected person can see far objects clearly but can't see nearby objects clearly.
- The near point of eye moves away.
- Image is formed behind the retina.

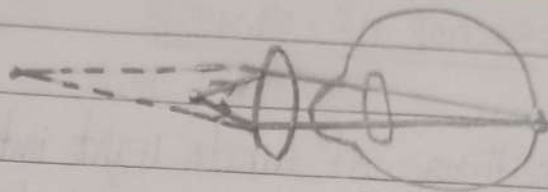
Causes of Hypermetropia

- Focal length of eye lens becomes too long.
- Eye ball becomes too small.

Correction

It is done by using convex lens of appropriate power.

- For a hypermetropic eye, image of distant object is formed behind the retina (not on retina).
- The convex lens placed in front of eye forms a real image of near object on retina.



Correction for Hypermetropia

Presbyopia

- Presbyopia is a vision defect that makes it difficult to see nearby objects clearly.

Causes of Presbyopia

- Power of accommodation of eye decreases with ageing.
- Weakening of ciliary muscles.

Correction

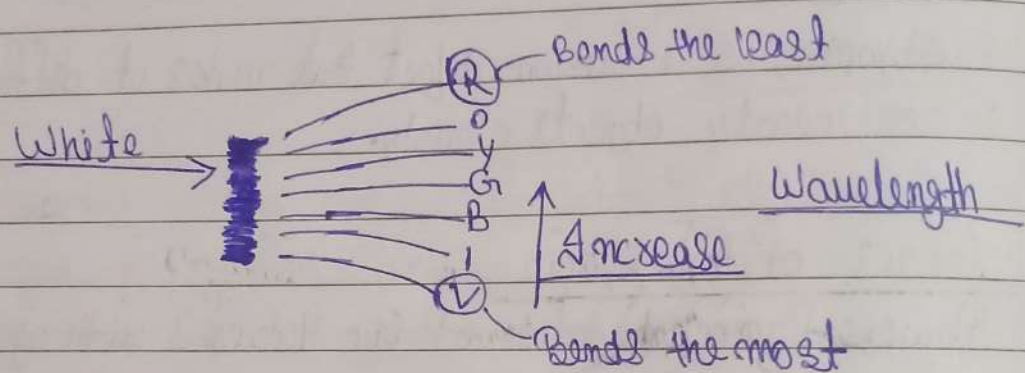
- Bifocal lenses (concave + convex) can correct presbyopia.

REFRACTION OF LIGHT THROUGH A GLASS PRISM

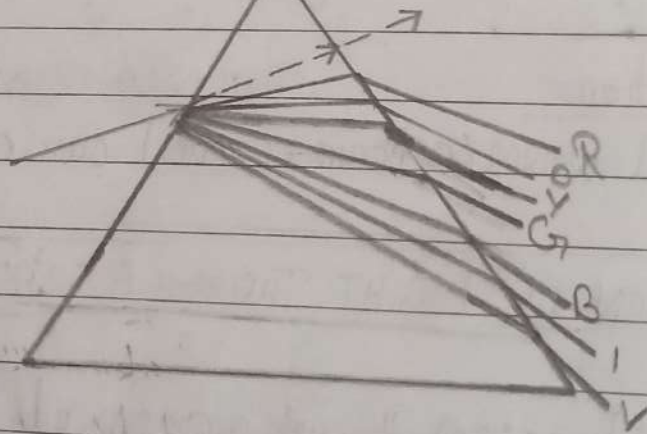
When light passes through a prism, it bends due to the change in speed of light when it enters the prism from air (less dense) to glass (denser). The bending of light is called refraction.

DISPERSION OF LIGHT

The splitting of white light into its components due to different bending ability for colors when it pass through prism is called Dispersion of Light.



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Total Internal Reflection

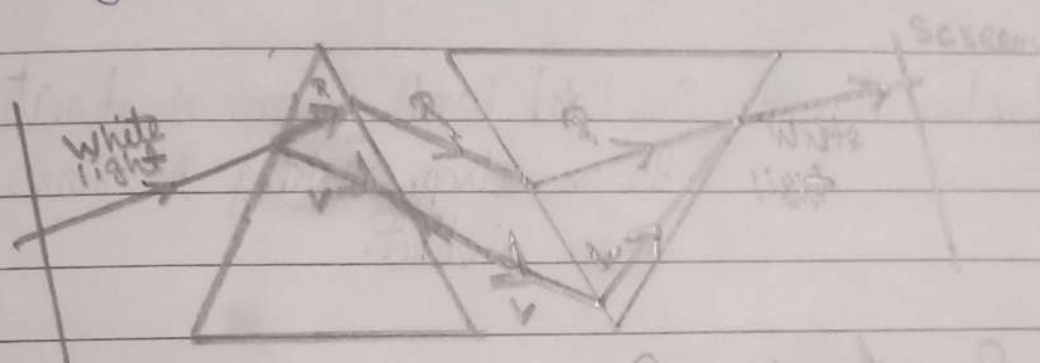
When light travels from denser medium to rarer medium with angle of incidence greater than critical angle then the refracted ray instead of emerging out again goes into the same medium. This is known as total internal reflection.

Two conditions:

- (i) Light travels from denser medium to rarer medium.
- (ii) The angle of incidence is greater than critical angle.

Newton's Double Prism Effect (Recombination of white light)

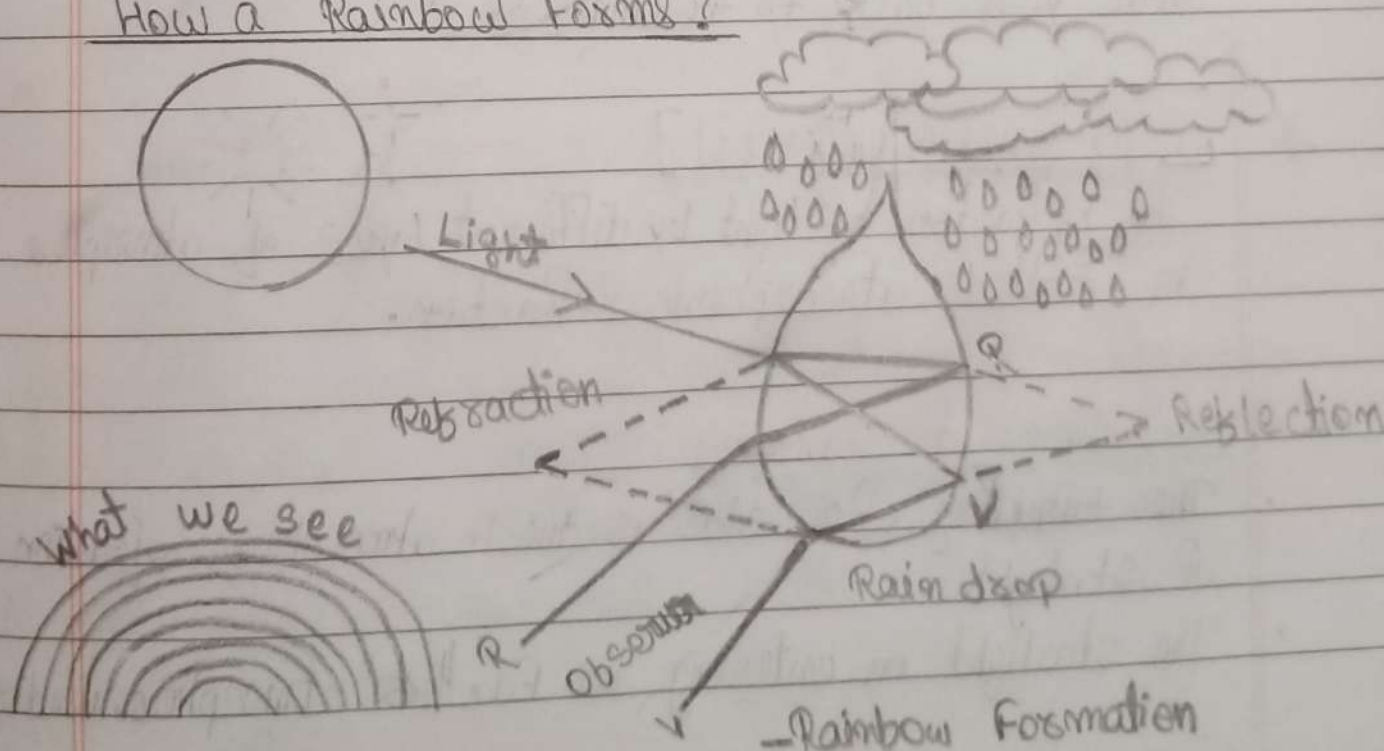
Newton found that when an inverted prism is placed in the path of dispersed light then after passing through the prism, they recombine to form white light.



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Recombination of white light

How a Rainbow Forms?



A rainbow forms when sunlight interacts with raindrops in the atmosphere. It involves three main processes:

1. Refraction: Sunlight bends as it enters a raindrop and splits into its colors (VIBGYOR).
2. Internal Reflection: The light reflects off the inside surface of the raindrop.
3. Refraction Again: The light bends again as it exits the raindrop, making the colors more distinct.

The rainbow appears as an arc with red on the outside and violet on the inside when you stand with your back to the sun.

* [ATMOSPHERIC REFRACTION]

The refraction of light by different layers of atmosphere is called atmospheric refraction.

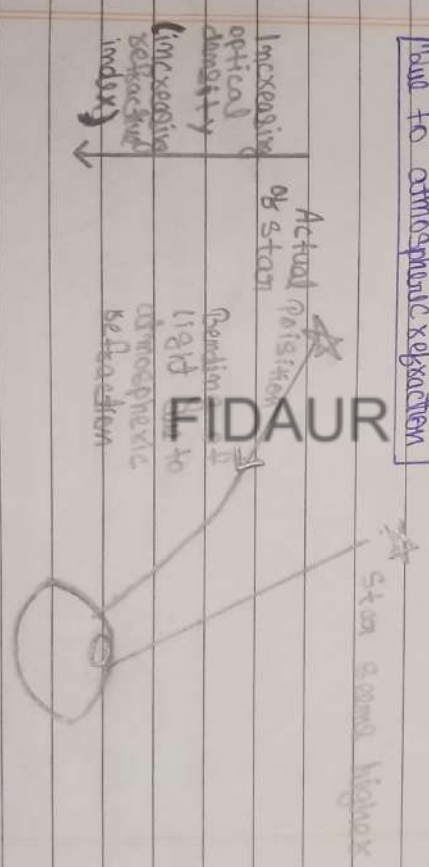
Twinkling of Stars

- The twinkling of a star is due to atmospheric refraction of starlight.
- The starlight on entering the Earth's atmosphere, undergoes

- refraction continuously before it reaches the Earth.
- The atmospheric refraction occurs due to a medium of gradually changing refractive index.
- Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position.

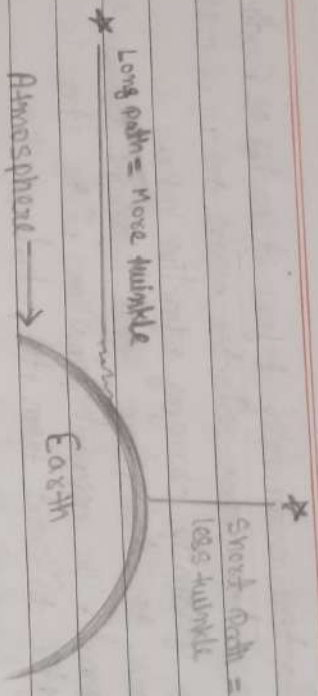
Why do celestial body appear slightly raised from their position

Due to atmospheric refraction

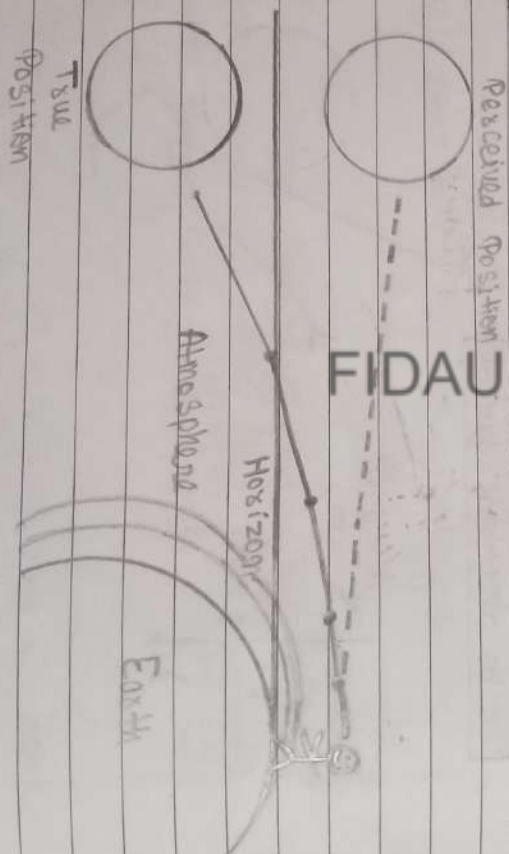


Why do stars twinkle but planets do not?

Stars twinkle because of turbulence in the atmosphere of the Earth. As the atmosphere churns, the light from the star refracted in different directions. Planets do not twinkle because they are very far away from us like stars.



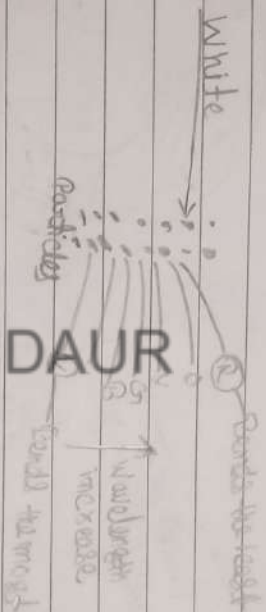
What is the reason behind 2 minutes early sunrise and 2 minutes delayed sunset?



It is because of atmospheric refraction. When the sun is slightly below the horizon, the light coming from it bends from less dense to more dense air and is refracted downwards.

SCATTERING OF LIGHT

Scattering occurs when light spreads in different directions after interacting with particles in the atmosphere. Shorter wavelengths like blue scatter more than longer ones like red, making the sky appear blue during the day.



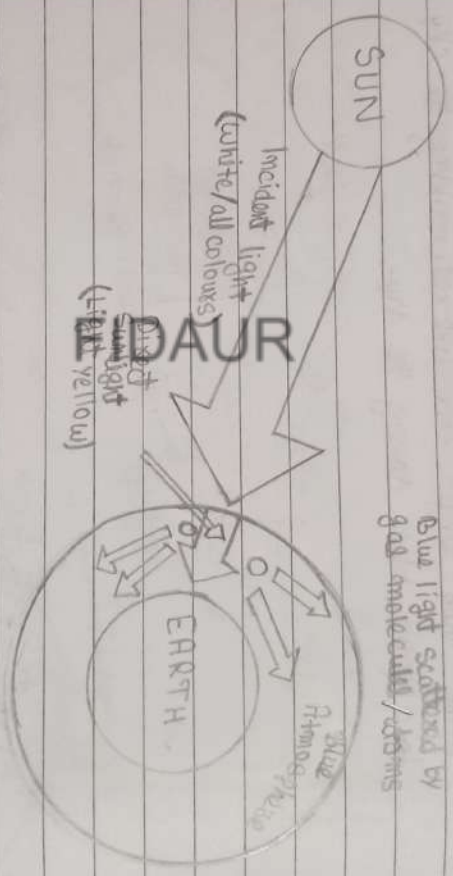
Tyndall Effect

The phenomenon of scattering of white light by colloidal particles is known as Tyndall effect.

- The colour of the scattered light depends on the size of the scattering particles.
- Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths.
- Tyndall effect can be observed when sunlight passes through a canopy of a dense forest.

Why is the colour of the clear sky blue?

Blue light is scattered more than other colors because it has shorter wavelength. Tiny atmospheric particles can scatter only shorter wavelengths.



Why do sun appear more reddish during sunrise and sunset?

Light rays have to travel a longer part of the atmosphere because they are very close to the horizon. Therefore, light other than red is mostly scattered away.

