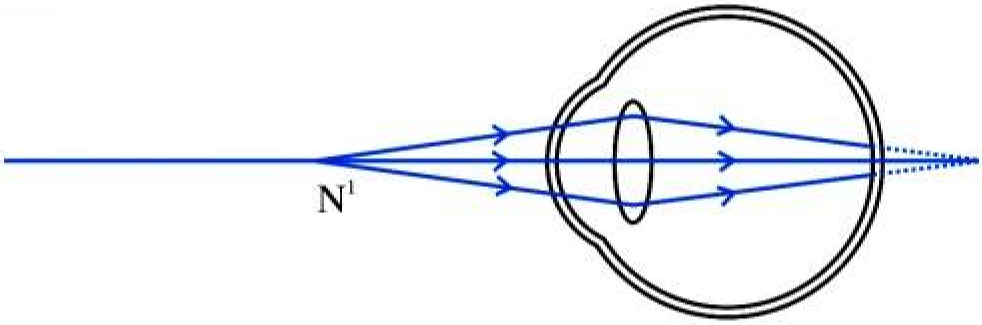
6.VISION AND THE WORLD OF COLOURS

FOCUS AREA

1. Long-sightedness, Near-sightedness- Reasons and Remedies
2. Dispersion of light
3. Formation of Rainbow
4. Scattering of light
5. Relation between wavelength of colours and Scattering
6. Colours of the rising and the setting sun

1. Long-sightedness, Near-sightedness- Reasons and Remedies

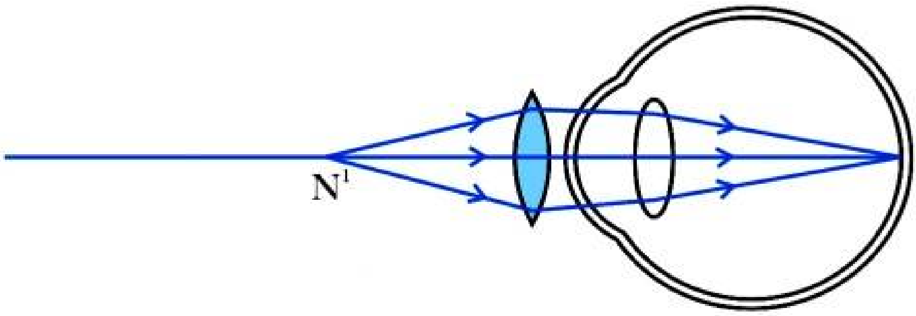
Hypermetropia or Long-sightedness



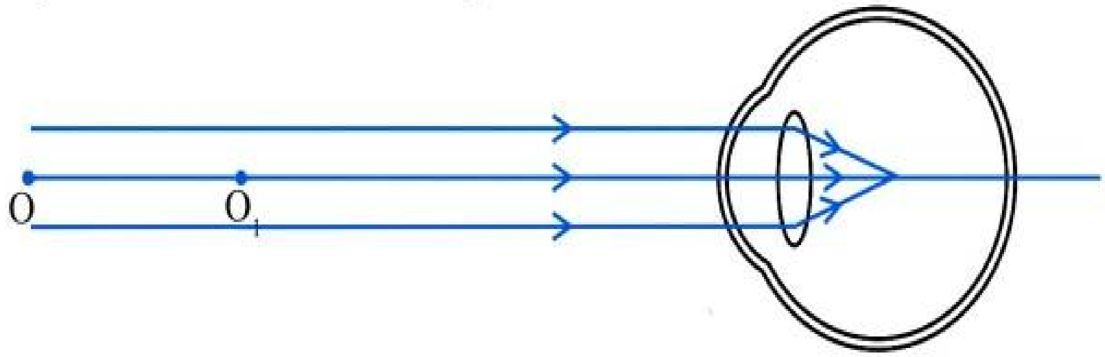
* For some persons, even though distant objects can be seen clearly, they may not be able to see nearby objects clearly. This defect is the long sightedness.
* The near point of the eye of such a person will be at a distance of more than 25 cm.
* The image of nearby objects formed behind the retina.

* What shall be the reasons behind this defect?
- The size of the eye ball is smaller.
- Power of the lens is low (focal length is high).

* What is the remedy for long – sightedness?
This can be rectified by using a convex lens of suitable power.



Myopia or Near-sightedness



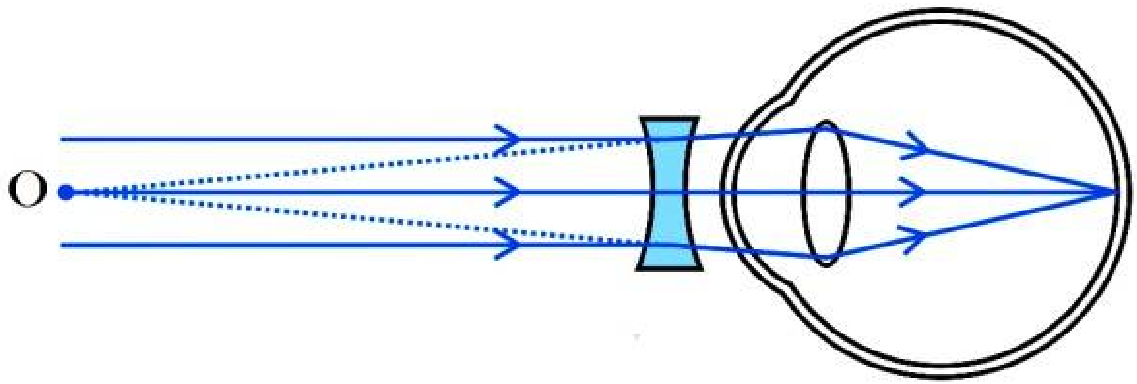
* For some persons, even though nearby objects can be seen clearly, they may not be able to see distant objects clearly. This defect is the near sightedness.

* The near point of such persons will not be at infinity. It will be at a definite distance from the eye.

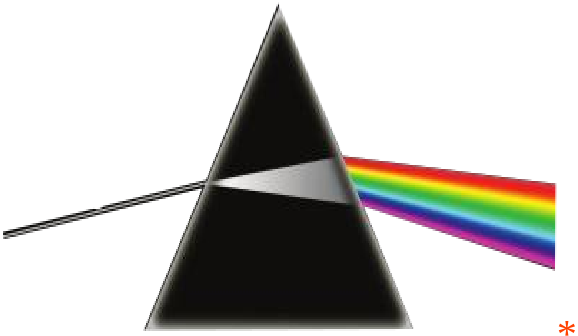
* The image of distant objects formed in front of retina.

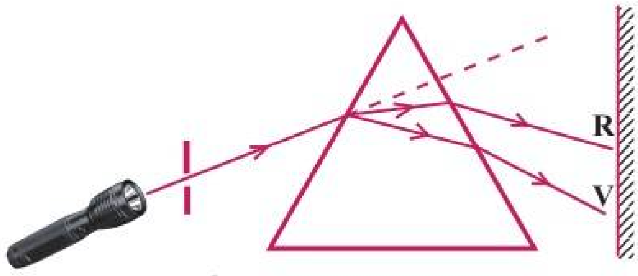
* What shall be the reasons behind this defect?
- The size of the eye ball is larger.
- power of the lens is high (focal length is low).

* What is the remedy for long – sightedness?
This can be overcome by using concave lens of suitable power.



2. Dispersion of light





* *

What are the colours seen on the screen?
VIBGYOR

Red (R)

Orange (O)

Yellow (Y)

Green (G)

Blue (B)

Indigo (I)

Violet (V)

* Which colour deviates the most?
Violet

* Which colour deviates least?
Red

* What may be the reason behind this difference in deviation?
Difference in wavelengths.
* What is this phenomenon? Explain.
Dispersion of light

- Dispersion is the phenomenon of splitting up of a composite light into its constituent colours. The regular array of colours formed by dispersion is the visible spectrum.

* What is composite light
Any light that is composed of more than one colour is a composite light
Ex: Sunlight

* Which colour has the shortest wavelength?
Violet

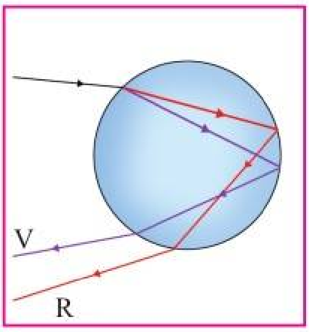
* Which one has the longest?
Red

* When light passes through the prism, as the wavelength increases, how does the deviation change?
- When the wavelength of the colour decrease, the deviation increases
- When the wavelength of the colour increases, the deviation decrease

3.Formation of Rainbow

1. When is the rainbow formed?
 * In the morning and in the evening
2. Where will be the Sun when the rainbow is seen in the East?
* West
3. Where will be the Sun when the rainbow is seen in the West?
*East
4. What is the phenomenon that causes rainbow?
*Dispersion of light caused by the water droplets in the atmosphere causes rainbow.

The figure shows a ray of sunlight falls obliquely on a water drop.



1. How many times does a ray of light undergo refraction when it passes through a water droplet?
* The light undergoes two times refraction in the water droplet

2. What about the internal reflection?
* One time

3. What is the colour seen at the upper edge of the rainbow?
* Red

4. What is the colour seen at the lower edge?
* Violet

5. How the rainbow is formed?

* Sunlight, when it passes through water droplets, undergoes refraction and internal reflection. The light ray emerging from the water droplets which make the same angle with the line of vision have the same colour. These droplets appear in the form of an arc of a particular colour. Thus there is red colour at the upper edge and violet colour at the lower edge. All the other colours are seen in between, depending on their wavelengths.

* When the position of the sun is near the horizon, the rainbow appears to be bigger.

* When seen from an aeroplane, the rainbow is seen as a circle.

* When the sun is much above the horizon, the rainbow disappears.

4. Scattering of light

Scattering is the change in direction brought out by the irregular and partial reflection of light when it hits the particles of the medium.

5. Relation between wavelength of colours and Scattering

* Colours like violet, indigo and blue have the smallest wavelengths in sunlight. They undergo maximum scattering.

* Red has comparatively greater wavelength and it can overcome small obstacles and hence scattering is low. As a result they travel greater distance.

* Rate of scattering and the size of the particles are interrelated. As the size of the particle increases, the rate of scattering also increases. If the size of the particles is greater than the wavelength of light, then the scattering is same for all colours.

6. Colours of the rising and the setting sun

1. Which are the occasions when sunlight has to travel greater distance through the atmosphere before reaching the eyes of an observer on the earth?
* Morning and evening.
2. As sunlight passes through the atmosphere, which colour in it undergoes maximum scattering? Which colour undergoes minimum scattering?
* Colour in it undergoes maximum scattering – Violet
* Colour in it undergoes minimum scattering – Red

3. When light reaches the observer after travelling long distances through the atmosphere, which colour reaches the eye? What is the reason?
* Red, it has highest wavelength and least scattering.

4. The western horizon remains reddish for some more time even after sunset. Why?
* During sunrise and sunset, light reaching us from the horizon has to travel long distances through the atmosphere. During this long journey, colours of shorter wavelength would be almost fully lost due to scattering. Then, the red light which undergoes only less amount of scattering decides the colour of the horizon. That is why the sun appears red during sunset and sunrise.

5. Can you now guess why red colour has been given to the tail lamps of vehicles and signal lights?
* Red light has highest wavelength and least scattering. So red light is able to travel the longest distance through the atmosphere.