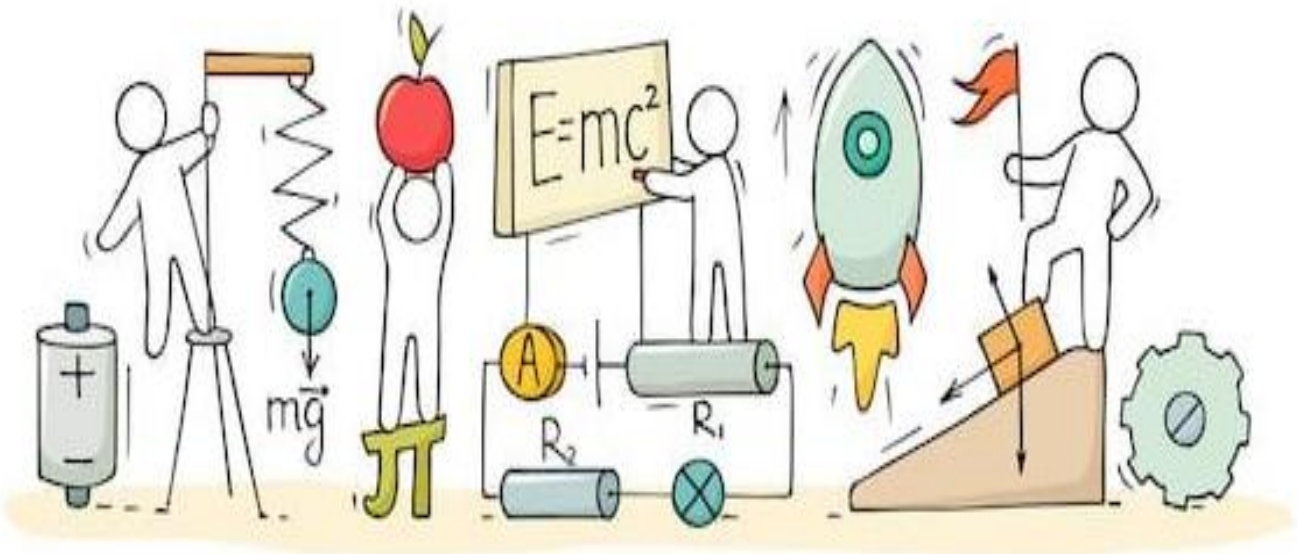
SCIENCE

Chapter 15: Light



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ॐ असतो मा सद्गमय।
तमसो मा ज्योतिर्गमय।
मृत्योर्मा अमृतं गमय।

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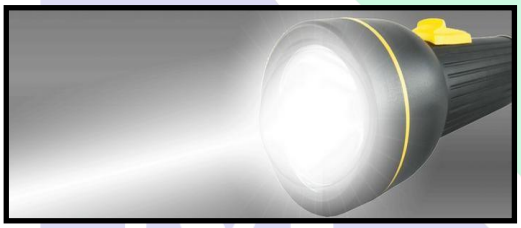
Light

Light

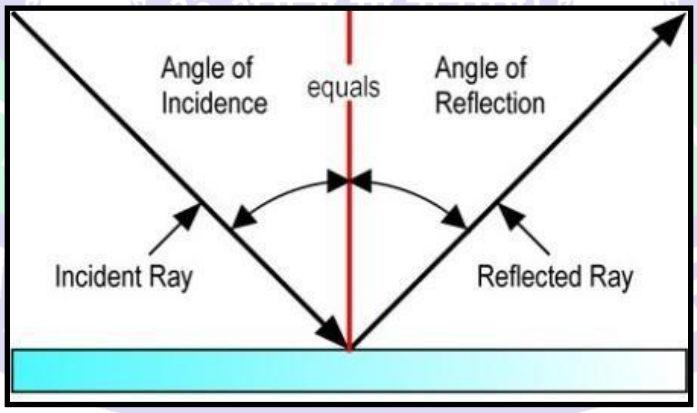
- Light is defined as a radiation which is visible to the human eye.
- The natural source of light on the Earth is the Sun.
- Sunlight plays an important role in the process of photosynthesis and thereby, in the growth of plants.
- Other sources of light are candlelight, fire, lasers, tube lights, electric bulbs etc.
- Light can travel through vacuum, i.e., it does not require a medium to travel.
- The path of light is always straight and not curved. It does not bend.
- Examples: Light emitted from a torch and the headlights of a vehicle.



- The direction of light can only be changed by reflection.

Reflection of Light

- The bouncing of light from a smooth surface such as a mirror is called reflection of light.



- Due to the reflection of light, the impression of an object formed in the mirror is called the image of the object.

- As the distance of the object from the mirror increases, the distance of the image also increases.
- Example: A candle placed in front of a plane mirror appears as if a similar candle is placed behind the mirror.

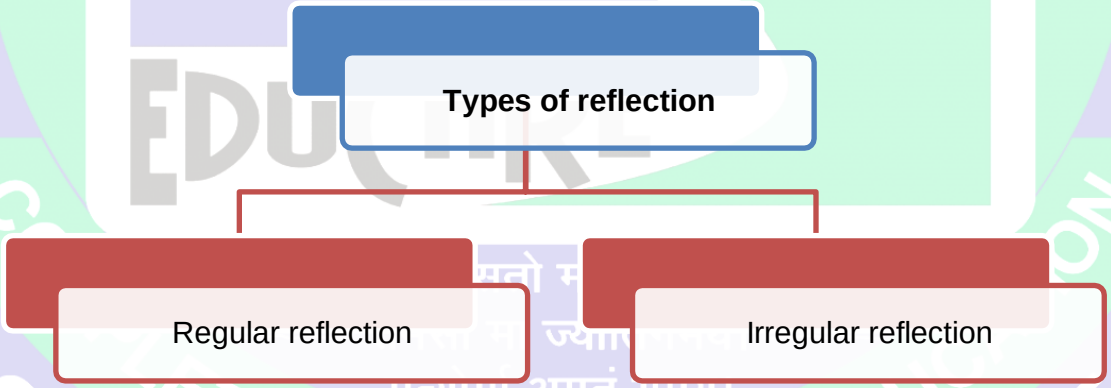
- An image formed by a plane mirror is erect and of the same size as the object.

Laws of Reflection

The laws of reflection are:

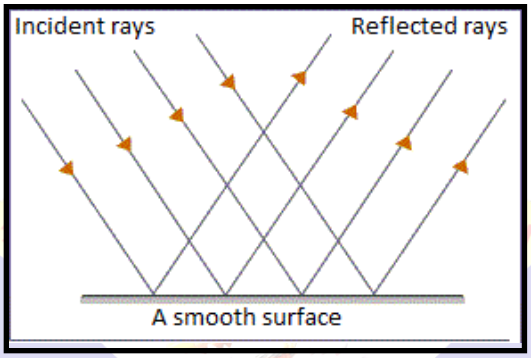
- The angle of incidence equals the angle of reflection.
- The incident ray, the reflected ray and the normal to the surface, all lie in the same plane.

Types of Reflection



Regular Reflection

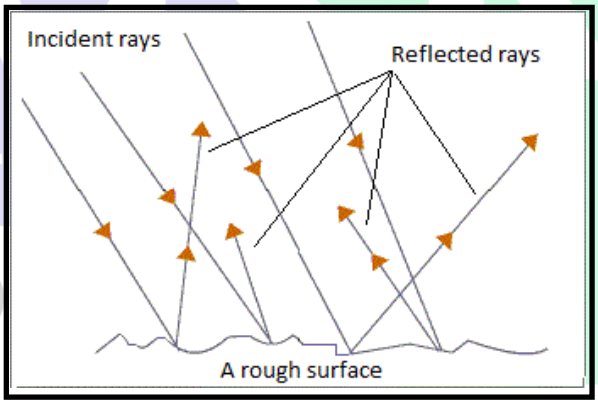
- Regular reflection is the reflection of light rays from a smooth surface such as a mirror, glass or water.



- The reflected rays of light move in a fixed direction.
- Images formed by regular reflection are always clear and distinct.

Irregular Reflection or Diffused Reflection

- Irregular or diffused reflection is the reflection of light from a rough surface such as a plastic sheet, writing paper, wooden board, cloth, skin, leather etc.



- This reflection occurs when a ray of light is incident on a wall or wood, which is not smooth or polished.
- The reflected rays do not travel in the same direction.

Left-Right Inversed

- It means that the images are inversed, i.e. the right part of an object appears on the left in the formed image, and the left part of the object appears to the right.

- Example: The word 'AMBULANCE' is painted left-right inversed. When the driver of a vehicle in front looks into the rear-view mirror, he can read the word AMBULANCE quickly and make way.

Characteristics of an Image

- The image formed by a plane mirror is:

Of the same size as that of the object.

Left-right inversed.

Erect and virtual.

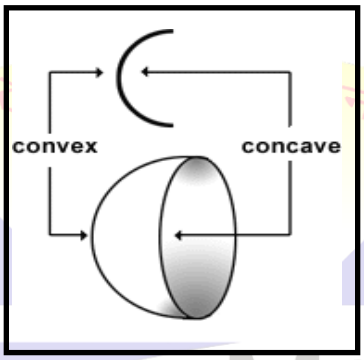
Formed behind the mirror at the same distance as the distance of the object in front of the mirror.

Spherical Mirrors

- Spherical mirrors have curved reflecting surfaces and are also called curved mirrors.
- These mirrors are made from a hollow sphere.
- There are two types of curved surfaces at each hemisphere:
  a. Inner curved surface

b. Outer curved surface

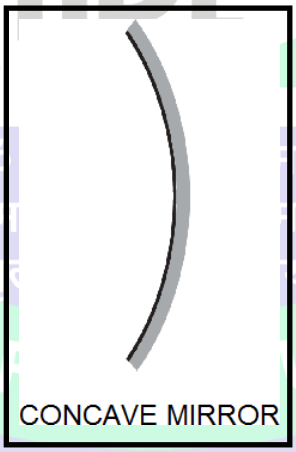
- The inner curved surface is called concave, while the outer curved surface is called convex.



- There are two types of spherical mirrors:

Concave Mirror

- If the reflecting surface of a mirror is concave, i.e. bent inwards, then it is called a concave mirror.



- A concave mirror is used to magnify objects.

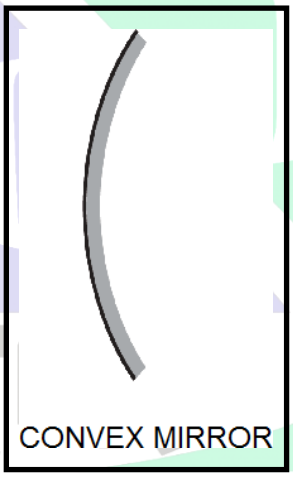
Uses of Concave Mirrors

- These mirrors are used by dentists to obtain a magnified image of the teeth.

- Doctors use concave mirrors to examine the ears, nose and throat.
- They are used in headlights of cars and scooters in order to increase their focus and brightness..
- People use it to shave and apply makeup.

Convex Mirror

- If the reflecting surface of a mirror is convex, then it is called a convex mirror.



- A convex mirror is also known as a diverging mirror or a fish eye mirror.
- The image formed by a convex mirror is virtual, erect and diminished, which means that a larger area is visible in a convex mirror than in a plane mirror of the same size.

Uses of Convex Mirrors

- These mirrors are used as rear-view mirrors in cars and motorcycles, as they enable the driver/rider to view the road and the vehicles behind.

- They are also used in supermarkets, stores and ATM centres as a security measure.

Types of Images formed by a Mirror

- A mirror forms the following two types of images - Virtual and Real.

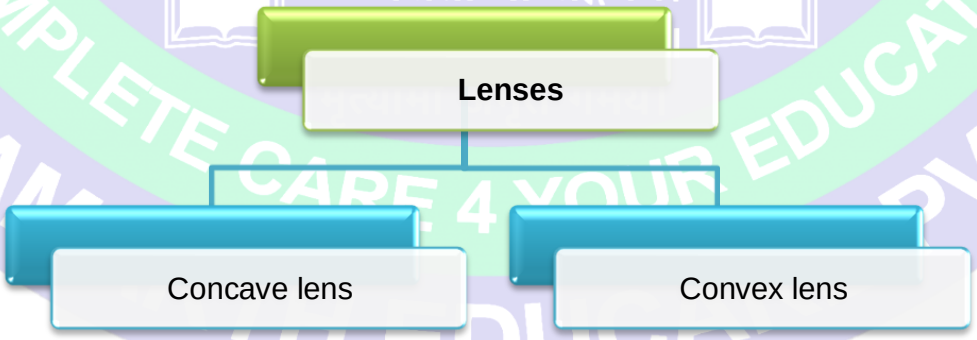
Virtual Image

- The image formed by a mirror which cannot be captured on a screen is called a virtual image.
- It is always erect.

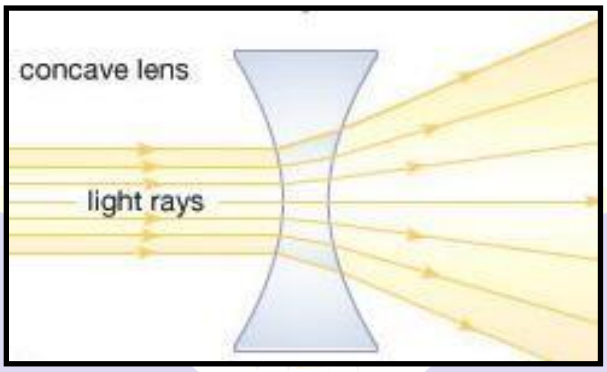
Real Image

- The image which can be captured on a screen is known as a real image.
- It is always inverted.
  Example: In a camera, images are real and can be captured on the negative, which acts as a screen.

Lenses

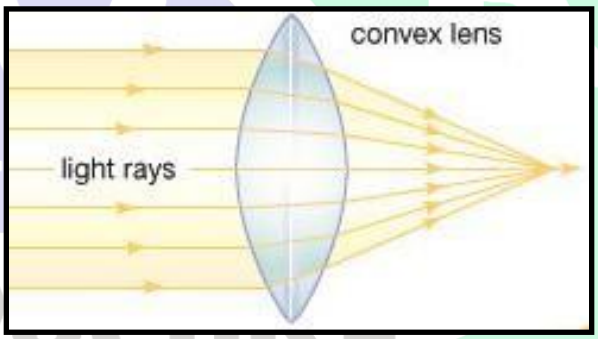


Concave Lens



- When light rays are incident on a concave lens, they bend outwards or diverge.
- This lens is also called a diverging lens.
- A concave lens is thinner at its center than at its edges.
- It is used to correct short-sightedness.

Convex Lens



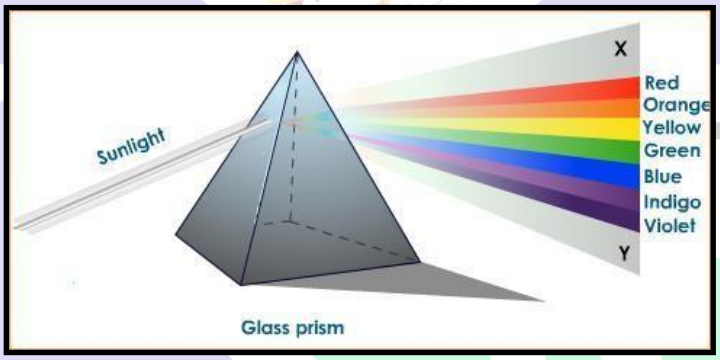
- When light rays pass through a convex lens, they bend inwards and converge at a common point to form an image of the source of light.
- This lens is also called a converging lens.
- A convex lens magnifies the object viewed through it.
- A convex lens is thick in the middle and thin at its edges.
- When the object is placed close to a convex lens, the image formed is virtual, erect and magnified.
- When the object is placed at a far off distance from a convex lens, the image formed is real, inverted and diminished.

Applications of Lenses

- Lenses are used in magnifying glasses, peepholes, cameras, bioscopes, binoculars, telescopes, microscopes and projectors.
- A refracting telescope uses a concave mirror and a convex lens.

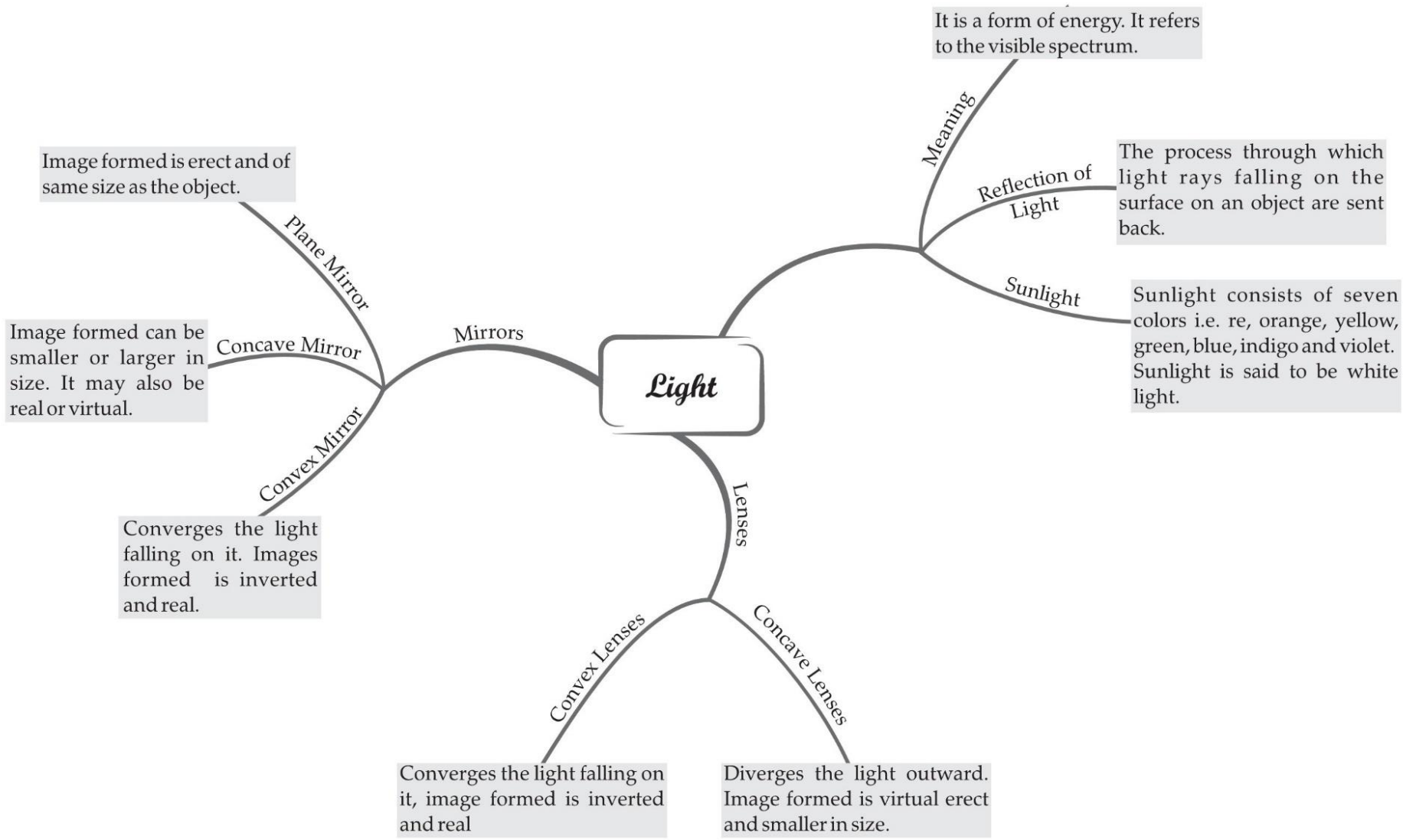
Dispersion of Light

- The phenomenon of splitting of a beam of white light into its constituent colours on passing through a prism is called dispersion of light.
- A rainbow is formed when white light from the Sun passes through tiny prism-like water droplets and splits into different colours.
- The order of colours from the lower end is violet, indigo, blue, green, yellow, orange and red, i.e. VIBGYOR.



MIND MAP : LEARNING MADE SIMPLE

CHAPTER-15



Important Questions

➢ Multiple Choice Questions:

Question 1. Which one of the following shows lateral inversion?

(a) Plane mirror

(b) Concave mirror

(c) Convex mirror

(d) Convex lens

Question 2. Which of the following is used as a side view mirror?

(a) Plane mirror

(b) Concave mirror

(c) Convex mirror

(d) Convex lens

Question 3. The path of the light is

(a) always a straight line

(b) a curved line

(c) a zig-zag line

(d) depends on the medium

Question 4. White light is composed of

(a) three colours

(b) seven colours

(c) five colours

(d) eight colours

Question 5. A virtual image

(a) can be formed on the screen

(b) cannot be formed on the screen

(c) is formed only by the plane mirror

(d) is formed only by the convex mirror

Question 6. The image formed by spherical mirror is virtual. The mirror will be

(a) concave

(b) convex

(c) either concave or convex

(d) none of these

Question 7. The coloured band of light obtained by dispersion of light is called

(a) image

(b) spectrum

(c) convergence

(d) scattering

Question 8. We can get an inverted image from

(a) both concave lens and convex lens.

(b) both concave mirror and convex mirror.

(c) both concave mirror and convex lens.

(d) both convex mirror and concave lens.

Question 9. A convex lens is

(a) thick at centre

(b) thin at the centre

(c) thick at edges

(d) hollow at the centre

Question 10. The image that can not be obtained on a screen is called

(a) real image

(b) virtual image

(c) diminished image

(d) none of these

➢ Fill In the Blanks:

1. An image can be obtained on a screen is called a ..... image
2. An image formed by ..... lens cannot be obtained on a screen.
3. ..... light deviates the least, while ..... light deviates the more.
4. The outer surface of a flat steel plate acts as a ..... mirror.
5. The inner surface of the reflector of a torch acts as a ..... mirror.
6. A ..... is a piece of any transparent material bound by two curved surfaces or by one curved and one plane surface.

➢ True or False:

1. The image formed by a convex mirror is erect.
2. The image formed by a concave mirror is formed on the screen.
3. The image formed by a plane mirror is real.
4. The change of sides of an object and its mirror image is called lateral inversion.
5. The image formed by plane mirror is erect.
6. When the reflecting surface of the spherical mirror is curved inwards, it is called concave mirror.

➢ Very Short Question:

1. Give an example to show that the path of light is always straight and never curved.
2. What is the image of an object?
3. Why the word 'AMBULANCE' is painted left-right inversed on the vehicle?
4. State the principle used in creating a mirror image.
5. Name the mirror having a curved reflecting surface.
6. Name the two types of spherical mirror.
7. State uses of the concave mirror.
8. State uses of the convex mirror.
9. What is a virtual image?
10. What is a real image?

➢ Short Questions:

1. What are the laws of reflection?
2. Differentiate between real & virtual image?
3. Why concave mirror is called a converging mirror and a convex mirror is called a diverging mirror?
4. Explain the nature of image formed in a concave mirror.
5. What are the uses of concave mirror?
6. What is a lens?
7. How is the rainbow formed?
8. Apart from rainbow, where else we can see seven colours of sunlight?

➢ Long Questions:

1. What is rainbow?

2. Images in a mirror are located at the same distance behind the mirror as the object in front of it. Explain the importance of this property of mirror.

3. What do you mean by left right inversed?

✓ Answer Key-

➢ Multiple Choice Answers:

1. (a) Plane mirror
2. (c) Convex mirror
3. (a) always a straight line
4. (b) seven colours
5. (b) cannot be formed on the screen
6. (c) either concave or convex
7. (b) spectrum
8. (c) both concave mirror and convex lens.
9. (a) thick at centre
10. (b) virtual image

➢ Fill In the Blanks:

1. real
2. concave
3. Red, violet
4. plane
5. concave
6. lens

➢ True or False:

1. False
2. True
3. False
4. True
5. True
6. True

➢ Very Short Answers:

1. Answer: Light emitted by torchlight and light emitted from the headlights of a vehicle
2. Answer: Due to the reflection of light, the impression of an object formed in a mirror is

called the image of the object.

3. Answer: So that when the driver of a vehicle in front looks into his rear – view mirror, can read ambulance written on it quickly and give way to it.
4. Answer: Principle of reflection
5. Answer: Spherical mirror
6. Answer: Concave mirror and convex mirror.
7. Answer: Concave mirrors are used by dentists to obtain a magnified image of the teeth. They are also used in solar heaters or solar concentrators, and as reflectors in flashlights, and headlights of cars and scooters.
8. Answer: Convex mirror are used as reflectors at sharp turns and tricky or 'blind' corners and in parking lots, and as rear-view mirrors in cars and on motorcycles.
9. Answer: The image formed by a plane mirror cannot be captured on a screen, and is called a virtual image.
10. Answer: Images that can be captured on a screen are known as real images.

➢ Short Answers:

1. Answer: The two laws of reflection are:
   - Angle of incidence is equal to angle of reflection.
   - Incident reflected ray & the normal lie on the same plane.
2. Answer: Real image can be obtained on a screen Image e.g.- Plane Mirror. But virtual Image cannot be obtained on a screen e.g. - Pinhole Camera, Photograph Camera.
3. Answer: Concave mirror is called a converging mirror because parallel rays of light fall on the mirror they converge at a point called focus. Convex mirror is called a diverging mirror because parallel rays of light fall on it they diverge after reflection.
4. Answer: The nature of image formed in a concave mirror depends on the portion of the object in front of the mirror. If the object is very close to the mirror the image is virtual, erect & magnified. As the distance increases image becomes real, inverted & its size keeps changing.
5. Answer: Following are the uses of concave mirror:
   - Used by the ENT Specialists, dentists.
   - Used as Shaving mirror.
   - Used by makeup artists.
   - Used in torches & Car headlights to get a parallel beam of light.
6. Answer: A piece of transparent material bound by curved surfaces. There are two types of

lens concave lens and convex lens. Convex lens is thick at the centre and thinner at edges, it is called converging lens concave lens is thin at the center and thicker at edge, it is called diverging lens.

7. Answer: A rainbow is formed by the refraction and reflection of the sun's rays through raindrops. When it is raining in one part of the sky and sunny in another, a rainbow appears. The centre of the rainbows arc is always directed away from the sun.
8. Answer: You can see seven colours of sunlight when it falls over soap bubbles, oil films, shiny surfaces of CD etc.

➢ Long Answers:

1. Answer: A rainbow is an optical phenomenon that is caused by reflection of light in water droplets in the Earth's atmosphere, resulting in a spectrum of light appearing in the sky. It takes the form of a multi-coloured arc. Rainbows caused by sunlight always appear in the section of sky directly opposite the sun. Rainbows can be observed whenever there are water drops in the air and sunlight shining from behind at a low altitude angle, the colour of rainbow are Red, Orange, Yellow, Green, Blue, Indigo, Violet.
2. Answer: Images in a mirror are located at the same distance behind the mirror as the object in front of it is mainly used in interior decoration and in architecture to make rooms appear brighter and bigger. Moreover, placing a mirror near lights, chandeliers and table lamps reflects the light over a larger area, and makes the room appear brighter. Images that cannot be captured on a screen are called virtual images.
3. Answer: Images are inversed, i.e. the right part of an object appears on the left in its images, and the left part of the object appears to the right. For example, the word 'AMBULANCE' is painted left-right inversed on the vehicle so that when the driver of a vehicle in front looks into his rear – view mirror, he can make out the word AMBULANCE quickly and give way.