Chapter 4

Light Energy

Chapter Objectives

In this chapter, you will learn about:

- Reflection
- Laws of reflection
- Plane mirror
- Speed of light
- Primary colours
- Formation of secondary colours by colour addition
- Appearance of the colour of an object
- Colour subtraction

We can see our images in a mirror. Can you search about the process, how mirrors are made? Also, investigate about the discovery of the mirror.

INTRODUCTION

All of us see our reflection in the mirror while getting ready to go to school, office for work, or to attend any function. What we see in the mirror is called an image. We can also see our image on the surface of calm water in ponds and polished steel utensils as well. The image so produced is due to the reflection of light. ***Reflection of light*** *refers to bouncing back of light after striking a surface.*

Fig. 4.1 Reflection in a plane mirror

MIRROR

We can see objects around us either because they emit light or reflect light. *Though all objects reflect light, no objects other than* ***mirrors*** *are perfect reflectors.*

The key factors that make a mirror different from other objects are:

1. It reflects most of the light falling on it.
2. It does not absorb light.
3. It does not allow light to pass through.

To manufacture a mirror with above properties, first, a thin clear glass sheet is taken. One side of the glass is then coated with a thin film of metal, such as silver or aluminium. This does not allow light to pass through. Then a paint made of red lead oxide is applied to protect the silver or aluminium film from eroding.

Mirrors can have a flat or curved surface. The glass that we have at our dressing table, usually has a flat surface. It forms images maintaining the same size as the reflected objects. It is called **a plane mirror.**

Coated: Thickly covered

Quick Check 1

Fill in the blanks.

1. In a mirror, ... is used to protect silver from getting eroded.
2. The looking glass is a ..... mirror.
3. The mirrors ..... light to form an image.
4. The size of an image formed by a plane mirror is ..... as that of the object.
5. Mirror does not ..... light falling on it.

REFLECTION

Take a plane mirror during the day time and hold it in such a manner that sunlight falling on the mirror is seen on the wall. Now, on changing the position and angle of the mirror in your hand, you will observe that the position and shape of light seen on the wall also changes. Plane mirrors reflect light. Thus, *reflection is defined as the phenomenon in which the ray of light bounces back as it falls on a smooth or a polished surface, like a mirror.*

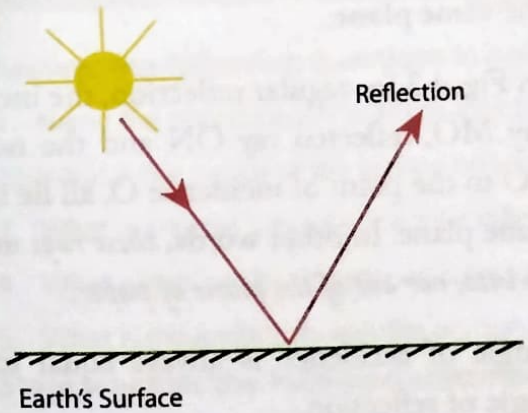


Fig. 4.2 Reflection of sunlight by the Earth's surface

Terms Related to Reflection

Let us discuss and try to understand some of the terms related to reflection.

Plane

A plane is a flat, two-dimensional surface with no thickness.

Ray

The path of light coming from a point source, in a given direction, is represented by a line with an arrow, which is called ray of light. Let us consider a light ray MO that is reflected by a mirror surface 'AB' as shown in Fig. 4.3.

Incident ray

The ray of light falling on a surface is called ***incident ray***. MO is the incident ray.

Point of incidence

The point O on the mirror surface, where the incident ray strikes, is called **point of incidence.**

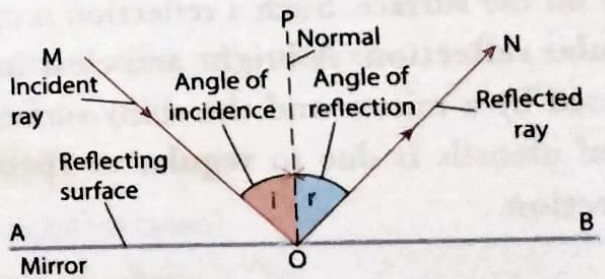


Fig. 4.3 Ray diagram of an incident and the reflected ray

Reflected ray

The incident ray bouncing back into the same medium is called ***reflected ray***. 'ON' is the reflected ray as shown in Fig. 4.3.

Normal

A straight line drawn perpendicular to the reflecting surface, at the point of incidence 'O', is called ***normal.*** Hence, 'PO' represents the **normal.**

Path: A route or track

Angle of incidence

The angle formed between the incident ray and the normal is called ***angle of incidence (i).*** ∠MOP is the angle of incidence.

Angle of reflection

The angle formed between the reflected ray 'ON' and the normal 'PO' is called ***angle of reflection (r).*** ∠PON is the angle of reflection.

Regular and Irregular Reflection

We know that mirrors reflect light and form an image. Similarly, we are able to see a stone, as it reflects light. But it does not form an image. Why do we see a clear image in a mirror but not in a stone? Let us understand the reason in the following section.

Regular reflection

When a parallel beam of light falls on a smooth and highly polished surface, reflected rays are also parallel to each other. Therefore, all of the rays reflect at the same angle as the incident rays on the surface. Such a reflection is called **regular reflection**. A bright and clear image formed by a mirror and the shiny surface of metal utensils is due to **regular** or **specular reflection**.

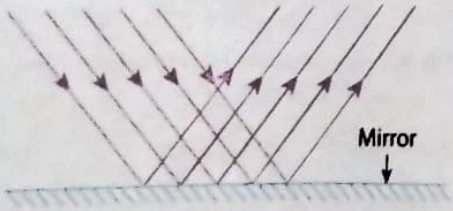


Fig. 4.4 Regular reflection

Irregular reflection

When a parallel beam of light falls on a rough surface, such as that of a stone, each ray of light scatters in different directions. Therefore, the image formed by such reflected rays is not as clear and bright as that formed by a mirror. This kind of reflection is called **irregular reflection** or **diffused reflection.**

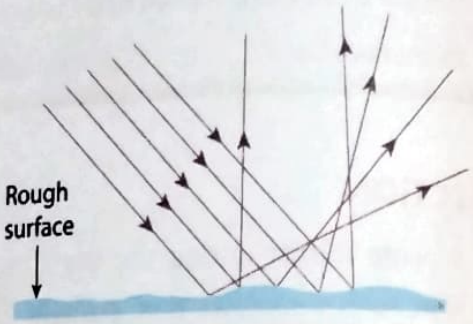


Fig. 4.5 Irregular reflection

LAWS OF REFLECTION

Laws of reflection govern the reflection of light rays by any smooth surface. The first law of reflection states that:

1. The incident ray, the reflected ray and the normal to the surface of the mirror, all lie in the **same plane.**

   In Fig. 4.3 for regular reflection, the incident ray MO, reflected ray ON and the normal PO to the point of incidence O, all lie in the same plane. In other words, *these rays neither go into, nor out of the plane of paper.*

2. Angle of incidence is always equal to the angle of reflection.

   Refer to the ray diagram of an incident and the reflected ray for regular reflection (Fig. 4.3), where $\angle i = \angle r$ or ∠MOP = ∠PON.

   This is the second law of reflection.

Let us verify the laws of reflection through the following experiment.

Specular: Relating to or having the properties of a mirror | **Diffused:** Spread over a wide area

ACTION TIME 1

Aim: To verify the laws of reflection.

Materials required: flash light, a mirror, white paper sheet, comb, tape, black strip, protractor.

Procedure:

- Fix a white sheet of paper on a table.
- Draw a straight line to place a mirror over it. Place a mirror over the line.
- Take a comb and close all its openings except the one in the middle. You can use a black strip to do the same.
- Use the slit to allow a ray of light that is coming from a flash light, as shown in the figure.
- Keep the comb on the white paper in such a way that the light ray falls on the reflecting surface of the mirror. Do you see a reflected light ray?
- Mark the point of incidence and also trace the path of the incident and reflected ray.
- Remove the mirror, comb and flash light. Now, draw the normal line and measure the angle of incidence and the angle of reflection.

What do you infer?

Write your inference in the notebook and discuss with your friends.

Devise an alternative method to prove the laws of reflection of light and present your plan to the class.

Quick Check 2

A. Answer the following questions in one word.

1. Name the phenomenon in which light bounces off a surface to the same medium.
2. What is the nature of the surface on which regular reflection occurrs?
3. What is another name for irregular reflection?
4. What is the line drawn perpendicular to the point of incidence called?
5. What is the angle between the normal and the reflected ray called?

B. State whether the following statements are True or False.

1. Light rays on touching a rough surface scatter in different directions. .....
2. According to the first law of reflection, the angle of incidence is equal to the angle of reflection. .....
3. According to the second law of reflection, the planes of incident ray and that of reflected ray lie perpendicular to each other. .....
4. If the angle of incidence of a light ray that falls on a mirror is 30°, then the angle of reflection is 60°. .....
5. The light ray that falls on a mirror always obeys laws of reflection. .....

Flash: To shine brightly and suddenly

IMAGE FORMED BY A PLANE MIRROR

When we look at the mirror, we see an image of ourselves that seems to appear on the mirror. But in reality, do you know where is the image positioned in a plane mirror? Let us see the answer in the following sections.

Image of a Point Object

Let us see how we view an image of an object at point O in a plane mirror AB (Fig. 4.6). We know that light rays coming from a point O travel in all directions. Consider only two rays of light OP and OQ coming from the point O. When the rays hit the mirror, they get reflected with the same angle, according to the law of reflection. The reflected rays are PR and QS. If we extend the reflected rays backwards, they will meet at a point I behind the mirror. Thus, an observer sees the image of the point 'O' which seems to come from 'I' behind the mirror. This is how the mirror reflects the light coming from a point 'O'. Let us extend this idea to explain how we see ourselves in a plane mirror.

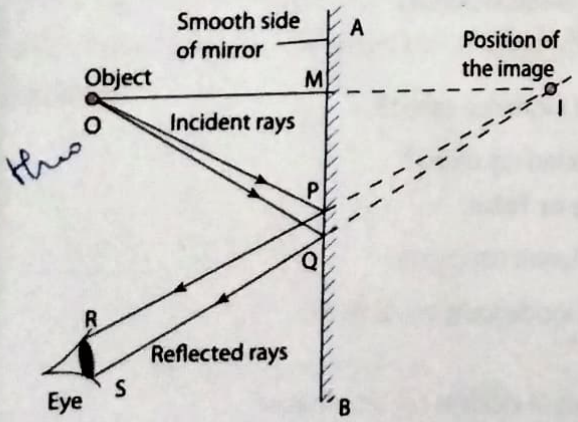


Fig. 4.6 Image formation of a point 'O' in a plane mirror

Image of an Object Larger than a Point

Imagine yourself standing in front of a mirror AB. Consider a point M on the tip of your head and another point N on your feet. Light rays from each point on your body travel in all directions. One of the rays from point M, which obeys the angle of reflection, finally reaches your eyes after hitting the mirror surface. Similarly, there must be a ray from point N that would reach your eyes as it bounces off the mirror surface. If you extend the reflected rays backwards, they appear to form an image having the same height as your size, behind the mirror. This is how you see a reflection of yourself in a mirror.

If you notice, the bottom half of the mirror is useless in forming the image. Hence, we do not need a mirror having the same size as the object that is intended to be seen.

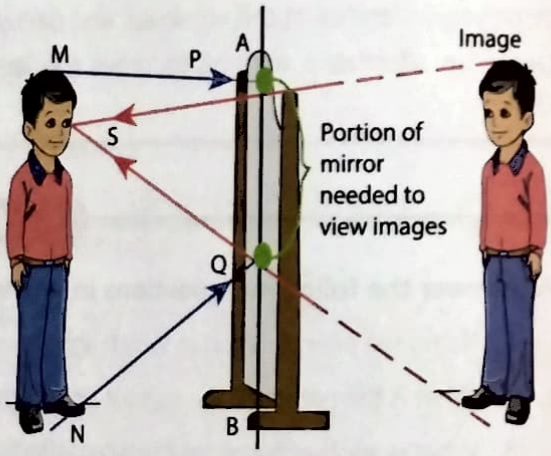


Fig. 4.7 Image formation of a person in a plane mirror

Lateral Inversion

Take a pencil in your right hand and stand in front of a looking glass. You will see that the left hand of your image is holding the pencil. Touch your right ears with the left hand. Though the image is the same as you, it appears as if you are touching your left ears with the right hand. *This phenomenon of a mirror in which the left side of an object appears to be on the right side in its image and vice versa is called lateral inversion.*

Intended: Planned or meant

ACTION TIME 2

Aim: To understand the phenomenon of lateral inversion.

Materials required: white paper, mirror

Procedure: Take a white sheet and write the letter 'd' over it. Place it in front of a mirror. What do you observe? Write the word 'Letter' and write what you see in the mirror. Explain your observation in terms of lateral inversion.

Fig. 4.8 Left hand of a person appears as the right hand of his image

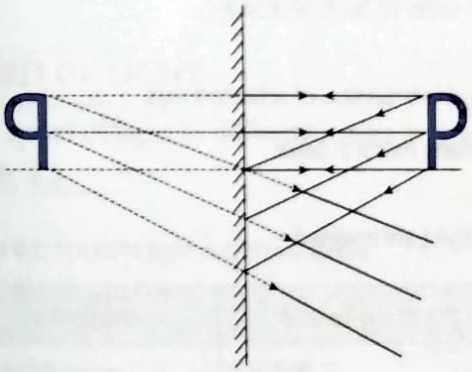


Fig. 4.9 Ray diagram to show lateral inversion

INFO HUB

The letters of the word 'AMBULANCE' are always printed backwards on an ambulance van. This is because the driver of the vehicle, ahead of the ambulance, can read the word in correct order in the rear view mirror of his/her vehicle.

Real Images

Real images are inverted images. They are formed on the location where light rays actually meet. This kind of image is formed by curved mirrors. In curved mirrors, images are formed on the same side of the mirror as the object.

Virtual Images

Virtual images are upright images. They are formed in locations where light rays do not actually meet. For example, whenever a plane mirror creates an image, the reflected rays only appear to come from a point. The point is located behind the mirror, where the reflected rays do not really meet. Hence, *the image formed by a plane mirror is a virtual image.*

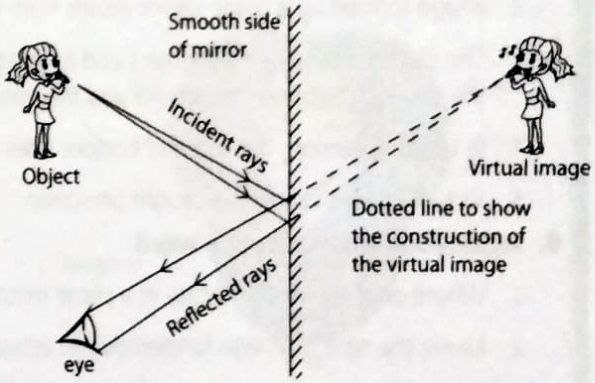


Fig. 4.10 Ray diagram to show virtual image

Table 4.1 Differences between real and virtual images

Real image	Virtual image
1. It is always inverted.	1. It is always upright.
2. Rays of light meet at a point after getting reflected by the reflecting surface.	2. Rays of light appear to meet at a point after getting reflected by the reflecting surface.
3. Real images can be captured on screen.	3. Virtual images cannot be captured on screen.

Curved: Having the form of a curve

Characteristics of an Image formed by a Plane Mirror

The image produced by a plane mirror has the following characteristics:

1. An image formed by a plane mirror is **virtual**.
2. A plane mirror always forms an **upright image** until the object is kept upright in front of the mirror. The upright image is also called an erect image.
3. The image is formed **behind the mirror at the same distance from the mirror** as the object in front of it.

To find out the position of the image in Fig 4.6, draw a perpendicular from point O to AB. Mark the point at which the perpendicular intersects the mirror surface at 'M' and extend it till the point T. You will notice that distances OM and IM are equal. Hence, the perpendicular distance of the image from the mirror is equal to the perpendicular distance of the object from the mirror.

4. The image is always of the same size as that of the object.
5. **The image is laterally inverted.**

Quick Check 3

A. State whether the following statements are True or False.

1. We need a mirror of the same size as the object is, in order to form an image of the same size. .....
2. Image formed by a plane mirror results from the actual intersection of reflected rays. .....
3. The distance between the object and its image in a plane mirror is twice the distance between the object and the mirror. .....
4. In lateral inversion, the top and bottom sides of an object are inverted. .....
5. Virtual images cannot be caught on screen. .....

B. Write your answer in one word.

1. Where does the image locate in a plane mirror?
2. Name the type of image formed due to actual intersection of reflected light rays.
3. Is a real image always inverted?
4. Is the image formed by a plane mirror enlarged?
5. If an object is placed at 30 cm from a mirror, what is the distance of the image from the mirror?

Application of Mirrors

Some of the applications of mirrors are given here:

1. We use plane mirrors as dressing table mirrors.
2. When one of the walls of a small room is covered by a plane mirror, it gives a false dimension to the small space.
3. In a barber shop, a plane mirror is used to show the customer, the back side of his head.
4. Army personnel and scouts use plane mirrors for signalling.
5. In solar cookers, plane mirrors are used to direct sunlight to the interior of the cooker.

Perpendicular: At an angle of 90° to a horizontal surface

6. Kaleidoscope and periscope are the interesting scientific instruments constructed using these mirrors.
7. Plane mirrors are used for decorations. In showcases, jewelleries and antique pieces are placed in between two plane mirrors to form multiple images, in order to grab the attention of the people.

Quick Check 4

State whether the following statements are True or False.

1. In showcases, jewelleries and antiques are placed in between two plane mirrors to get enlarged images. .....
2. Light ray undergoes four successive reflections in a periscope. .....
3. Light ray leaving a periscope is perpendicular to that entering the periscope. .....
4. The image produced by a periscope is laterally inverted. .....
5. Army personnel and scouts use plane mirrors for signalling. .....

SPEED OF LIGHT

The speed of light in different media is given in Table 4.2.

Table 4.2 Speed of light in different media

Medium	Speed (in m s^{-1})
Air or Vacuum	3×10^8
Water	2.25×10^8
Glass	2×10^8

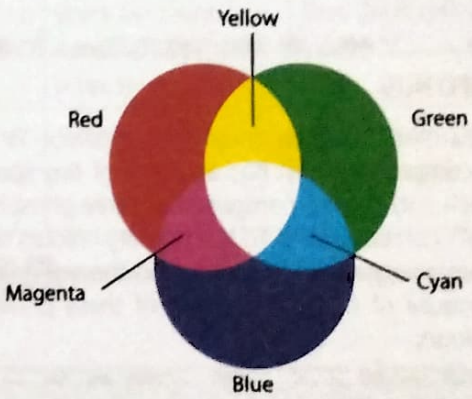


Fig. 4.11 Red, green and blue colours on combination, produce white colour

PRIMARY COLOURS

The colours of light that produce white light when combined with the correct intensity are called ***primary colours.*** (Red, green and blue (RGB) are primary colours.) All the other colours are made by mixing primary colours in suitable proportions.

Formation of Secondary Colours by Colour Addition

The colours produced by mixing any two primary colours of light are called secondary colours or composite colours. Magenta, cyan and yellow colours are secondary colours.

Kaleidoscope: A toy consisting of a tube containing mirrors and pieces of coloured glass or paper
Periscope: An instrument used in submarines which allows you to look above the surface of the water

ACTION TIME 3

Aim: To form secondary colours.

Take three torches and cover their glasses with red, green and blue cellophane papers, so as to produce red, green and blue light respectively. Now, switch ON the torches. Project all the three coloured lights on a white screen or wall, so that these coloured lights may overlap. Now, you will observe that the area where red and green coloured lights overlap, appears yellow. Also, the area where red and blue coloured lights overlap appears magenta. In the same way, the area where blue and green coloured lights overlap, gives cyan colour. You will further observe that the area where all the three coloured lights overlap, appears white. We can also write these results as given below:

Additive colour

Red	+	Green	=	Yellow
Red	+	Blue	=	Magenta
Blue	+	Green	=	Cyan

INFO HUB

You must have observed that a colour TV or a computer screen has an array of tiny spots. Each such spot is composed of three phosphor dots corresponding to the primary colours red, blue and green. The colours on the screen are because of the combination of these primary colours.

INFO HUB

The use of complementary colours is very common in day-to-day life. During white washing of buildings, indigo is mixed with lime. With the passage of time, the colour of buildings becomes yellowish. As blue is the complementary colour of yellow, so mixing of indigo in lime keeps the buildings white for a long time.

COMPLEMENTARY COLOURS

***Complementary colours** are the two colours, which give white light when mixed together.* For example, red and cyan are complementary colours because they produce white light on mixing together. In the same way, blue and yellow, and green and magenta are also complementary colours.

Name the pigment that gives the green colour to plants.

APPEARANCE OF THE COLOUR OF AN OBJECT (BASED ON REFLECTION AND ABSORPTION)

The colour of the object is not contained within the object. The colour of the object is determined by the way the object interacts with light and ultimately reflects or transmits it to our eyes. When visible light strikes an object,

Spot: A small round or roundish mark, differing in colour or texture from the surface around it

some part of it gets absorbed. That part of the light will never be visible to the eyes.

When the white light (sunlight) is allowed to pass from a glass prism, it splits into rainbow colours VIBGYOR. The main colours of the white light are: Violet, Indigo, Blue, Green, Yellow, Orange, Red.

Let us consider a few examples to explain this.

Table 4.3 Appearance of the colours of different objects

	White Sheet of Paper	*Hibiscus* (red)	Leaves (green)	Trousers (cyan)
Colours that an object can absorb	None	Except red, all colours	Except green, all colours	Only red
Colours that an object can reflect	All	Red	Green	Blue and green
Appearance of an object in white light	White (as no colour is absorbed)	Red (as all other colours get absorbed)	Green (as all other colours get absorbed)	Cyan (Blue+Green) (as blue and green get reflected, while red get absorbed)
Appearance of an object in red light	Red (as there is only red light to reflect)	Red	Black (as there is no green colour to reflect)	Black (as it absorbs red)
Appearance of an object in blue light	Blue (as there is only blue light to reflect)	Black (as there is no red light to reflect)	Black (as there is no green light to reflect)	Blue (as it reflects blue)
Appearance of an object in green light	Green (as only green light gets reflected)	Black (as there is no red light to reflect)	Green	Green (as it can reflect green)

Quick Check 5

Complete the following table.

	Rose (white)	Rose (blue)	Leaves (green)	Shirt (magenta)
Colours that an object can absorb.				
Colours that an object can reflect.				
Appearance of an object in white light.				
Appearance of an object in red light.				
Appearance of an object in blue light.				
Appearance of an object in green light.				

COLOUR SUBTRACTION

We know that white light consists of three primary colours—red, green and blue. If white light is allowed to pass through a cloth, and it absorbs red and blue, then green colour will be reflected from it. Therefore, the cloth will appear green. This shows the **process of colour subtraction.**

$$W - (R + B) = (R + G + B) - (R + B) = G$$

Fig. 4.12 Absorbs red and blue, reflects green

Now, consider another piece of cloth that absorbs only green colour and reflects blue and red. Then, the cloth will appear magenta.

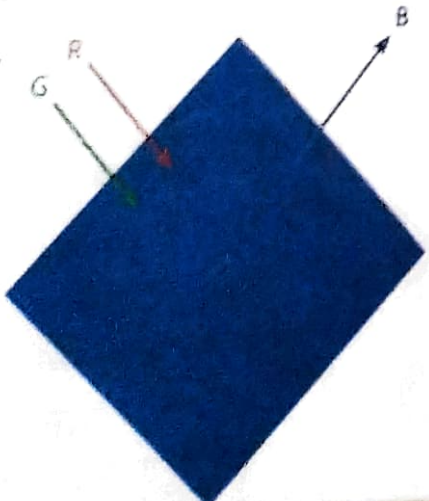
$$W - G = (R + G + B) - G = R + B = M$$

Fig. 4.13 Absorbs green, reflects red and blue

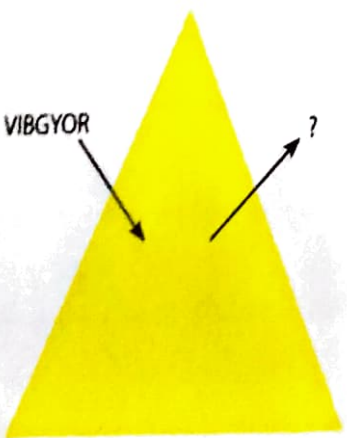
Quick Check 6

In the following objects, identify which colours will be absorbed and reflected, and what colour will appear to the observer?

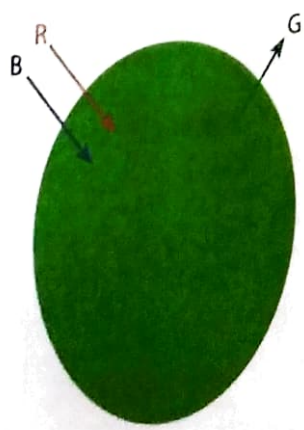
1.



2.



3.



KEY TERMS

Mirror: A highly polished and silvered glass that reflects most of the light falling on it

Lateral inversion: The behaviour of a mirror in which the left side of an object appears to be on the right side and vice versa

Real images: Images formed due to actual intersection of reflected rays

Virtual images: Images that appear to come from a point where reflected rays do not actually meet

QUICK NOTES

* Mirror reflects most of the light falling on it. It does not absorb light and also does not allow light to pass through.
* We see objects due to regular reflection.
* We see reflection on a mirror due to regular reflection of light.
* Image formed by a plane mirror is virtual, upright, laterally inverted, of the same size as the object, located behind the mirror at the same distance as the object.
* Plane mirrors are used in many ways in our day-to-day life.
* Laws of reflection state that:
  a. The incident ray, the reflected ray, and the normal to the surface of the mirror, all lie in the same plane.
  b. Angle of incidence is always equal to the angle of reflection.

RUN-THROUGH

I. Very Short Answer Questions.

A. Tick (✓) the correct option.

1. The type of reflection that takes place on a highly polished surface is:
   a. regular ☐ b. normal ☐ c. irregular ☐ d. diffused ☐
2. A line drawn perpendicular to the mirror at the point of incidence is called:
   a. incident ray ☐ b. reflected ray ☐ c. transmitted ray ☐ d. normal ☐
3. If the angle of incidence is 50°, then the angle of reflection will be:
   a. 90° ☐ b. 40° ☐ c. 50° ☐ d. 130° ☐
4. In a plane mirror, an image appears to be formed .....
   a. on the surface of the mirror ☐ b. in front of the mirror ☐
   c. behind the mirror ☐ d. above the mirror ☐
5. The image formed by a plane mirror is:
   a. virtual ☐ b. magnified ☐ c. diminished ☐ d. real ☐

6. The necessary condition for a light ray to obey the laws of reflection is:
   a. The surface on which the light ray falls should be rough. ☐
   b. The surface on which the light ray falls should be smooth. ☐
   c. The surface on which the light ray falls should be flat. ☐
   d. The surface on which the light ray falls should be curved. ☐

7. If the angle between the incident ray and the surface of the mirror is 60°, then the angle of incidence is:
   a. 60° ☐ b. 90° ☐ c. 180° ☐ d. 30° ☐

8. Regular reflection occurs on:
   a. smooth surface ☐ b. flat surface ☐
   c. curved surface ☐ d. rough surface ☐

9. Plane mirrors are not used for:
   a. signalling ☐ b. decorations ☐
   c. seeing larger images ☐ d. reflection ☐

10. Which among the following is not an application of a plane mirror?
    a. Kaleidoscope ☐ b. Periscope ☐
    c. Dressing table mirror ☐ d. Stethoscope ☐

11. A type of reflection occurring on the surface of a tree is called:
    a. regular reflection ☐ b. lateral inversion ☐
    c. irregular reflection ☐ d. specular reflection ☐

B. Fill in the blanks.

real, cannot, reflect, real, incident, reflections, virtual, can, normal, plane, regular, reflection

1. Mirrors ..... light that falls on their smooth surface.
2. ..... image is formed by actual meeting of reflected rays and it ..... be captured on a screen.
3. ..... image is always erect.
4. Virtual image ..... be obtained on screen.
5. ..... reflection helps us see an object clearly.
6. The angle formed between incident ray and normal is called angle of ..... .
7. According to law of reflection, the incident ray, the reflected ray and ....., all lie in the same plane.
8. ..... helps us to see our image in the mirror.
9. Image formed by a ..... mirror is laterally inverted.

C. Match the following:

Column A	Column B
1. Diffused reflection	a. Reflects the light and forms an image
2. Lateral inversion	b. Angle between incident ray and normal
3. Specular reflection	c. Bouncing off the light from a rough surface
4. Multiple image	d. Number of images formed by a mirror are multiple
5. Mirror	e. Angle between reflected ray and normal
6. Angle of reflection	f. Bouncing off the light from smooth and polished surface
7. Angle of incidence	g. Right side of object is changed as left side in the image

D. State whether the following statements are True or False.

1. The image formed by a plane mirror is diminished.
2. The angle of incidence is the angle measured between the incident ray and surface of mirror.
3. A real image can be captured on screen.
4. The image formed by a plane mirror is larger than the object.
5. The image formed by a plane mirror is real.
6. The distance of an object and that of image from the surface of a plane mirror is the same.
7. During reflection, the angle of incidence is always greater than the angle of reflection.
8. Virtual images cannot be seen on screen.
9. Due to irregular reflection, we are able to see objects.

II. Short Answer Questions.

1. Explain how mirrors are manufactured.
2. What are the characteristics that make a mirror a perfect reflector?
3. If you stand 2 m in front of a plane mirror, what is the distance behind the mirror at which your image is formed? Give reasons to support your answer.
4. What is meant by lateral inversion?
5. Distinguish between virtual and real images.
6. What is meant by irregular reflection?
7. State two uses of plane mirrors.
8. Write short notes on:
   a. Primary and secondary colours b. Colour subtraction
9. Differentiate between image and shadow.

10. Why is the word 'AMBULANCE' written laterally inverted on the vehicle?
11. Answer and give reasons.
    a. Y – Y = (R + G) – (R + G) (yellow light is allowed to pass through a yellow paper)
    b. Y – R = (R + G) – R = G (yellow light is allowed to pass through a red paper)

III. Long Answer Questions.

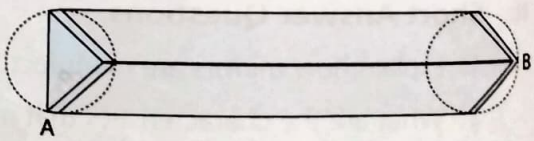
1. Explain the laws of reflection in detail.
2. State the applications of plane mirrors.
3. Briefly explain regular and irregular reflections.
4. Devise a method to investigate the laws of reflection of light.
5. State the characteristics of an image formed by plane mirrors.
6. Explain how a plane mirror forms an image of a pencil placed in front at 10 cm distance from the mirror. Also, explain the characteristics of the image so formed.

IV. Challenge

1. Would the law of reflection be true when light is reflected from a chair? Give reasons to support your answer.
2. Find out the English letters which look exactly the same in a plane mirror.
3. Explain why the shiny surface of a silver plate is not able to form a clear image like a mirror does.
4. Sukhiram, a washerman, uses a few drops of indigo after washing white clothes. Why?
5. A ray of light is normally incident on a plane mirror. What are angles of incidence and reflection?
6. Do laws of reflection hold good in case of curved mirrors?
7. Sunny is standing at a distance of 1 m from a plane mirror to see his clear image. What is the distance between Sunny and his image?

V. Enrichment

A. Construct a Kaleidoscope: Designers of wallpapers, fabrics and artists use kaleidoscopes to get ideas for new patterns. It is a device used to produce beautiful patterns of colourful beads or threads. This works on the principle of multiple images formed by inclined mirrors.



Take three identical mirrors of rectangular shape. Take a white paper and apply gum or Fevicol on it. Place the mirrors length-wise on the gummed paper. Make sure there is a 2 mm of space in between mirrors. Now, fold the mirrors to form triangular tube with shining surface inside the tube. Tape around the tube. Now close one of its ends using ground glass. Place some colourful beads or threads inside the tube and close another end using another clear plastic. Hold your kaleidoscope towards a light source and enjoy seeing the colourful patterns.

B. Know your Scientist — Euclid (435 BCE – 365 BCE)

Ancient Greek mathematician Euclid described the law of reflection around 300 BCE. Euclid was one of the greatest mathematicians and he is often referred as the father of geometry. Euclid gathered up all the knowledge developed in Greek mathematics at that time and wrote a book called