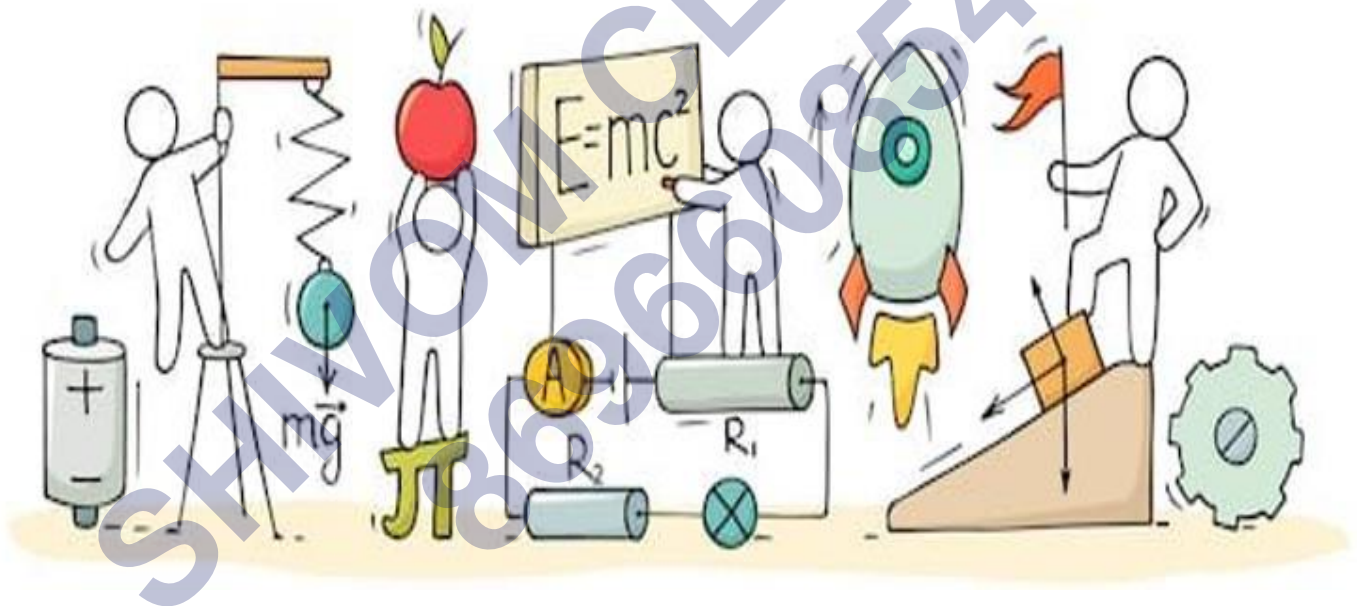


SCIENCE

Chapter 11: Light, Shadows and Reflection



Light, Shadows and Reflection

Light

- Light is defined as radiation which is visible to the human eye.
- It helps us see different colourful objects around us.
- The natural source of light is the Sun.
- Sunlight allows us to see objects during the day. It also plays an important role in the growth of plants and in processes such as photosynthesis.
- Luminous objects are objects which emit light of their own. Example: Sun
- Non-luminous objects are objects which reflect light. Examples: Moon, mirrors

Importance of Light

- Light is the main source of energy for animals and plants.
- The sunlight provides natural warmth that creates suitable conditions for the growth and development of life.
- The green plants required sunlight to make their food by the process of photosynthesis.
- The natural colour of light is white, but this white light has seven different colours: violet, indigo, blue, green, yellow, orange and red.
- The objects absorb specific colours of light and reflect the other colours. This reflected colour declare the colour of the object. For example, grass cannot absorb the green colour. So, the green colour is reflected that comes to our eyes.



Sources of Light

The objects that emit light are called sources of light. There are two sources of light: natural

and man-made. For example, the sun, stars and fireflies are natural sources (Figure 1 a), while an electric bulb, a burning lamp and tube light are man-made sources of light (Figure 1 b).



Figure 1: Sources of light: a) Firefly (natural source; b) Candle (man-made source)

The objects that become hot when they emit light are called hot sources of light. For example, the sun, a burning candle or lamp and an electric bulb, etc (Figure 2).



Figure 2: Hot source of light: the sun.

The objects that emit light without becoming hot are called cold sources of light. For example, fireflies (Figure 3).

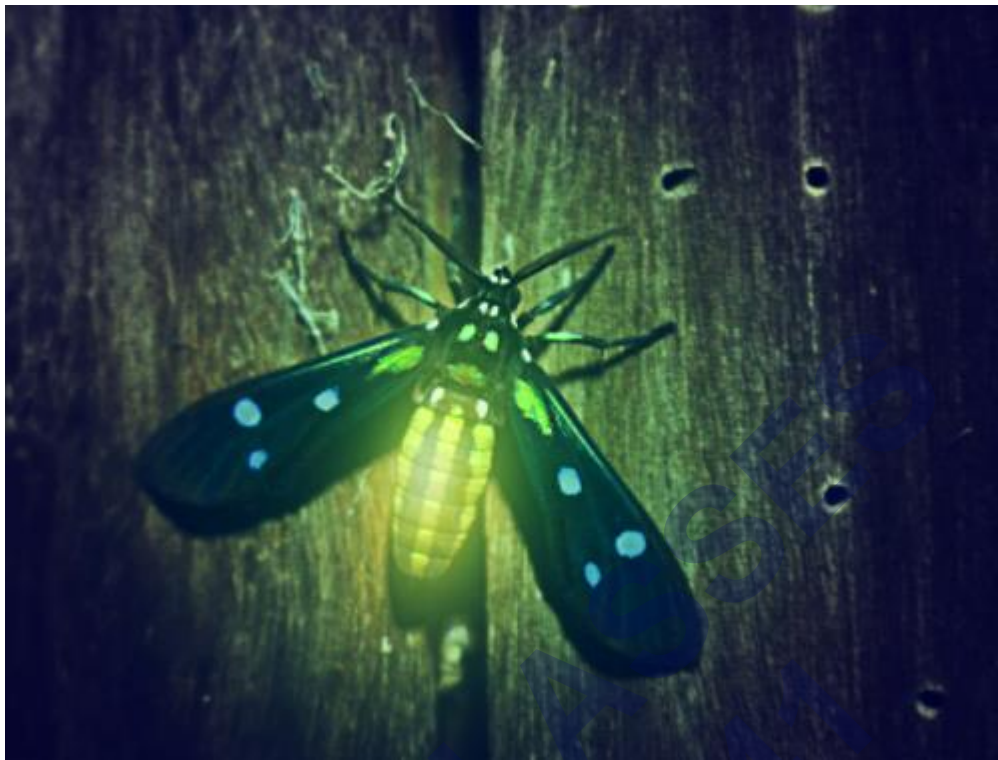
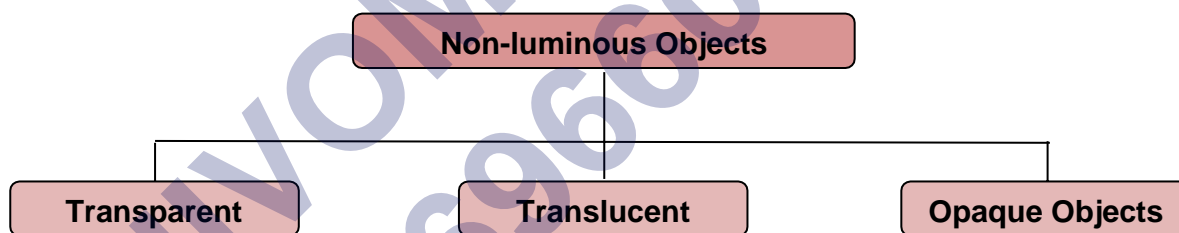


Figure 3: Cold source of light: firefly.

Types of Non-Luminous Objects



Transparent Objects

- These objects allow light to pass through them.
- Examples: A clear empty glass, a windowpane and eye lenses.



Translucent Objects

- These objects allow only some of the light to pass through them and the other light rays are scattered.
- Examples: Thin tissue paper, frosted glass, tinted car windows and waxed paper.



Opaque Objects

- These objects do not allow light to pass through them.
- Example: Cardboard, bricks, wood, buildings and eyelids.



Shadows

- A shadow is created when an opaque object blocks light.
- The objects must be opaque or translucent to form a shadow.
- Light travels in a straight line. So, when it is blocked, a shadow is formed.
- Transparent objects will not produce any shadow as light will pass through them.
- The shape of the shadow may not be identical to the shape of the object because the shadow's shape depends on the position of the source of light and the place where the shadow falls.
- If an object is moved closer to the light source, then the shadow gets bigger.
- If an object is moved further away from the light source, then the shadow gets smaller.



Nature of a Shadow

The shadow is categorized into two parts based on the brightness of the dark patches:

- **Umbra:** It is the darkest part of the shadow present in the middle of it, which forms due to the absence of light.
- **Penumbra:** It is the faintest part of the shadow present at the corners of it. It is formed when the light is not completely blocked (Figure 7).

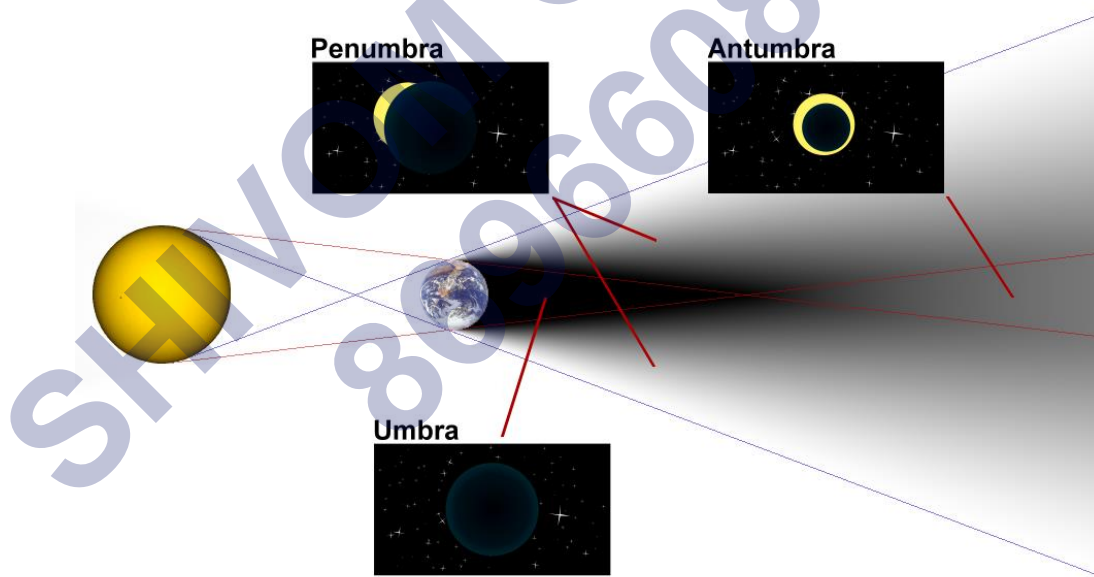


Figure 7: Umbra and Penumbra

Eclipses

The eclipses are formed on the basis of rectilinear propagation. They are shadows formed naturally when the sun, moon and earth aligned in a straight line.

Solar Eclipse:

- When the sun, moon and earth align in a straight line and the moon falls between the sun and the earth casts its shadow on earth then this phenomenon is known as solar eclipse.
- During a solar eclipse, the dark side of the moon faces the earth. This phenomenon takes place on a new moon day.
- The moon's shadow forms a total solar eclipse on the region of the earth where the umbra of the moon falls on it, while the partial solar eclipse takes place on the regions where the penumbra of the moon's shadow falls (Figure 8).

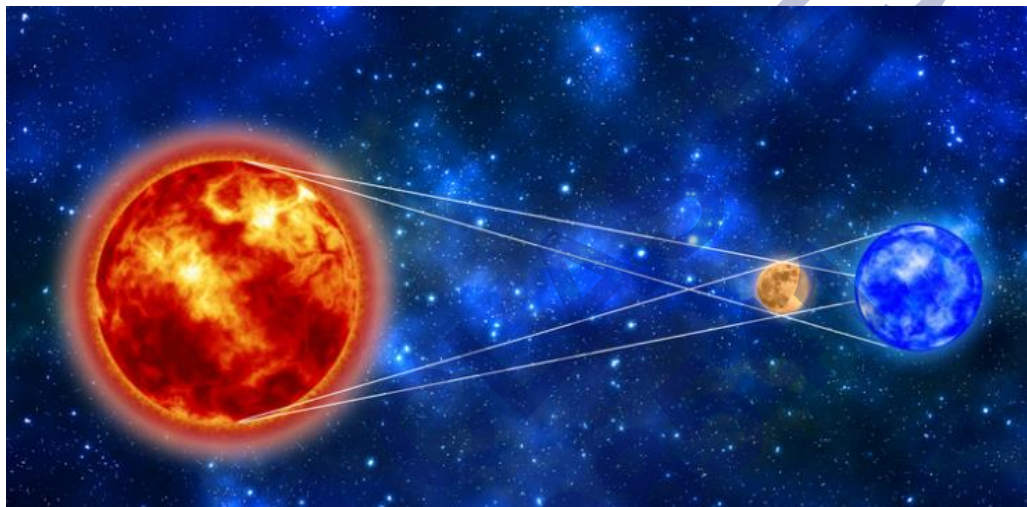


Figure 8: Solar Eclipse.

Do not look directly to the sun during a solar eclipse because this will damage your eyes permanently. However, if you really want to look at the sun then you should use eye filters such as X-ray reports.

Lunar Eclipse

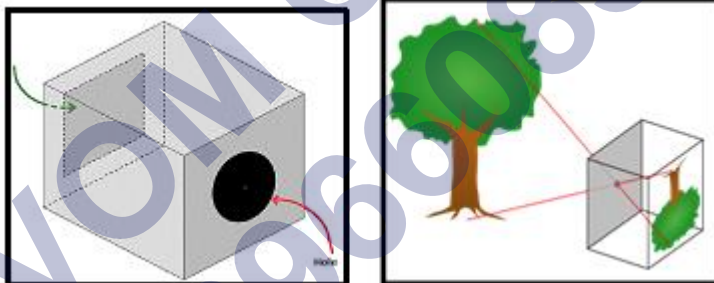
When the sun, moon and earth align in a straight line and the earth is present in the middle of the sun and the moon, casting its shadow on the moon then this phenomenon is called a lunar eclipse.

The total lunar eclipse is formed in the regions of the moon where the earth's umbra falls, whereas the partial lunar eclipse is formed where the earth's penumbra falls (Figure 9).



A Pinhole Camera

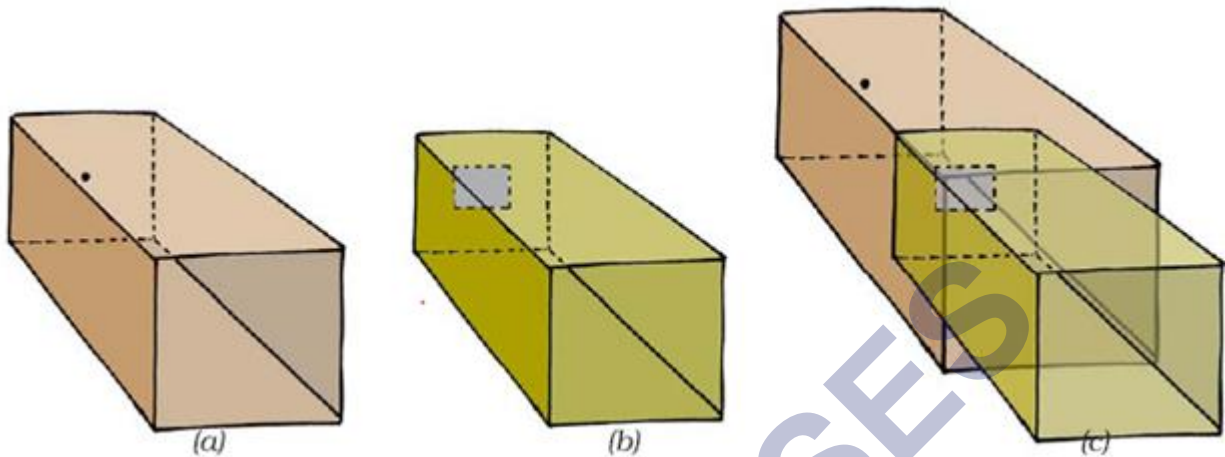
- A pinhole camera is a simple camera without a lens and with a single small hole or an opening through which the light Passes.



- Light from a scene passes through this single hole and projects an inverted image on the opposite side of the box.
- The human eye in bright light is similar to a pinhole camera.

How to use it

- Hold the pin hole camera look through the open face of the smaller box. You should use a piece of black cloth to cover your head and the pinhole camera.
- Now focus on the object you want to capture in the camera. Make sure that the objects you wish to look at through your pinhole camera are in bright sun shine.
- Move the smaller box forward or backward till you get a picture on the tracing paper pasted at the other end



Mirrors and Reflection

Mirror

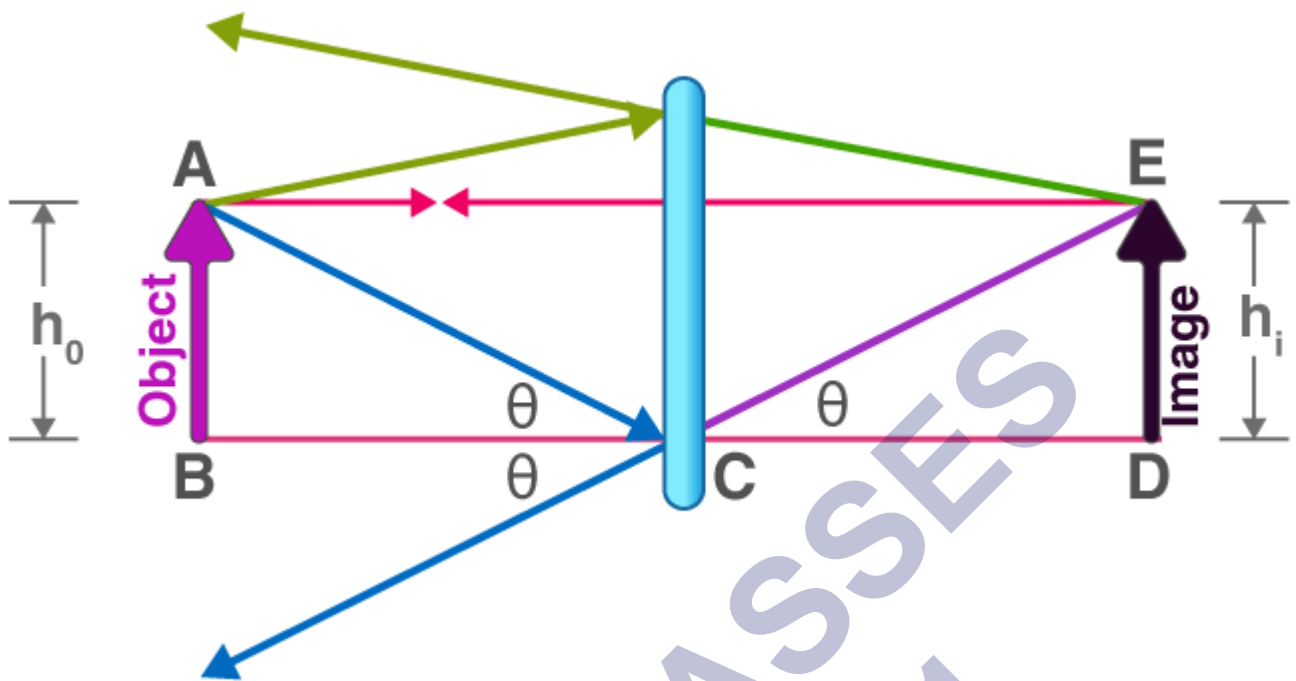
- A mirror is an object which reflects light.
- When we look into the mirror, we see the reflection of our face in the mirror.
- A mirror changes the direction of light that falls on it.

Reflection

- Reflection is light which travels along a straight line and gets **reflected** from the mirror.

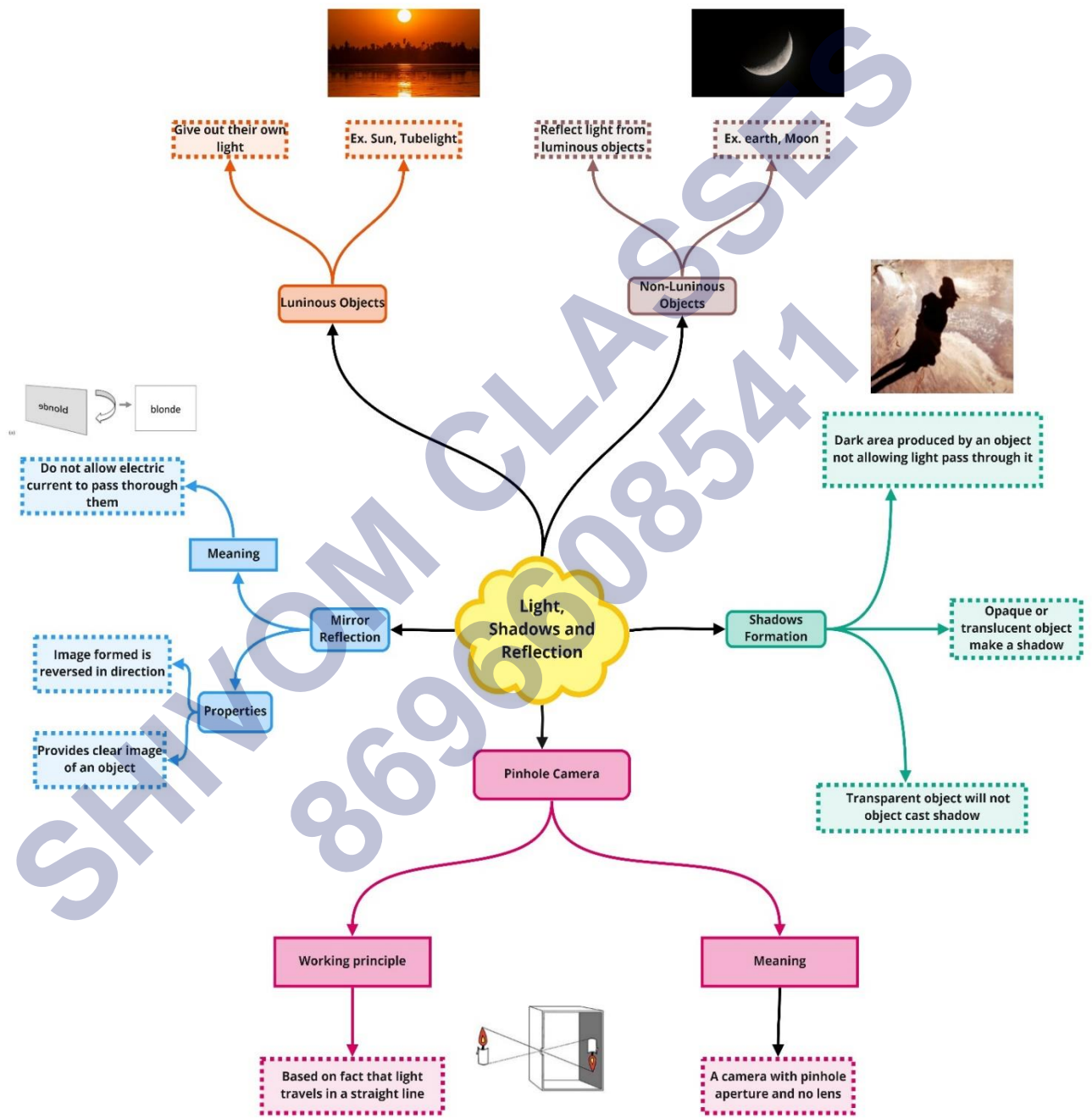


Image formation by Plane Mirror



- A plane mirror reflects the light that falls on it.
- The beam of light that falls on the mirror is called incident ray, while the light that reflects called the reflected ray.
- The angle of incident ray equals to the angle of the reflected ray.
- The incident ray reflected ray and normal ray lies at the common point of the mirror.
- A plane mirror has a property of lateral inversion in which the image formed in the mirror has an opposite side. For example, when you see your image in the mirror your right hand becomes left and your left hand becomes right.
- The image formed is erect, same size and laterally inverted. It retains the same colour as the object.

Class : 6th Science
Chapter- 11: Light, Shadows and Reflection



Important Questions

Multiple Choice Questions:

Question 1. Light travels in

- (a) straight line
- (b) curved line
- (c) zig-zag line
- (d) randomly

Question 2. When an opaque object comes in the path of light it forms

- (a) an image with colours
- (b) shadow
- (c) black and white image
- (d) depends on the colour of the light

Question 3. Which types of objects do not allow light to pass through them?

- (a) Translucent
- (b) Opaque
- (c) Transparent
- (d) Penumbra

Question 4. Which is an example of a translucent object?

- (a) A thin sheet of paper
- (b) A thin glass slab
- (c) A thin iron sheet
- (d) All of these

Question 5. Bouncing back of light from shining surfaces is called

- (a) Reflection
- (b) Refraction
- (c) Bending
- (d) Dispersion

Question 6. What is lateral inversion?

- (a) Image becomes inverted
- (b) Image bends laterally
- (c) Right of the object appears left of the image
- (d) All of these happen

Question 7. Which letters of English alphabet will not show lateral inversion?

- (a) I, O, U
- (b) N, Z, X
- (c) I, X, E
- (d) A, E, I

Question 8. Which is a device to image the sun?

- (a) Plane mirror
- (b) Pinhole camera
- (c) A straight pipe
- (d) Glass slab

Question 9. Which of the following is a cold source of light?

- (a) Firefly (Jugnu)
- (b) Tube light
- (c) The sun
- (d) Electric bulb

Question 10. Out of these, which one is not a man-made luminous body?

- (a) Electric bulb
- (b) Burning candle
- (c) Firefly (Jugnu)
- (d) Oil lamp

Very Short Question:

1. Whether the moon is luminous or non-luminous body?
2. What is umbra?
3. How does a light ray travel?
4. Give one natural source of light.
5. What is shadow?
6. What is penumbra?

Short Questions:

1. State difference between a luminous and a non-luminous body.
2. Why is the moon not considered as a luminous body?
3. What is an incandescent body? Give example.

4. When does a shadow form?
5. Draw a diagram to illustrate the formation of umbra and penumbra.
6. What are the essential conditions for the formation of shadow?
7. Define reflection of light.
8. Write difference between shadow and image.

Long Questions:

1. What is reflection of light? Explain reflection of light with the help of an activity.
2. Explain the manner in which light travels with the help of an activity.
3. Explain that light has the property of rectilinear propagation.

Answer Key-

Multiple Choice Answers:

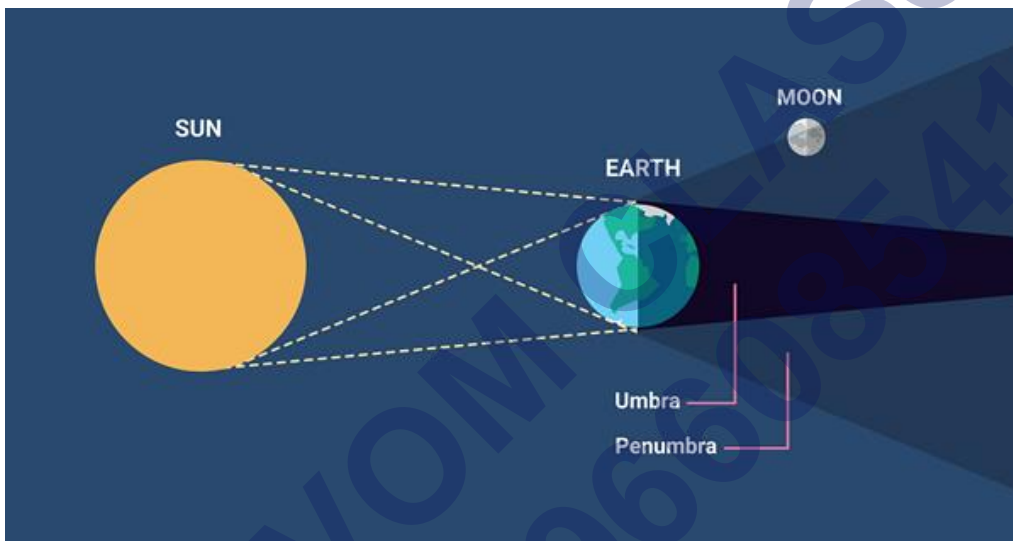
1. (a) straight line
2. (b) shadow
3. (b) Opaque
4. (a) A thin sheet of paper
5. (a) Reflection
6. (c) Right of the object appears left of the image
7. (a) I, O, U
8. (b) Pinhole camera
9. (a) Firefly (Jugnu)
10. (c) Firefly (Jugnu)

Very Short Answers:

1. Answer: Moon is non-luminous body.
2. Answer: Umbra is the dark region behind object facing light which does not receive light at all.
3. Answer: Light ray travels in a straight line.
4. Answer: Sun is a natural source of light.
5. Answer: Shadow is the dark space behind an opaque object where light does not reach.
6. Answer: The less darker shadow formed penumbra. on the periphery of dark shadow is called penumbra.

Short Answer:

- Answer: The bodies which emit light are called luminous bodies. Example: sun, stars, burning candle etc.
The bodies which does not emit light are called non-luminous bodies. Example: moon, earth, blackboard.
- Answer: Moon is non-luminous body because it shines by reflecting the sunlight falling on it.
- Answer: The bodies which emit light when heated to a very high temperature are called incandescent bodies. Example: electric bulb.
- Answer: Shadow is formed when light does not reach behind the opaque object kept in the path of light
- Answer:



- Answer:
 - There should be an opaque material.
 - There should be a source of light and screen.
 The object must be placed in the path of light. Then shadow is formed on the screen.
- Answer: When light rays after striking the smooth and shiny surface return to same medium, this phenomenon is called reflection of light.
- Answer:

Image	Shadow
It is formed by intersection of reflected rays.	Shadow is formed when light does not reach behind the object.
Image is seen when reflected rays	No light enters the observer's eyes.

approach to observer's eyes.	
Image gives more information such as colour, structure etc.	Shadow does not provide such information.
Image can be straight or inverted.	Shadow is never inverted.

Long Answer:

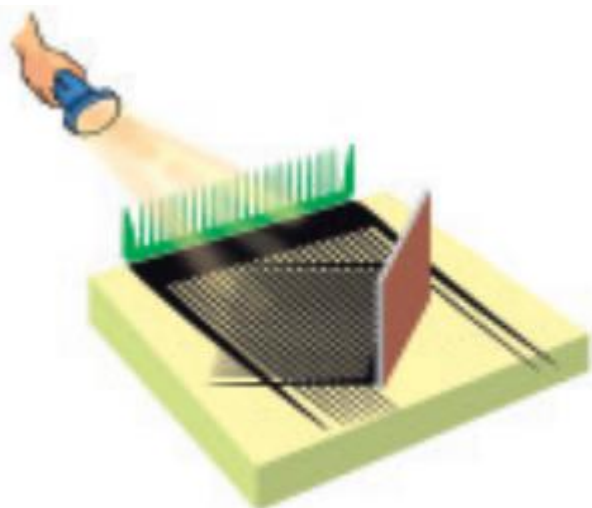
1. Answer: When light rays fall on a highly polished (e.g. mirror) smooth surface and return to the same medium, it is called reflection of light.

Activity to show reflection of light: This activity should be done at night or in a dark room. Ask your friend to hold a mirror in his hand at one corner of the room. Stand at another corner with a torch in your hand. Cover the glass of torch with your fingers and switch it on. There should be small gap between your fingers. Direct the beam of torch-light on to the mirror that your friend is holding. Adjust the direction of torch so that patch of light falls on your friend standing in the room. This activity shows the reflection of light also that light travels in straight line.



2. Answer: Take a comb and fix it on one side of a thermocol sheet. Fix a mirror on the other

side as shown in figure. Spread a dark coloured sheet of paper between the mirror and the comb. Send a beam of light from a torch through the comb. You get a pattern of light similar to that shown in figure. This activity explains the manner in which light travels and gets reflected from a mirror.



3. Answer: We take three pieces of cardboard. Place them one on the top of one another and make a hole in the middle of each cardboard by using a thick nail. Erect these cards up on the table at a short distance away from each other. Take a candle which is of the same height as the holes in the cards. Light the candle and place it in front of the cards. We see that the light of candle is visible only when the holes on cards lie in a straight line. If we disturb them the light of candle disappears. This experiment shows that light propagates in a straight line.

