

# 9

## Light

We'll cover the following key points:

- Sources of Light
- Properties of Light
- Transparent, Translucent and Opaque Objects
- Formation of Shadow



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### Learning Outcomes

**By the end of this chapter, students will be able to:**

- Understand the concept of light and its importance in the natural world.
- Identify and explain different sources of light, both natural and artificial.
- Describe the properties of light, including reflection, refraction, and dispersion.
- Classify objects as transparent, translucent, or opaque based on their ability to transmit light.

### Guidelines for Teachers

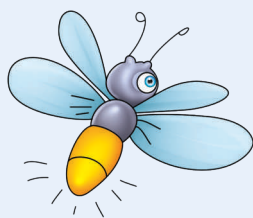
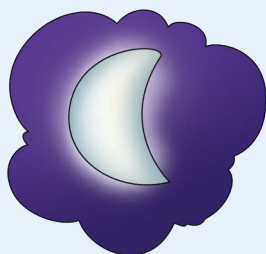
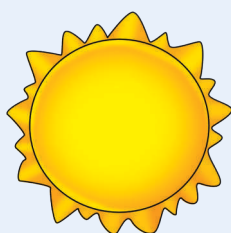
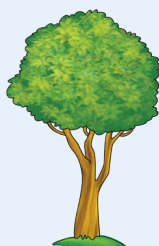
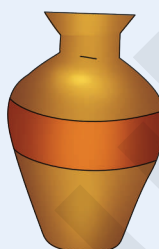
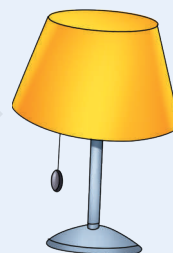
The teacher can begin the chapter by discussing the significance of light in daily life and its role in vision and energy. Use diagrams, models, or demonstrations to explain sources of light, such as the sun, lamps, and fire. Discuss the properties of light, focusing on reflection, refraction, and dispersion, with simple experiments like using a mirror or a prism to demonstrate these properties. Introduce the concept of transparent, translucent, and opaque objects with real-life examples, and encourage students to classify various materials. To explain the formation of shadows, set up experiments using a light source, objects, and a screen to show how different factors, like distance and angle, affect the shadow's appearance.



## Warm Up

Experiential Learning

Write 'L' for luminous objects and 'NL' for non-luminous objects.

☐☐☐☐☐☐☐☐

### Fun Fact



White light, like sunlight, is actually made up of all the colors of the rainbow! When light passes through a prism or raindrop, it splits into red, orange, yellow, green, blue, indigo, and violet. This natural phenomenon creates beautiful rainbows that show us how diverse light really is.

Light is a form of energy and is very important in all aspects of our lives. In the absence of light plants would not be able to grow as they require sunlight to prepare their food and in absence of plants, animals and humans would have nothing to eat.

We see with our eyes but we cannot see anything when there is no light. It would be complete darkness and no object would be visible to us.

### Sources of Light

Light travels from a light source. It travels in all directions from its source.



Take a Task



Watch Remedial

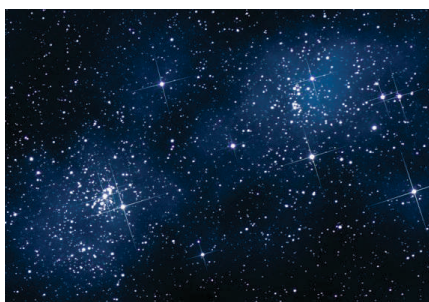


## Natural Light

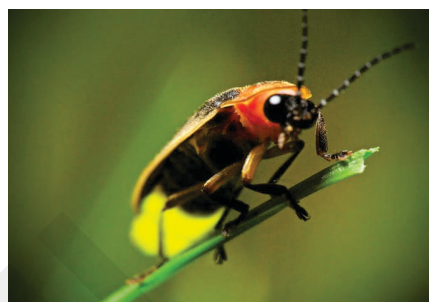
The Sun is the main source of natural light. Other forms of natural light are the stars and the moon. Stars provide very less amount of light at night because they are very far from the earth compared to the Sun. The moon, especially the full moon provides little light at night but it is just the light reflected from the Sun. Some animals also emit their own lights such as glow-worms, fireflies and some fish.



Sun



Stars



Firefly

## Artificial Light

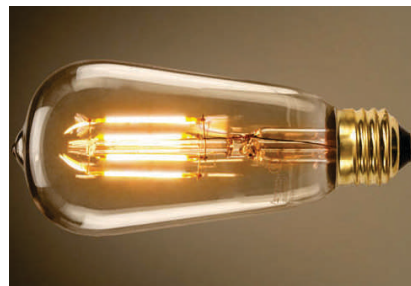
Sources of artificial light are burning wood, candles, earthen lamps. Now-a-days we use electric bulb, tube and lamp as sources of light. Artificial sources of light are made by humans.



Lamp



Candle



Bulb

**Luminous** bodies are those which emit light of their own such as the Sun, the stars and the bulb. **Non luminous** bodies are those which do not have their own light such as the moon, book etc. Non luminous objects are visible to us when light from luminous object falls on them.

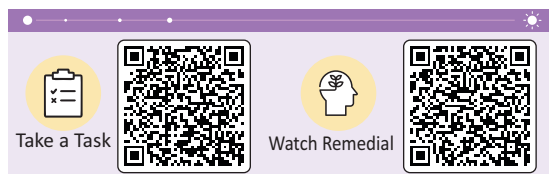
Luminous objects	Non-luminous objects
1. Objects that give out or emit light of their own are called luminous objects.	1. Objects that do not give out or emit light of their own are called non-luminous objects.
2. <b>Examples</b> : The Sun, stars, a candle, an oil lamp, a torch, an electric bulb etc.	2. <b>Examples</b> : Table, Chair, Eraser, Pen, Pencil etc.

## Properties of Light

### Light travels in a straight line

Light travels in a straight line in the form of rays. It travels very fast at the speed of 3,00,000 km in a second! Light does not bend, it can only be blocked. Light continues to travel in a straight line until it hits something else.

It is evident from shadow formation that light travels in a straight line.



#### Activity

Creative Learning

Place an object (say a ball) in the path of light.

#### What do you observe?

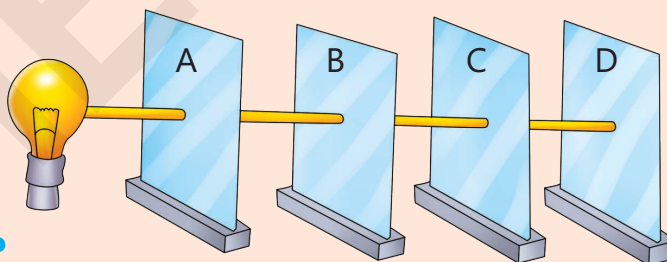
We see a dark area on the other side because your ball has blocked the light from reaching the other side. The dark area formed is the shadow.



#### Activity

Creative Learning

Take 4 square cards of the same size with a hole punched in the centre of the cards. Place all 4 cards vertically on a table with the help of modelling clay at an equal distance from each other such that holes of all 4 cards are in alignment. Now turn off the light in the room and place flashlight at one end of the row of square cards placed on the table.



#### What do you observe?

We observe that the holes are in alignment and the light travels and falls on the wall as a large circular patch.

Now, gently move card B such that its hole gets shifted. Now, all three holes are not in a straight line. So, no circular patch appears on the wall this time.

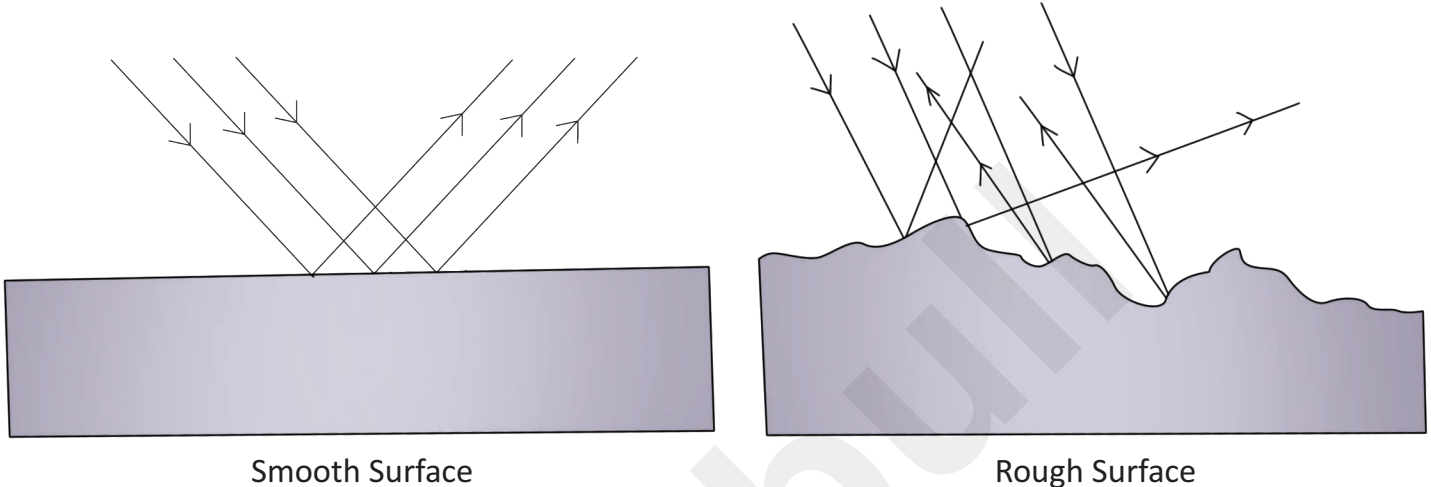
**Conclusion:** Light travels in a straight line.

## Light reflects when it hits a surface

When light rays hit on any surface, it bounces back (it reflect back). We are able to see objects because light rays enter our eyes after bouncing off rough surface. This is called **reflection of light**. A rough surface reflects or bounces off light in all directions whereas smooth and polished surface bounces off light in one direction. Therefore, mirrors are good reflectors.

### Did you know ?

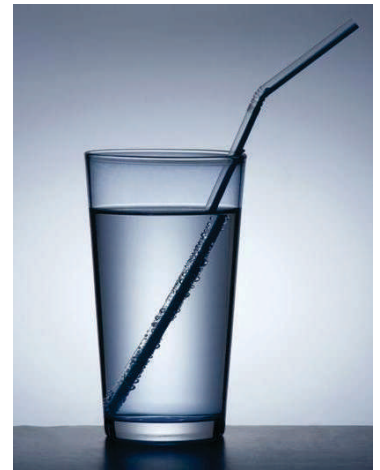
The sunlight that we see here on earth actually left the Sun 8 minutes before.



## Refraction of Light

Light rays usually travel in straight lines, but when they pass from one material to another they can be forced to bend (change direction and continue on a new straight path). The bending is called **refraction**.

An example of how refraction works is placing a straw in a glass of water, with part of the straw in the water. When looking at a certain angle, the straw appears to bend at the water's surface. This is because of the bending of light rays as they move between the air and the water.



### Check 'N' Mate

### Critical Thinking

#### Fill in the blanks.

1. \_\_\_\_\_ occurs when light bounces off objects.
2. \_\_\_\_\_ occurs when light is bent.
3. When light strikes a surface that is rough, the light will bounce off in \_\_\_\_\_.
4. When light strikes a surface that is smooth, the light will bounce off at equal \_\_\_\_\_.



## Transparent, Translucent and Opaque Objects

Material that allows light to pass through them in straight lines are called **transparent objects**. An object on the other side of transparent material is clearly visible. Example: glass, crystal, clear plastic etc.

Material that allows some light to pass through them are called **translucent objects**. Object on other side of translucent material is not clearly visible. Example: Tissue paper, frosted glass, coloured glass, butter paper, coloured plastic etc.

Materials that do not allow any light to pass through them are called **opaque objects**. **Examples:** wood, metal, stone, our body etc.

We want sunlight to enter our rooms and that is why windows are made of glass. It allows us to see outside our rooms. We also wear goggles in the swimming pool to dive under water and see everything much more clearly.

A common example of translucent material is our bathroom window. It allows some light through, but not all as we want light to enter our bathrooms but at the same time do not want anyone to see inside.

Doors are generally made of wood which is opaque and does not allow any light to pass through.

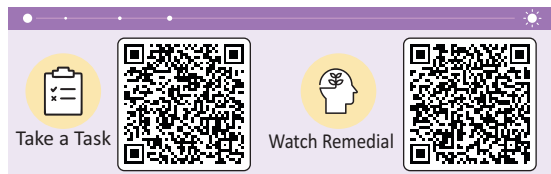
Some substances are more translucent when the temperature changes. Candle wax becomes almost see through when it is melted. Butter also becomes clear when it is heated in a pan, but it is opaque when cold.

## Formation of Shadow

A shadow is formed when light is not able to pass through an opaque object. When an opaque object come in the path of the light, the light falling on that object cannot reach the other side, therefore, that particular region becomes dark. The rest of the area is lit as there is nothing to stop the light from passing through. A shadow is always formed on the opposite side of the light.

To form a shadow:

- ✦ There should be a source of light.
- ✦ The object must be opaque or translucent. Opaque objects make dark shadows and



### Did you know ?

Space is dark because light is only visible when it has an object of which to bounce off.

### Did you know ?

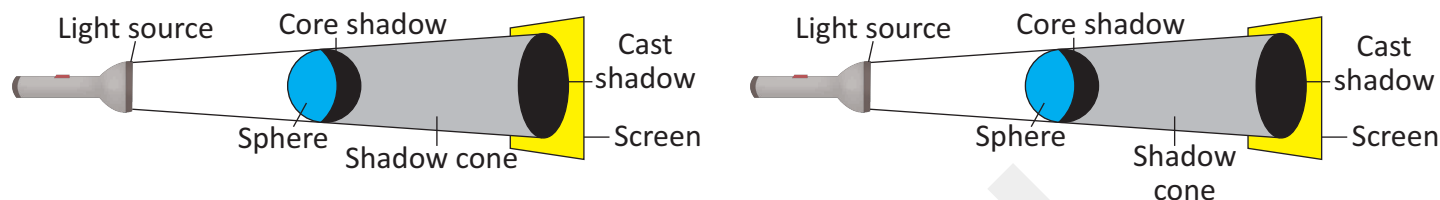
Rainbows are made when light enters water droplets in the air, gets refracted inside the droplet and is refracted again while leaving it.



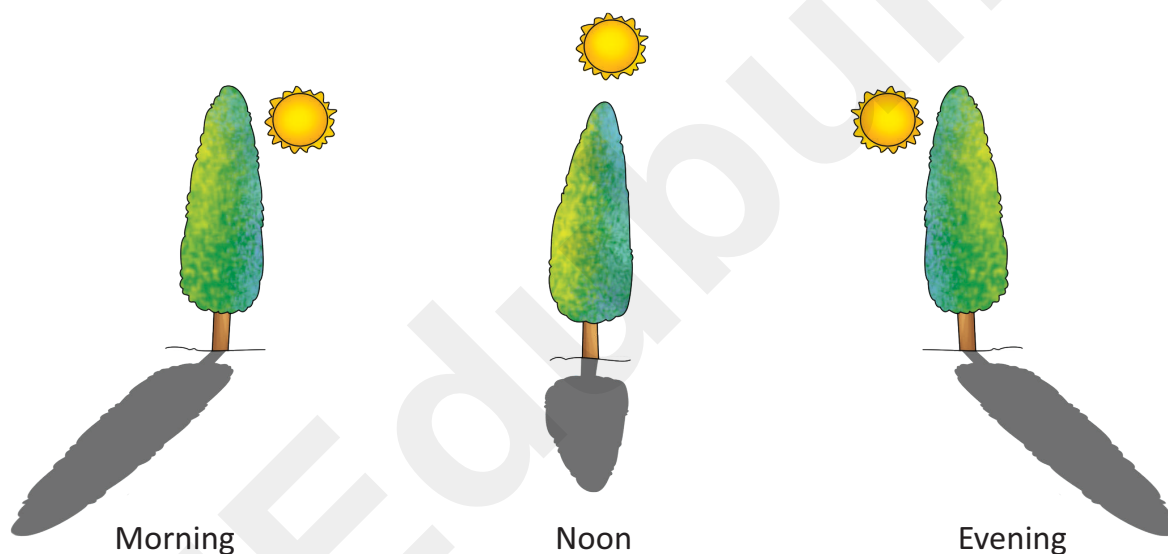
translucent objects make faint shadows. A transparent object will not make any shadow, as all light will pass through it.

★ And a screen.

If we bring an object closer to the light source, the shadow becomes bigger as it blocks more of the light rays and if we take an object away from light source, the shadow becomes smaller as it blocks less amount of light.



The Sun casts long shadows in the morning and evening as the Sun is lowest in the sky. The Sun casts the shortest shadows at midday, when the Sun is highest in the sky.



The sun appears low in the early morning and late afternoon. This makes the shadow longer in the early morning and late afternoon than at noon.

### Check 'N' Mate

### Critical Thinking

Write 'T' for true and 'F' for false statements.

1. Transparent objects allow light to pass through them. ☐
2. Crystal frosted glass, coloured glass, butter paper are the examples of translucent objects. ☐
3. Doors are the opaque objects. ☐
4. The Sun cast short shadows in the morning and evening. ☐
5. Some substances are more translucent when the temperature changes. ☐



## In a Nutshell

- ✦ Light is a form of energy and it travels in a straight line.
- ✦ The Sun is a natural source of light. An electric bulb is an artificial source of light.
- ✦ Luminous objects produce their own light whereas non-luminous objects do not produce their own light.
- ✦ When light rays hit on any surface, it bounces back (it reflect back).
- ✦ When light travels from one medium to another, it bends. This bending of light is called refraction.
- ✦ Materials that allow light to pass through are called transparent materials, that allow some light to pass through are called translucent and that does not allow any light to pass through them are called opaque materials.
- ✦ Shadows are formed when the path of the light is blocked by an opaque object.
- ✦ Only opaque and translucent objects can cast a shadow whereas transparent objects cannot as they allow light to pass through them completely. Translucent objects make faint shadows.



## Key Words

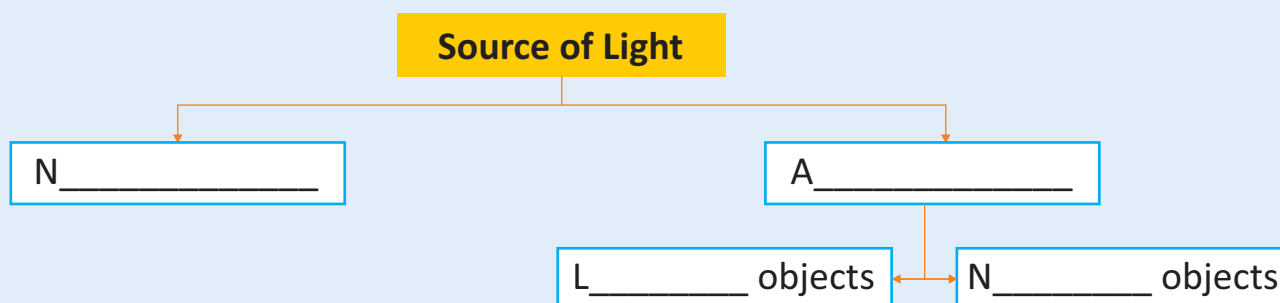
Luminous	:	Giving off light
Opaque	:	Not able to be seen through
Artificial	:	Made or produced by human beings
Translucent	:	Semi-transparent

## Improving Vocabulary

## Time to Recall

## Remembering and Analysing

Recall and complete the concept map given below.







Gap Analyzer™



# EXERCISE

That turn curiosity into confidence—let's begin!



## A. Objective Type Questions.

1. What do we call material that allows light to pass through, making objects clearly visible when viewed through this material?
  - a. Transparent
  - b. Opaque
  - c. Translucent
2. Light always travels in a \_\_\_\_\_ line.
  - a. curvy
  - b. oval
  - c. straight
3. Reflection happens when light strikes and then \_\_\_\_\_ a surface.
  - a. breaks
  - b. bounces off
  - c. reflects
4. What is the bending of light through transparent materials called:
  - a. Refraction
  - b. Reflection
  - c. Transparent
5. People cast shadow on ground as they walk because they block:
  - a. View
  - b. Way
  - c. Light
6. Shadow is short when Sun is overhead at:
  - a. Noon
  - b. Sunset
  - c. Morning
7. Frosted (privacy) shower glass is:
  - a. Opaque
  - b. Translucent
  - c. Transparent

## B. Name the following :

1. Light is form of \_\_\_\_\_ .
2. We cannot see anything when there is no \_\_\_\_\_ .
3. Sun is the main source of \_\_\_\_\_ on Earth.
4. Sources of artificial light are burning wood, \_\_\_\_\_, and earthen lamps.
5. Light travels in a \_\_\_\_\_ line in the form of rays.
6. A \_\_\_\_\_ surface reflects or bounces off light in all directions.

## C. True or False :

1. A rough surface reflects or bounces off light in all directions. \_\_\_\_\_
2. A transparent object will make dark shadow. \_\_\_\_\_
3. Light travels very slowly. \_\_\_\_\_
4. Luminous bodies are those which emit light of their own. \_\_\_\_\_

#### D. Short Answer Questions.

1. What is light? What are the different sources of light?
2. Differentiate between luminous and non-luminous objects.
3. What do you understand by reflection of light?
4. What is the size of the shadow when the source of light and the object are closer to each other?
5. What is the size of the shadow when the source of light and the object is moved away from each other?

#### E. Long Answer Questions.

1. Explain reflection of light with the help of an activity.
2. Explain with an example that light travels in a straight line.
3. What is refraction? Explain with an example.
4. Differentiate among transparent, translucent and opaque objects.
5. What is a shadow? Why are they formed?
6. List the three conditions necessary for formation of shadow.



#### Time to Apply

#### Applying and Creating

1. On a bright sunny day, Monika is standing on a bridge, looking into a creek. The water is so still and clear that he can easily see fish swimming. Is the water in the creek transparent, translucent or opaque?
2. Sarika uses markers to make a picture on wax paper. She hangs her picture in the window so light can shine through. Is the wax paper transparent, translucent, or opaque?
3. Aryan replaces a light bulb on his lamp. He places a cloth lamp shade on top of the lamp. Is the lamp shade transparent, translucent or opaque?
4. Nishant took a shower. His glass shower door was covered in steam. Was the glass door transparent, translucent or opaque?



#### Time to Discuss

#### Pondering and Communicating

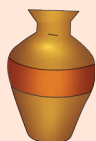
1. Why is moon considered as a non-luminous body?
2. Why the kitchen containers are made of glass?
3. Can you convert a transparent glass sheet into a translucent glass sheet? How?



## Time to Observe

Observing, Critical Thinking, Analysing

Match the pictures with their shadows. Draw a line to pair them up:



## Time to Create

Creating and Collaborating

### Spinning White Light

**Materials:** 7 crayons: red, orange, yellow, green, blue, indigo (blue plus purple), and violet (purple); scissors; 24" of strong, thin string; sharpened pencil

Steps:

1. Colour each section of the wheel using the colours shown.
2. Cut out the wheel. Using a pencil, carefully poke two small holes in the centre of the wheel as shown (Figure 1).
3. Thread the string through the holes and tie the ends together. Centre the circle on the string (Figure 2).
4. Follow your teacher's directions to make the spinner spin properly (Figure 3).

Figure 1

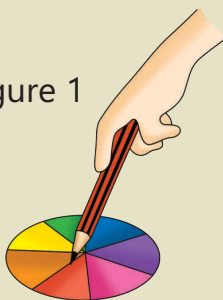


Figure 2

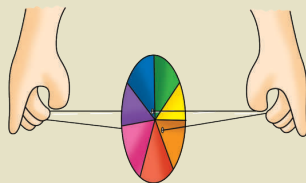


Figure 3

