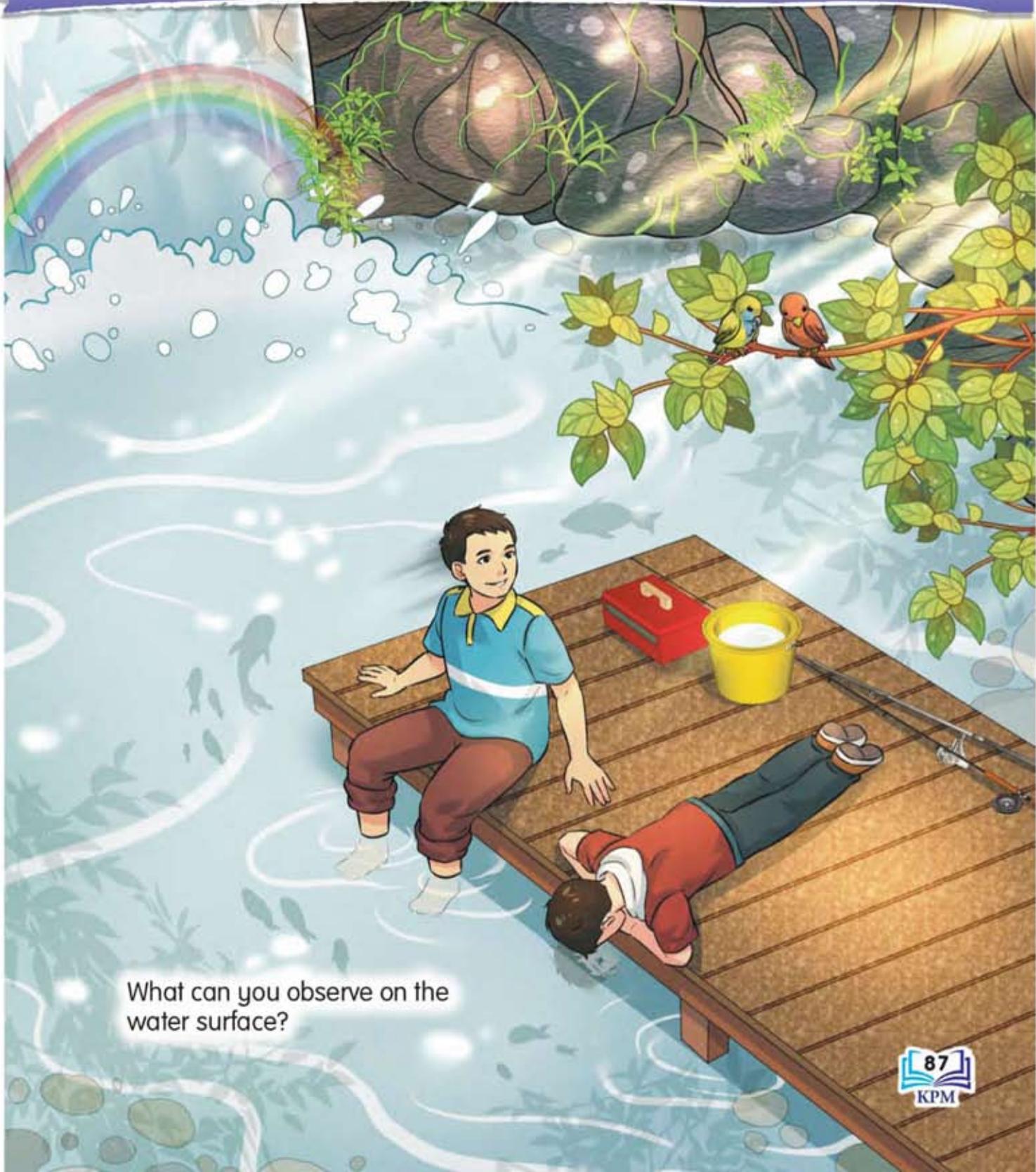


# UNIT 5

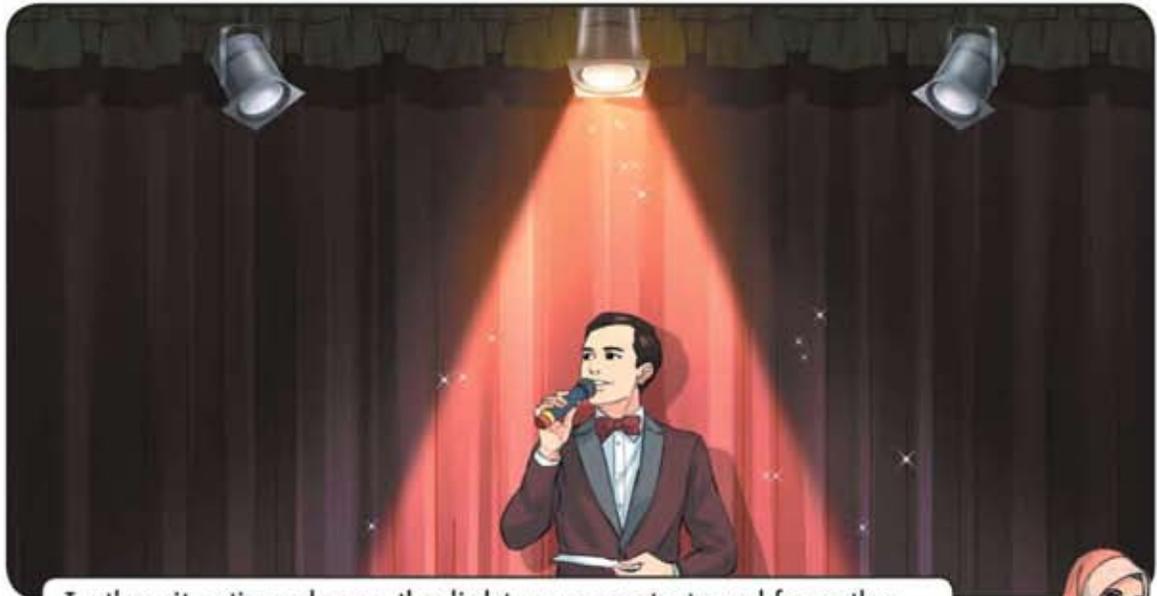
# PROPERTIES OF LIGHT



What can you observe on the water surface?

## Light Travels

Do you know that light travels? Observe the situation below.



In the situation above, the light appears to travel from the source of light. It moves in a straight line. There are many situations that show that light travels in a straight line around us. Take a look at the examples below.



Light from a car headlights.



Sunlight rays shine between the tree trunks in a forest.



Light from a helicopter.

All the examples above show that light travels in a straight line. Let us carry out an investigation to prove this.



## LET'S TEST

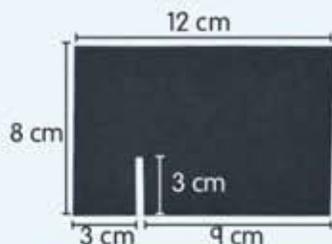
## Light Travels in a Straight Line

GROUP  
ACTIVITY

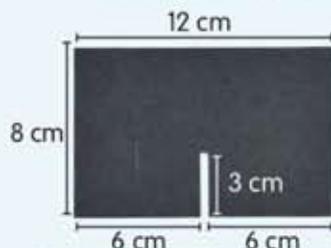
**Aim** To show that light travels in a straight line.

### Apparatus and Materials

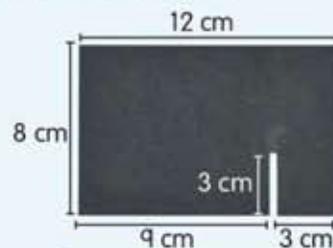
A torch, 3 cardboards with a slit, black cardboard (screen), wooden block



(i) Cardboard with slit



(ii) Cardboard with slit

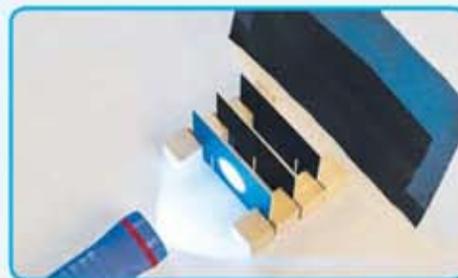


(iii) Cardboard with slit

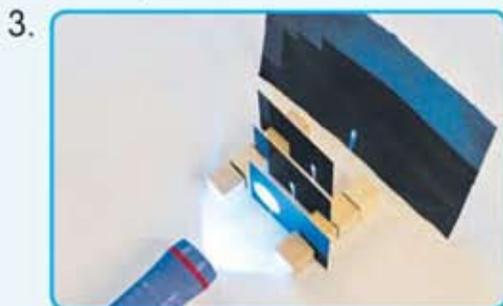
### Steps



1. Arrange the cardboards with slits and the screen as shown in the picture.



2. Switch on the torch and observe the screen.



Adjust the arrangement of the cardboards with slits until a light is formed on the screen.

### Questions

1. How does the arrangement of the slits on the cardboards enable the formation of light on the screen?
2. Based on the arrangement of the slits in this activity, what can you say about how light travels?

## Shadow Clarity of Objects

Shadows are formed when a moving light is obstructed by an object. The clarity of the shadows formed may vary according to the type of object that obstructs it. The types of objects can be **transparent**, **translucent** or **opaque**. Let us investigate.



### LET'S TEST

### Compare and Contrast the Shadow

GROUP  
ACTIVITY

**Aim** To investigate the clarity of shadow.

**Apparatus and Materials** Torch, clear plastic, coloured plastic, manila card, adhesive tape, scissors, popsicle sticks, white paper

#### Steps



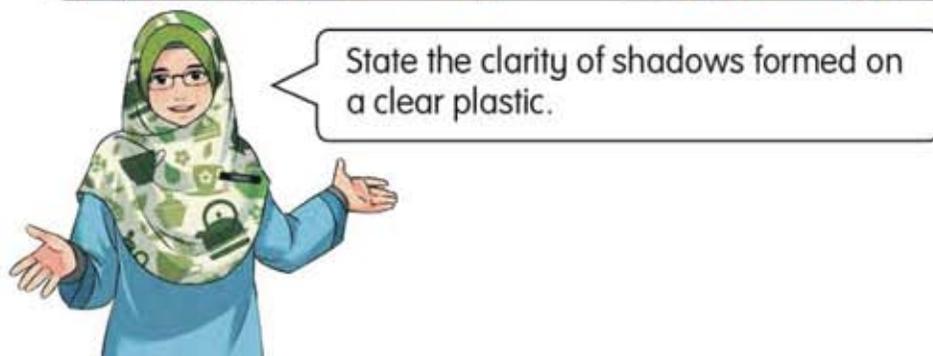
1. Draw a butterfly shape on the clear plastic, coloured plastic, and manila card. Then, tape a popsicle stick to each piece.
2. Direct the torch towards a butterfly-shaped manila card. Observe the shadow formed.
3. Repeat step 2 using coloured plastic and clear plastic of the butterfly shape.
4. Observe and record the clarity of the shadows formed in a table as shown below.

Object	Clarity of shadow (clear / less clear / none)
manila card	

#### Question

Which object formed a clear shadow? Give your inference.

Based on the activity that you have carried out, let us read the following conversations.



## Factors Affecting the Size of Shadows



### Experiment on the Size of a Shadow

**Aim:** To determine the factor which affects the size of a shadow.

**Problem statement:** What is the factor that affects the size of a shadow?

**Hypothesis:** The further the distance of an object from the light source, the smaller the size of the shadow.

**Determining the variables:**

- (i) Manipulated variable: Distance of light source from the object.
- (ii) Responding variable: Size of shadow.
- (iii) Constant variable: Distance of object from the screen.

**Apparatus and materials:** Torch, ruler, cylindrical object, adhesive tape, flip chart paper

**Steps:**

1. Stick a flip chart paper on the wall.
2. Place the cylindrical object on the table.
3. Direct the torch to the cylindrical object.
4. Sketch the shape of the shadow produced on the flip chart paper.
5. Repeat steps 3 and 4 by changing the distance between the torch and the object.
6. Record the results of the experiment in the table as shown below.

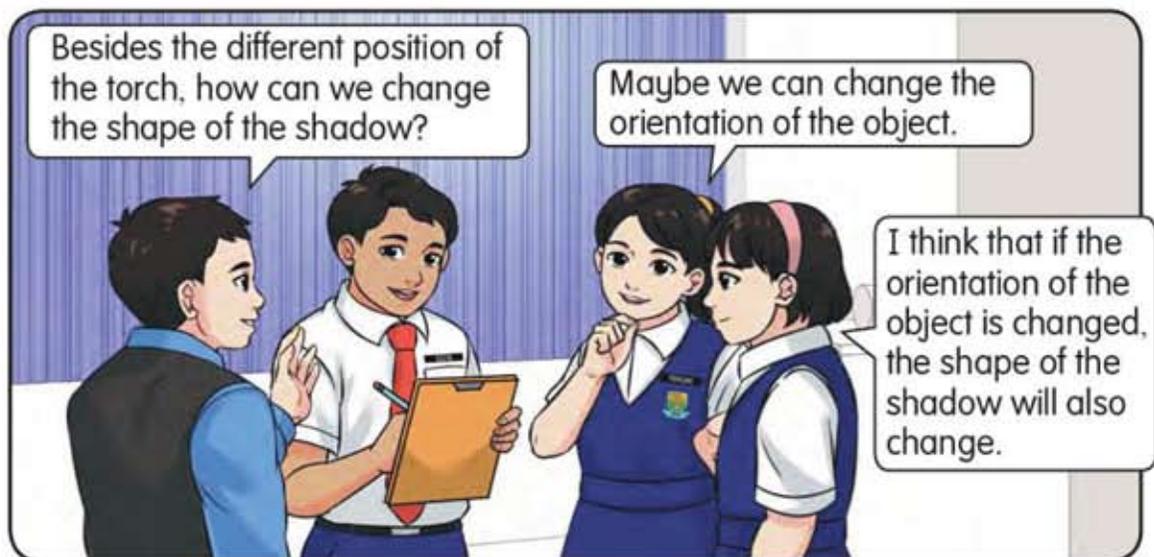
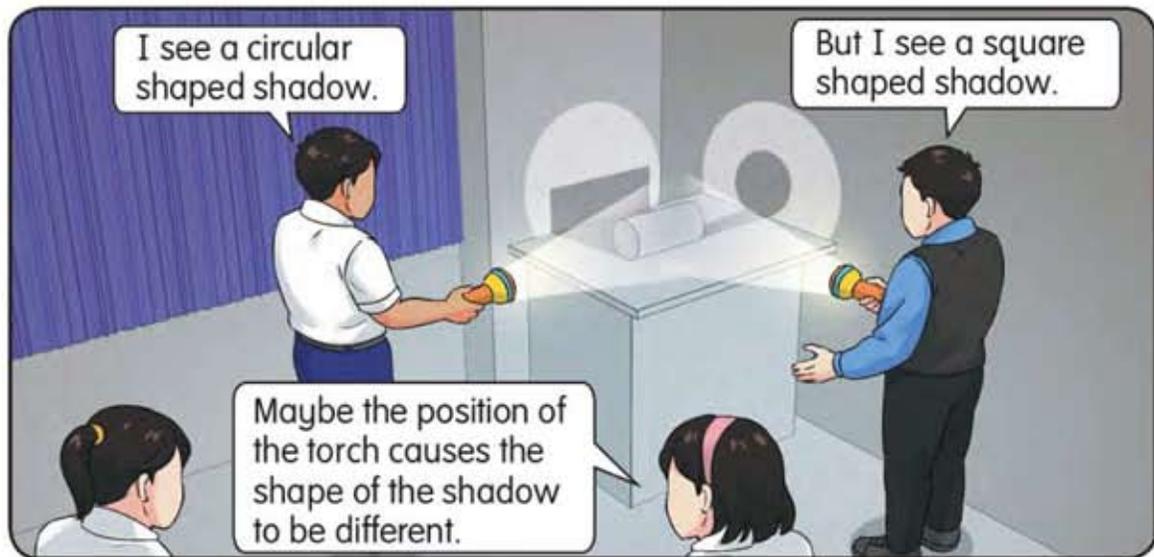
Distance of object from torch (cm)	Size of shadow
5	
10	

**Conclusion:** The \_\_\_\_\_ the distance between the light source and the object, the \_\_\_\_\_ the size of the shadow. Hypothesis is accepted/not accepted.

The size of the shadow becomes larger if the distance between the light source and the object is shorter. What if the distance between the object and the screen changes? Plan and carry out an experiment.

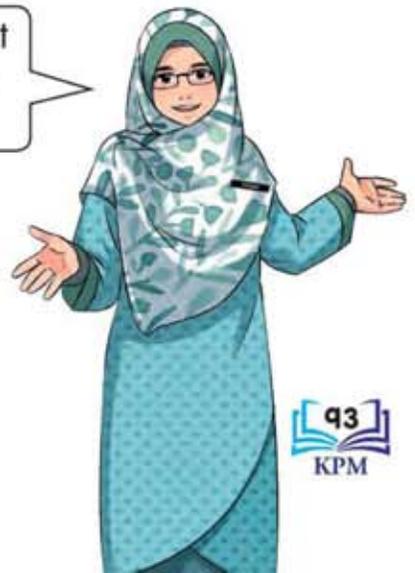


## Factors Affecting the Shape of Shadows



The orientation of the object and the position of the light source affect the shape of the shadow. Plan and carry out an experiment to test this hypothesis.

Based on the experiments that you have carried out, what is your conclusion about the factors affecting the size and shape of a shadow?



## Reflection of Light

When we look in the mirror, we can see our image. This is due to the **reflection of light**. Look at the picture below.

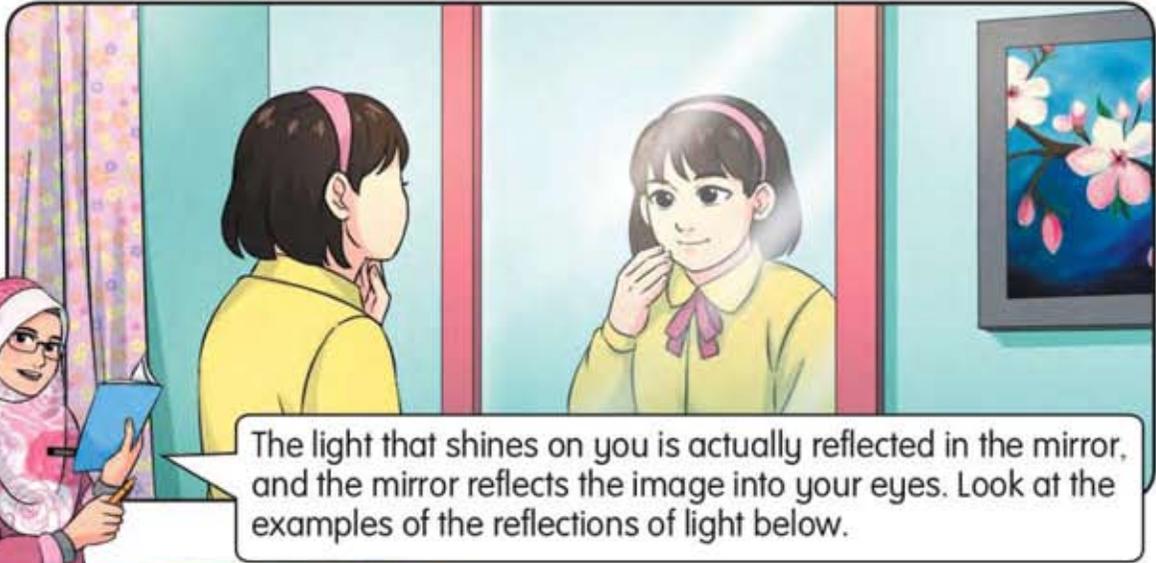


Image formed on the water surface.



Image formed on the floor tiles.



Image formed on a metal surface.



Why is there a shiny part in the torch?





## LET'S TEST

## Reflection of Light

GROUP  
ACTIVITY

**Aim** To investigate the reflection of light

**Apparatus and Materials** 2 face mirrors, 1 metal spoon, 1 tin lid, watch, string

### Steps

1.



Hang a face mirror outside the classroom with a string.

2.



Hold the metal spoon towards the sunlight. Adjust it so that light is formed on the face mirror. Observe what happens.

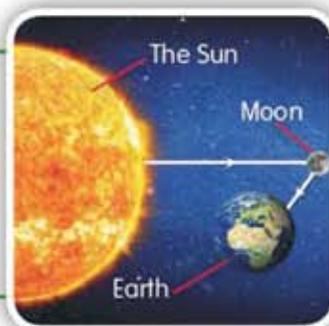
3. Repeat step 2 by replacing the metal spoon with the watch, tin lid, and face mirror.

### Questions

1. Based on the observations during this activity, what is the property of light being tested?
2. If a piece of paper is used to replace the metal spoon, what will you observe? Give your reason.

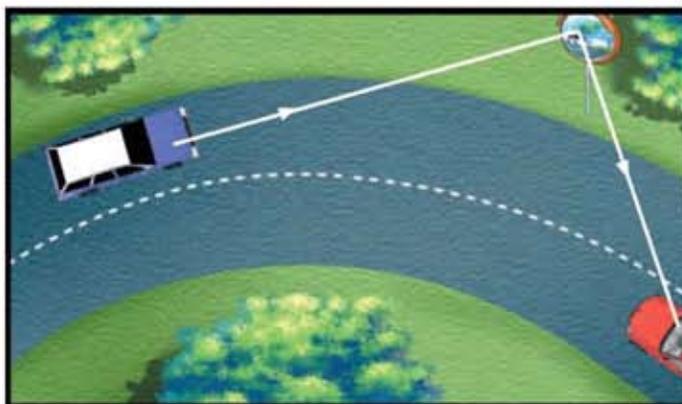
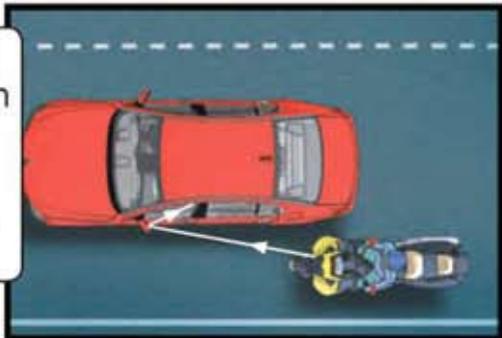
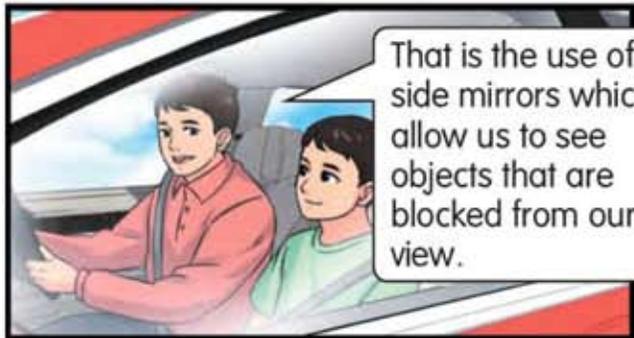
### SCIENCE-INFO

The moon is not a source of light. The moon looks bright at night because it reflects the sunlight towards Earth.



## Applications of Reflection of Light

Let us read the story below.



That is a convex mirror. The mirror allows the driver to see another vehicle blocked from the driver's view to avoid an accident.

In our daily lives, many situations involve the reflection of light as shown in the examples below.



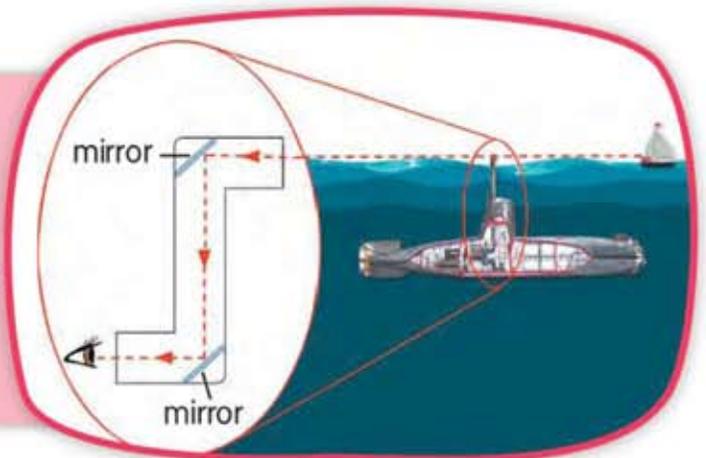
A dental mirror helps the dentist to see the patient's dental condition.

Customers at a shoe store can see the image of the shoes worn using the mirror.



A customer at a salon can see the image of the back of her head through the mirror.

Navy personnel in a submarine can see the object at the surface of the sea using a periscope. Two mirrors in the periscope reflect the obstructed light from an object to the eyes of the observer.



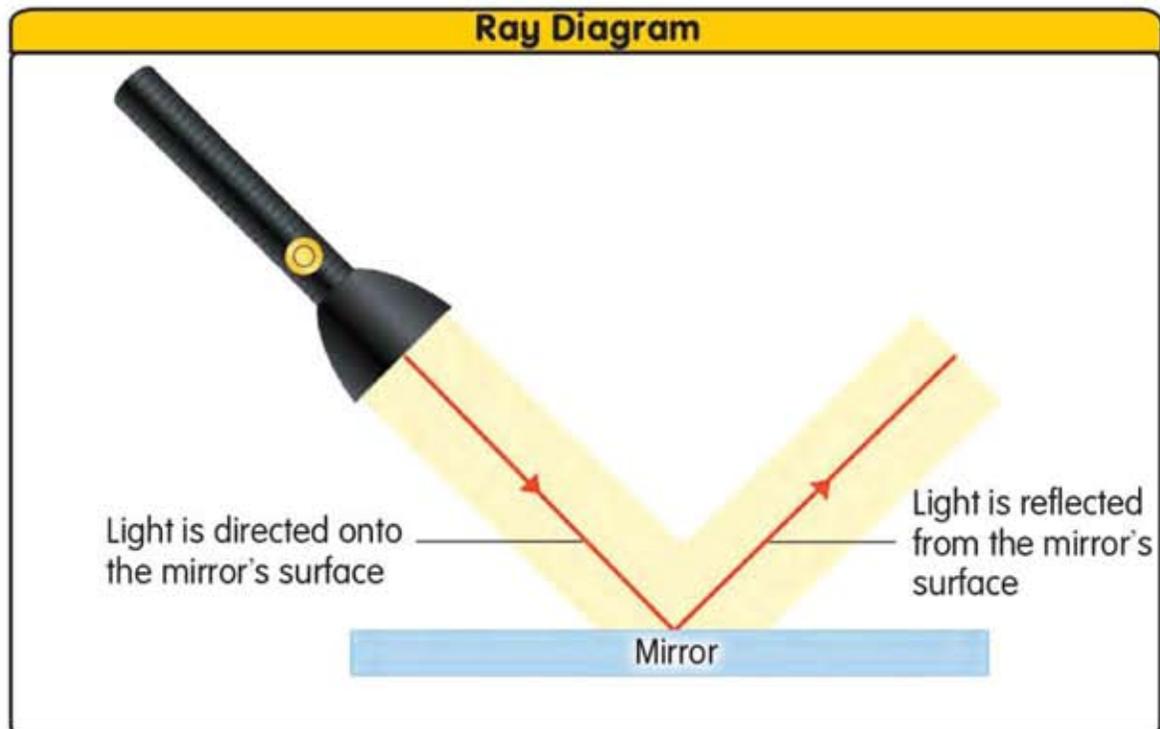
Give an example of a situation in your daily life where light is reflected. Explain its use.

## Ray Diagram

Observe the picture below.



When the light is directed onto a flat, smooth surface like a mirror, the light is reflected. This situation can be drawn in the form of a ray diagram as shown below.





## FUN ACTIVITY

## Drawing a Ray Diagram

GROUP  
ACTIVITY

### Apparatus and Materials

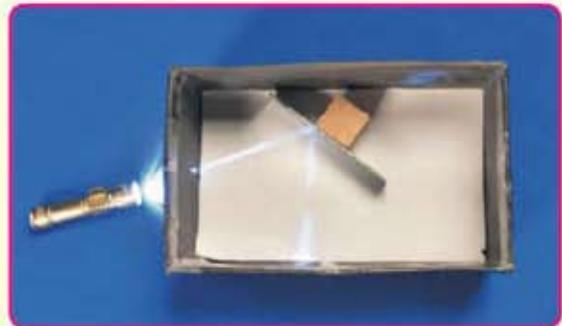
Mirror, black box with a slit, white paper, torch, wooden block, ruler



### Steps



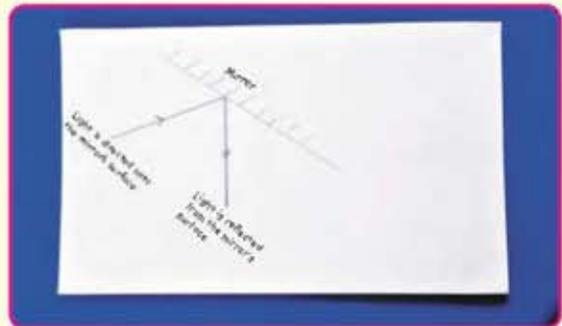
1. Place the white paper on the bottom of the box and arrange the mirror as shown in the picture.



2. Direct the torchlight through the slit on the box towards the mirror.



3. Observe the light reflected from the mirror. Then, draw the light ray on the white paper using a ruler.



4. Remove the white paper and label your drawing.

### Question

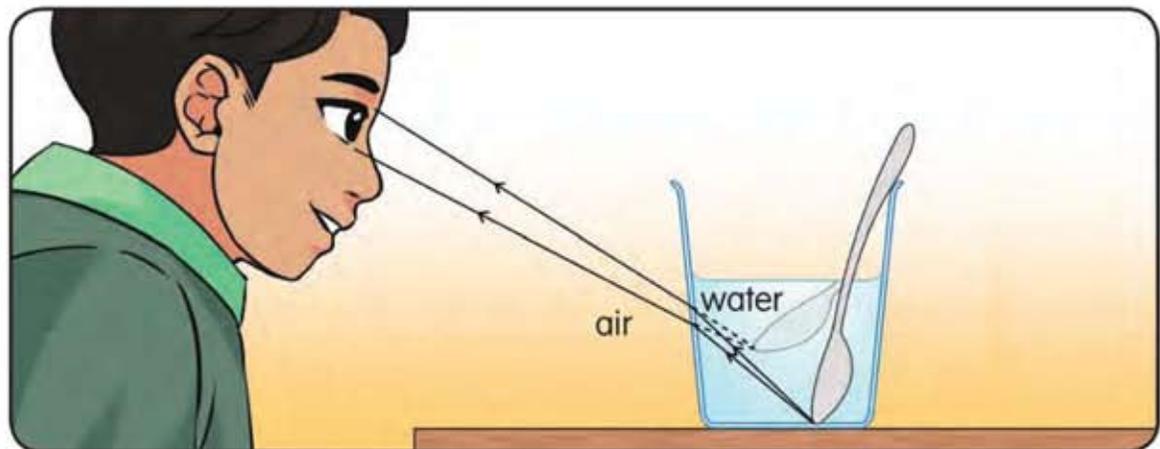
Why is a ruler used to draw a ray diagram?

## Refraction of Light

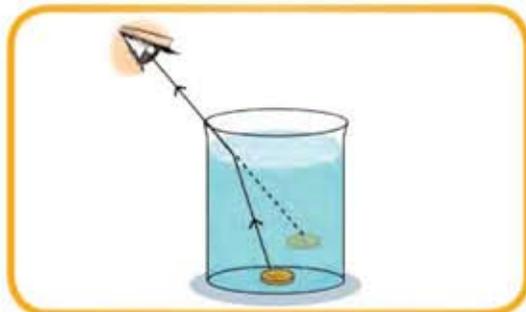
One afternoon, Siva was at Pak Abu's stall. Suddenly... .



The light from the spoon in the water is refracted when the light travels from water to air. This causes the spoon to appear bent.



When light travels through two different mediums, the direction of light will change. This is called **refraction of light**.



What is the property of light that causes the spoon to appear bent?





## LET'S TEST

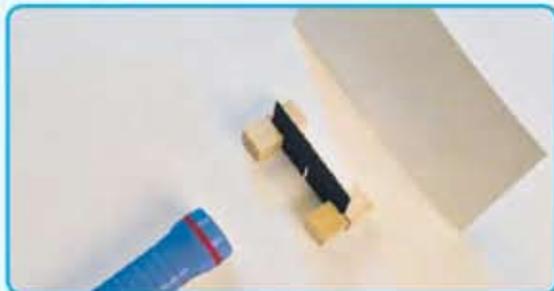
## Refraction of Light



**Aim** To investigate the refraction of light.

**Apparatus and Materials** Torch, bottle filled with water, marker pen, ruler, white paper, cardboard with a slit, wooden block

### Steps



1. Arrange the apparatus and materials as shown in the picture.



2. Switch on the torch.



3. Observe and draw the direction of the light ray on the white paper formed by the slit.



4. Place the bottle filled with water as shown in the picture.

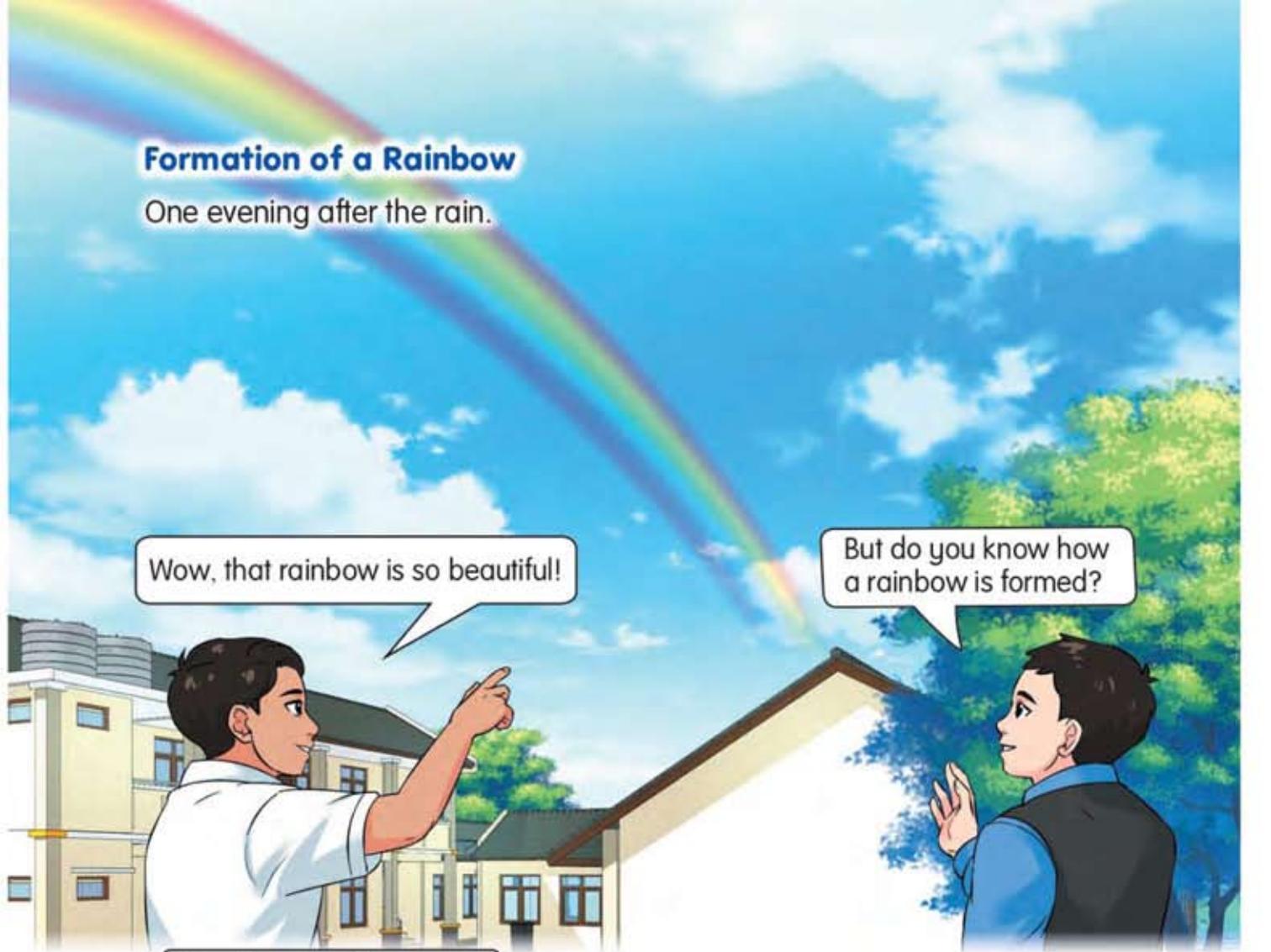
5. Observe the direction of the light ray on the white paper after passing through the bottle filled with water.

### Questions

1. What happens to the direction of the light ray after passing through the bottle filled with water?
2. What is the property of light tested in this activity?
3. Give an example of a situation in your daily life that can be related to the property of light above.

## Formation of a Rainbow

One evening after the rain.



Wow, that rainbow is so beautiful!

But do you know how a rainbow is formed?



Usually when the Sun shines during or after the rain, a rainbow is formed.



Oh, I see.



Do you know that when the Sun shines on the rain droplets, the light will be refracted? This will form a rainbow. Carry out an investigation.



**Aim** To investigate the formation of a rainbow.

**Apparatus and Materials** Mirror, flip chart paper, adhesive tape, basin, water

### Steps



1. Tape a flip chart paper onto a wall outside the classroom.



2. Place a basin filled with water under the sunlight.



3. Put a mirror into the basin of water as shown in the picture.



4. Adjust the bottom part of the mirror which is under the water surface towards the Sun until a rainbow is formed on the flip chart paper.

### Questions

1. What is the function of the mirror and the water?
2. How is the light from the Sun able to form a rainbow?

## Importance of Properties of Light in Daily Life

If light does not travel in a straight line, cannot be reflected and refracted, what will happen? Take a look at the situations below.



**Situation 1**

If light does not travel in a straight line, is the light from the torch able to directly shine on the object you are looking for?

If light cannot be reflected, can we see our face in the mirror?



**Situation 2**



**Situation 3**

If light cannot be refracted, can the hand lens magnify the image of the object?

Why are the properties of light important in our daily life?





## FUN ACTIVITY

## Application of the Properties of Light

### Apparatus and Materials

Face mirror, binoculars, periscope, hand lens, flip chart paper, marker pen

GROUP  
ACTIVITY

### Steps



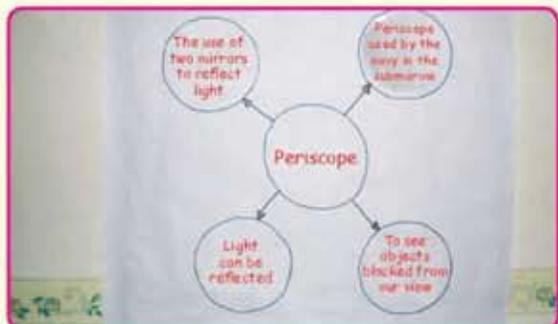
1. Form four groups. The leader of each group selects any device, such as a periscope, a pair of binocular, a hand lens or a mirror.



2. Each group discusses how the properties of light are applied by the device based on its use.



3. Present the discussion in the form of a mind map based on the creativity of the group members.



4. Display the group work in class. Pupils can view the work of other groups.

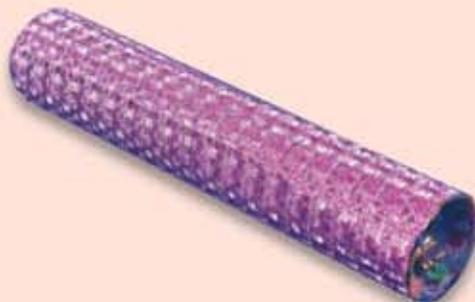
### Question

Give an example of another device that applies the properties of light to solve problems in daily life. Explain.



Steps

Make a kaleidoscope according to your creativity using cylindrical object, aluminium foil, beads, manila cards, black paper, glue, adhesive tape, scissors, and clear plastic.





## MIND REFLECTION

1. Properties of light are; a) light travels in a straight line, b) can be reflected, c) can be refracted.
2. A transparent object is an object which allows all light to pass through it. Hence, no shadow is formed.
3. A translucent object is an object which allows some light to pass through it. Hence, the shadow formed is less clear.
4. An opaque object is an object which does not allow any light to pass through it. Hence, a clear shadow is formed.
5. Factors affecting the size of a shadow are:
  - Distance between the object and the light source
  - Distance between the object and the screen
6. Factors affecting the shape of a shadow are:
  - Orientation of the object
  - Position of the light source
7. Applications of reflection in daily life are as follows:



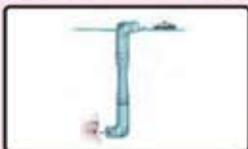
The face mirror reflects light from our face to our eyes.



Dental mirror reflects light from the teeth and enables the dentist to examine the condition of the teeth easily.

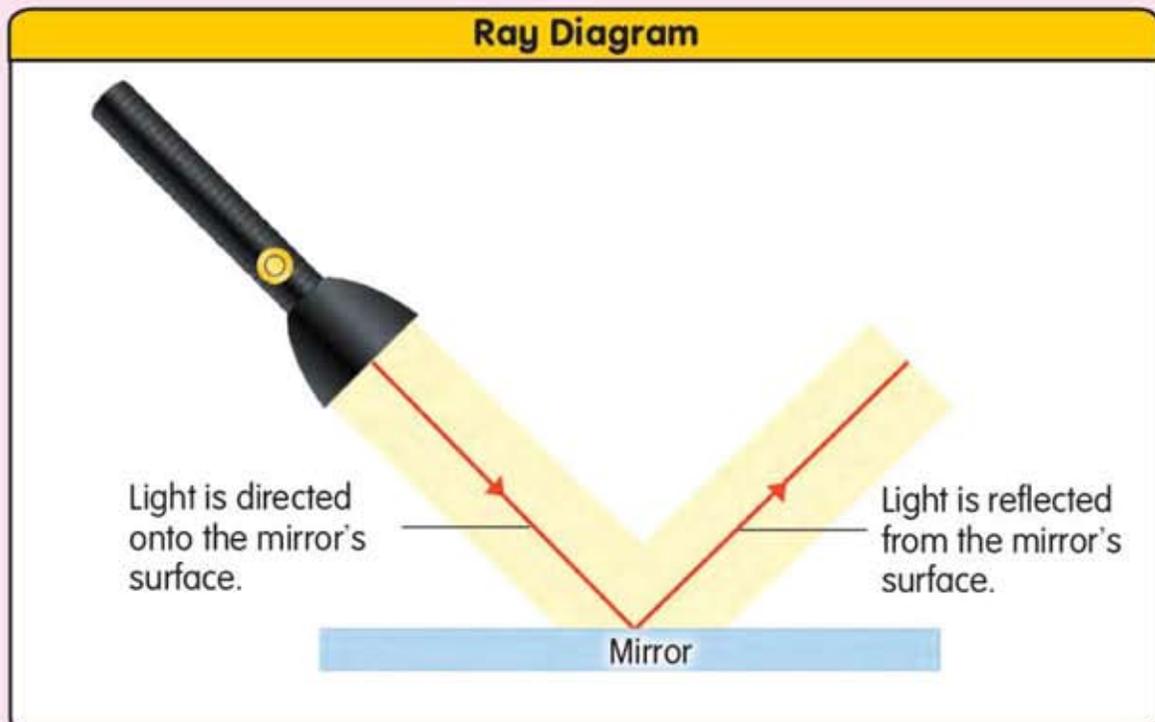


Convex mirror reflects light from blocked object to our eyes.

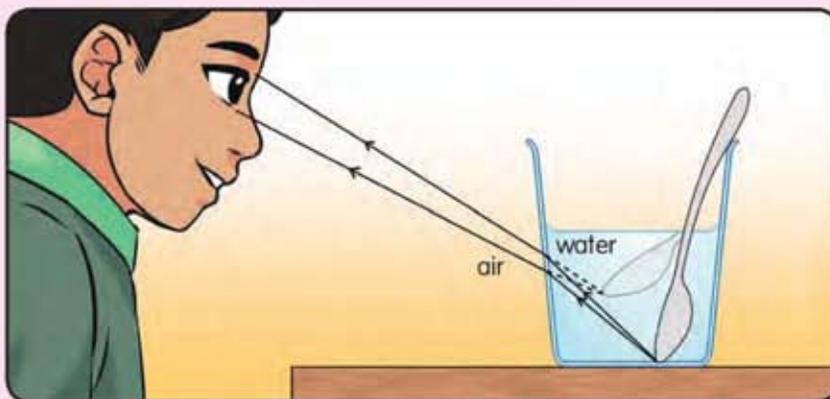


Two mirrors in the periscope reflect obstructed light from an object to our eyes.

8. The reflection of light can be drawn in the form of a ray diagram as shown below.



9. When light travels through two different mediums, the direction of light will change. This is called refraction of light.



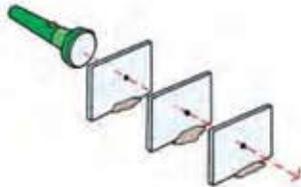
10. When the Sun shines on rain droplets, light is refracted and a rainbow is formed.



## MIND TEST

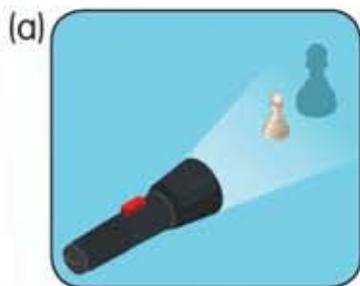
Answer all questions in the Science exercise book.

- The three properties of light are light travels \_\_\_\_\_, can be \_\_\_\_\_, and can be \_\_\_\_\_.
- The diagram below shows an investigation about the property of light.



What is the conclusion about the property of light investigated above?

- Tick (✓) the picture which shows that light travels in a straight line.



- (a) Match.

### Object

Opaque

Transparent

Translucent

### Clarity of shadow

None

Less clear

Clear

- Compare the clarity of shadows formed between a translucent object and an opaque object.

5. What are the factors affecting the shape of shadows?
6. State the factors affecting the size of shadows.
7. In an investigation, a group of Year 4 pupils carried out an experiment to measure the size of a shadow by changing the distance between the light source and the object.

The table below shows the results of the investigation.

<b>Distance between the light source and object (cm)</b>	10	15	20
<b>Size of shadow</b>	Large	Medium	Small

- (a) Based on the investigation above, how can you increase the size of the shadow?
  - (b) What can you conclude from this investigation?
  - (c) State the variables involved:
    - (i) Manipulated variable
    - (ii) Constant variable
    - (iii) Responding variable
8. The diagram below shows one part of a car.



State the property of light applied to the part of the car and describe its function.

9. Complete the picture below in the form of a ray diagram.



How do you make the fish in the aquarium look bigger?

10. How is a rainbow formed?