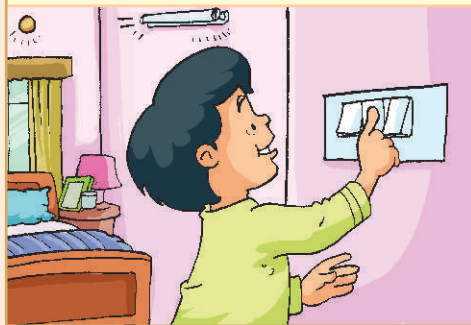


Nitoo was very tired. He wanted to sleep early. So he changed his clothes and switched off the lights.



As he lay in bed, he saw a frightening figure.



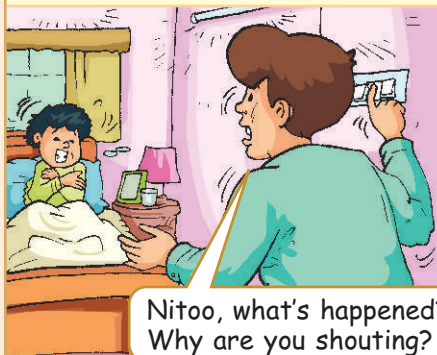
Nitoo was scared.

Ghost!!!



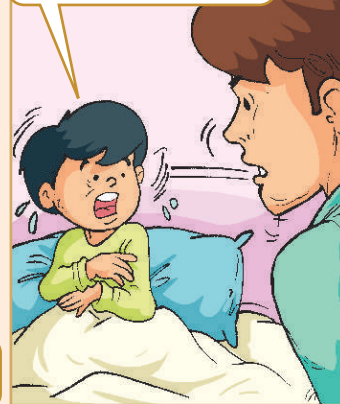
Help me!

His father rushed to his room and switched on the lights.



Nitoo, what's happened? Why are you shouting?

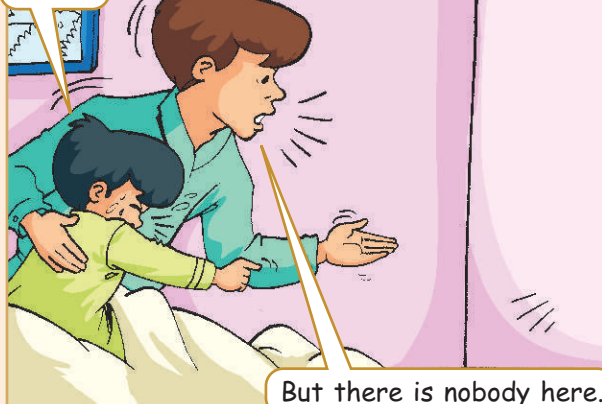
Dad, I saw a ghost.



Ghost! Where?



There.

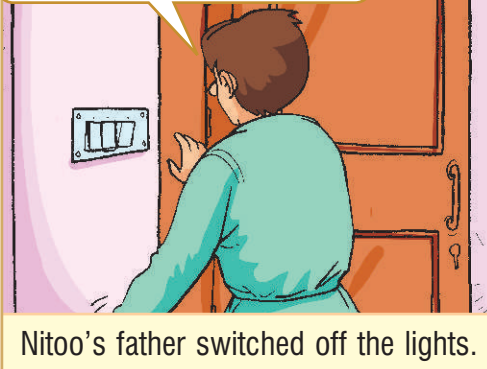


But there is nobody here.

Believe me, Papa. I saw it.



Okay, then I should switch off the lights again.



Nitoo's father switched off the lights.

Eek! There it is.

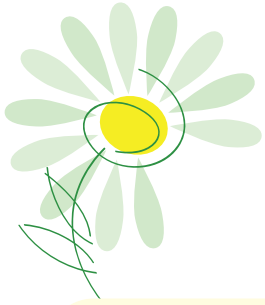


That? Ha!... Ha!... Ha!

Look at it, Nitoo. It's just a showpiece. When you darken the room, its shadow is cast on the wall. And you think it is some kind of ghost!



Oh Daddy, how stupid I am!



The Sun, Shadow and Eclipses

BEFORE WE START, LET'S CHECK

What you already know

Fill in each blank choosing the correct word.

1. The _____ is the source of light on the earth. (*moon / sun*)
2. The sun is much _____ than the earth. (*bigger / smaller*)
3. Without _____, no shadow can be formed. (*sun / light*)
4. In the morning, the shadows are formed in the _____. (*west / east*)
5. Our shadow is _____ at noon. (*shortest / longest*)

What you will know

What is the sun?



What is a shadow?
How is it formed?



What are the characteristics of a shadow?

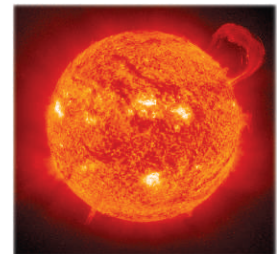


What are solar and lunar eclipses?



THE SUN

The sun is just like the other stars that we see in the sky. It seems like a large round red ball only because we are much closer to the sun than to any other star. The sun is, in fact, our closest star. It is 149.6 million kilometres away from the earth. Some other stars may be much larger and brighter than the sun, but they are so far away that they only look like points of light in the night sky.



At around 13,92,000 kilometres wide, the sun's diameter is about 110 times wider than the earth's. The sun is so big that more than 1 million earths could fit in it.

The sun is a ball of hot, glowing gases. Its surface temperature is around 5,500°C. It gets hotter as we go deeper. The sun is so hot that the planets millions of kilometres away from it can feel its heat. Without the sun, our planet would simply be a dark, frozen world.

Besides heat, the sun also provides us with light. Without the sun, there would be no daylight. It takes about 8 minutes for sunlight to reach the earth. This means that we see the sunset eight minutes after the event has actually taken place.

SHADOW

Have you ever noticed that when you walk on the road during the daytime, a dark shape on the ground also moves along with you? What is it?

It is your **shadow**.

You must have also seen shadows of trees, poles buildings, etc. on the ground in the daytime.

What is a shadow?

We all know that light travels in a straight line. When any object comes in the path of light, a shadow of that object is formed.

Thus, we can say that a shadow is an area of darkness where light is blocked.

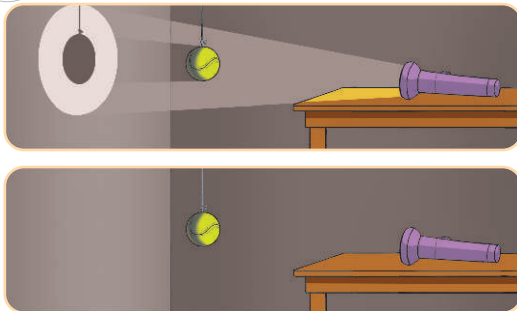
Things required for a shadow

There are three things required for a shadow to form: light, an object and a surface.

Let us understand it by doing some activities.



Fun and Learn



- Take a torch, a rubber ball, a pin and a piece of string.
- Put the pin in the ball and tie the string.
- Hang the ball near a wall.
- Light a torch and place it near the ball as shown.
- Switch off the lights and make the room dark.
- You will see the shadow of ball on the wall.
- Now switch off the torch.
- There will be no shadow on the wall.

Thus, *a shadow is formed only in the presence of light.*



Fun and Learn

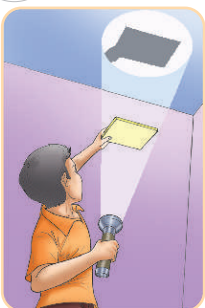


- Arrange the torch and the ball as before.
- You will see the shadow of the ball.
- Now, remove the ball.
- There will be no shadow on the wall.

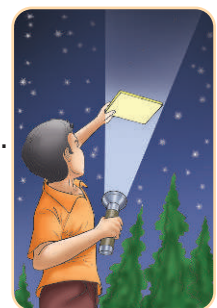
Thus, *a shadow is formed only of an object.*



Fun and Learn



- Take a notebook and a torch.
- Switch off all the lights and make the room dark.
- Hold the torch in a vertical position in one hand.
- Hold the notebook in the other hand slightly away from the torch.
- Switch on the torch.
- You will see the shadow of the notebook on the ceiling.
- Repeat this activity in the open under the sky.
- You will not see any shadow.



Thus, *a shadow needs a surface on which it is formed.*

Objects which form shadows

All objects do not form shadows. Let us do some activities to check this.



Fun and Learn

Take a piece each of wood, paper and glass. Also take a torch. Make the room dark and stand near a wall. Switch on the torch.



First, place the piece of wood between the torch and the wall.

You will see a very dark shadow.



Next, place the piece of paper between the torch and the wall.

You will see a very faint shadow.



Finally, place the piece of glass between the torch and the wall.

You will see no shadow.

The piece of wood did not allow any light to pass through it. Thus, its dark shadow is formed. Such objects are called **opaque objects**. Objects made of wood, metal, leather, etc. are opaque objects.

The piece of paper allows light to pass through it only partially. Thus, its shadow is very faint. Such objects are called **translucent objects**. Objects made of paper, butterpaper, etc. are translucent.

The piece of glass allows light to pass through it completely. Thus, its shadow does not form. Such objects are called **transparent objects**. Water, cellophane paper, objects made of glass, etc. are transparent objects.

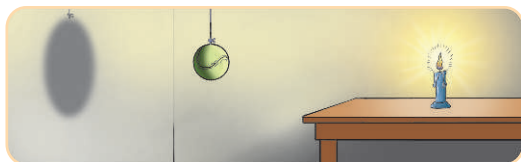
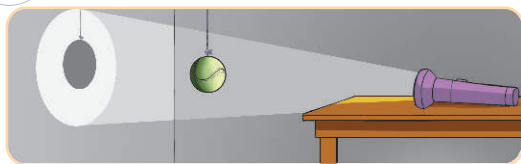
Sharpness of a shadow

The shadow of the same object can be dark or light.

Let us see how.



Fun and Learn



- Arrange the torch and the ball as before.
- Switch off the lights and make the room dark.
- Switch on the torch.
- You will see a dark shadow of the ball on the wall as before.
- Now replace the torch with a lighted candle.
- This time the shadow of the ball is blurred and not very sharp.

Thus, *the sharpness of a shadow depends on the brightness of the source of light.*

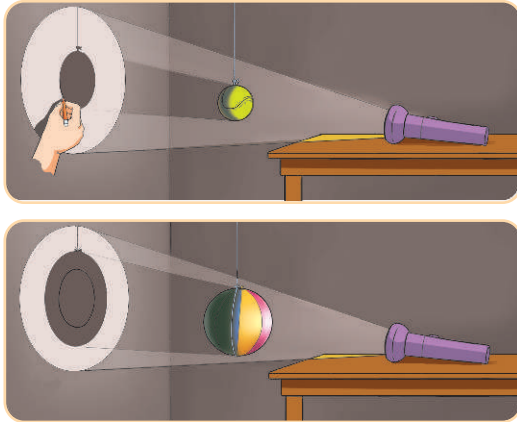
Size of a shadow

The size of the shadow of an object depends on two things:

- ✧ the size of the object itself,
- ✧ the distance between the object and the source of light.



Fun and Learn

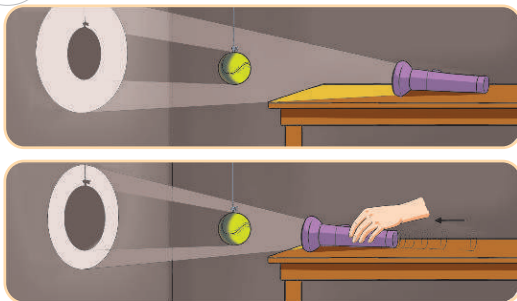


- Arrange the torch and the ball as before.
- Make the room dark and observe the shadow on the wall.
- Take a pencil and draw the shape of the shadow on the wall.
- Now, without disturbing the torch, remove the ball.
- Replace it with another bigger ball. Make sure that its position remains the same.
- Observe its shadow on the wall and draw its shape.
- Switch on the light and observe the size of the two shadows.
- You will see that the shadow of the bigger ball is also bigger.

Thus, **bigger objects form bigger shadows.**



Fun and Learn



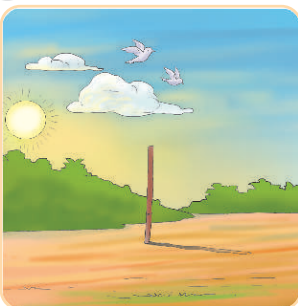
- Arrange the torch and the ball as before.
- Switch off the light and make the room dark.
- Observe the shadow of the ball on the wall.
- Now hold the torch and start moving it towards the ball.
- Observe the change in the shadow.
- You will see that as the torch goes nearer the ball, the size of the shadow increases.

Thus, **when the source of light is near to the object, its shadow is big.**

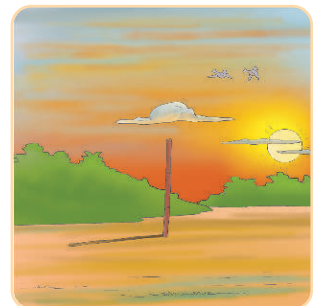
Direction of the shadow



Fun and Learn



- Take a long stick and fix it in an open ground.
- Observe it at dawn. We know that the sun rises in the east. The shadow of the stick is formed on the opposite side, that is, in the west.
- Then, observe it in the evening, when the sun sets in the west.
- This time the shadow of the object is formed in the east direction.



Thus, **the shadow of an object is always formed on the opposite side of the source of light.**

ECLIPSES

We know that the moon moves around the earth in a fixed orbit. Similarly, the earth also moves around the sun in its fixed orbit.

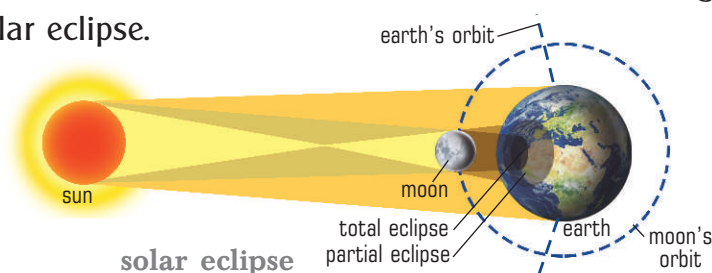
Sometimes, during their orbits, the moon and the earth form a line with the sun. When this happens, the light of the sun is blocked by the body in the middle (either the moon or the earth). It results in the shadow of the middle body formed on the other body. That is called an **eclipse**.

There are two kinds of eclipses — **solar eclipse** and **lunar eclipse**.

Solar eclipse

A solar eclipse occurs when, during its course of revolution, the moon comes in between the sun and the earth.

When this happens, the moon casts a shadow on the earth. The sky gets slowly dark as the moon moves in front of the sun. Since the sun gets hidden behind the moon, it is called a solar eclipse.



partial solar eclipse



total solar eclipse

At some places, the moon does not cover the sun completely. Only a part of the sun is invisible. It is called a **partial solar eclipse**.

At some places, the sun is completely hidden behind the moon. It is called a **total solar eclipse**.

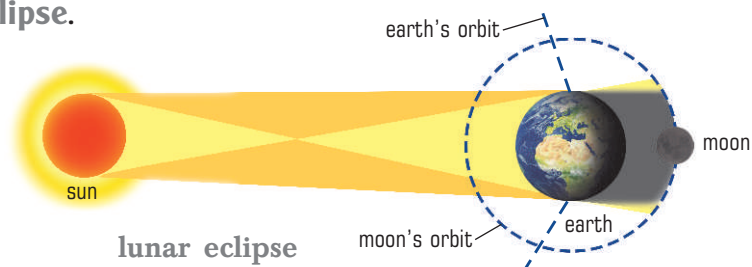
A solar eclipse is seen during the daytime. It lasts only a few minutes. One should never look at a solar eclipse with the naked eye. It can harm the eyes.

Lunar eclipse

A lunar eclipse occurs when the earth comes in between the sun and the moon.

The earth blocks the sun's rays from reaching the moon.

At some places, the shadow of the earth covers the moon partially. It is called a **partial lunar eclipse**.



partial lunar eclipse



total lunar eclipse

At some places, the moon is completely hidden by the shadow of the earth. It is called a **total lunar eclipse**.

A lunar eclipse always takes place on a full moon day. During a lunar eclipse, the full moon's bright face slowly changes into a dark orange colour. It is because even though the moon is in the earth's shadow, some sunlight is able to pass through the earth's atmosphere and reach the moon, giving it an orange colour.



Lunar eclipses can last up to an hour and a half. They are safe to look at with binoculars or a telescope.

Words to Remember

shadow	–	an area of darkness where light is blocked
opaque objects	–	objects that do not allow any light to pass through them
translucent objects	–	objects that allow light to pass through them only partially
transparent objects	–	objects that allow light to pass through them completely
eclipse	–	the phenomenon in which the shadow of a heavenly body falls on another
solar eclipse	–	the phenomenon in which the moon casts its shadow on the earth
lunar eclipse	–	the phenomenon in which the earth casts its shadow on the moon

Points to Recall

- * The sun is the closest star to the earth.
- * The sun provides us with light and heat
- * Sunlight takes about eight minutes to reach the earth.
- * When an object comes in the path of light, a shadow of that object is formed.
- * There are three things required for a shadow to form—light, an object and a surface.
- * Transparent objects do not form any shadows.
- * Opaque and translucent objects form dark and faint shadows respectively.
- * The brighter the light, the sharper is the shadow.
- * Bigger objects form bigger shadows.
- * The nearer the source of light to the object, the bigger will be its image.
- * The shadow of an object is always formed on the opposite side of the source of light
- * A solar eclipse occurs when the moon comes in between the sun and the earth in a line.
- * A solar eclipse is seen during the daytime and lasts a few minutes.
- * A lunar eclipse occurs when the earth comes in between the sun and the moon in a line.
- * A lunar eclipse always takes place on a full moon day and lasts up to an hour and a half.

Exercises

A. Tick (✓) the correct option.

- The sun provides us with

(a) heat	<input type="checkbox"/>	(b) light	<input type="checkbox"/>	(c) both (a) and (b)	<input type="checkbox"/>	(d) none of these	<input type="checkbox"/>
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- The surface temperature of the sun is around

(a) 500°C	<input type="checkbox"/>	(b) 555°C	<input type="checkbox"/>	(c) 5,500°C	<input type="checkbox"/>	(d) 2,500°C	<input type="checkbox"/>
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- What is needed for a shadow to be formed?

(a) light	<input type="checkbox"/>	(b) object	<input type="checkbox"/>	(c) surface	<input type="checkbox"/>	(d) all of these	<input type="checkbox"/>
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- Which of the following is an opaque object?

(a) coin	<input type="checkbox"/>	(b) glass tumbler	<input type="checkbox"/>	(c) butter paper	<input type="checkbox"/>	(d) none of these	<input type="checkbox"/>
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5. During a total lunar eclipse, the moon's colour changes into

(a) grey



(b) orange



(c) black



(d) purple



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

1. Many stars are bigger than our sun.
2. Light travels in a straight line.
3. A shadow becomes sharper in dimlight.
4. In the evening, shadows are formed in the west direction.
5. During a total lunar eclipse, the moon hides the sun completely.



C. Answer in one or two words only.

1. Name the closest star to the earth.
2. What kind of objects allow light to pass through them?
3. Does the size of an object affect the size of its shadow?
4. Which eclipse is seen during the daytime?
5. Which eclipse is safe to look at with the naked eye?

D. Answer in one sentence only.

1. How much time does sunlight take to reach the earth?
2. What is a shadow?
3. Name the three things required for a shadow to form.
4. What is a translucent object?
5. What is a solar eclipse?

E. Answer in a few sentences.

1. Write a few lines about the size of the sun.
2. Differentiate between opaque and transparent objects.
3. How can we prove that bigger objects form bigger shadows?
4. Differentiate between partial and total solar eclipses.
5. Explain lunar eclipse with the help of a diagram.



BRAINSTORM

1. In a solar eclipse, what is the source of light, what is the object and what is the surface?
2. What would happen if the sun suddenly stopped burning?
3. Which of the following objects will cast a dark shadow, a faint shadow and no shadow at all?

a piece of plain paper, a piece of plain glass, a thin sheet of plastic, a piece of cloth, a spectacle lens, a piece of cardboard, an ice cube, a mirror

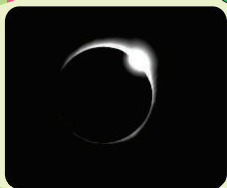


TELL YOUR TEACHER

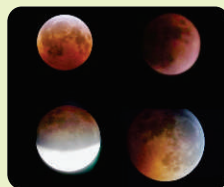
Read the following and tell your teacher whether each child did a right thing or a wrong thing. Why?

- It is a bright sunny day. Monu and her elder sister Mita were playing in a park. Suddenly, the sunlight started to fade. Birds started chirping loudly. Monu looked up at the sky. The sky was clear and there were no clouds. Monu was puzzled. He then tried to look at the sun. But, Mita stopped him from doing so.

FIND OUT



What is this phenomenon popularly known as? When does it happen?



What is the Danjon Scale? Who proposed it?

Project

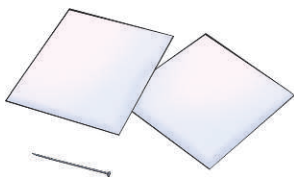
- Find out the date of the last total solar eclipse seen in India and the major places from where it was seen. Take help from newspapers, magazines, books and the Internet and write a brief report on it. Submit it to your teacher.
- Take a sheet of chart paper and show solar and lunar eclipses on it. For the sun, the moon and the earth, paste picture cuttings. Use colouring pens for labelling.



Activity Time

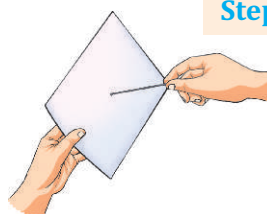
Making a pinhole projector

Never look at the sun with the naked eye during a solar eclipse. Instead, use a pinhole projector to watch it. Let us see how we can make and use it.



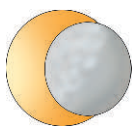
You need

- two sheets of plain white paper
- a sharp pin

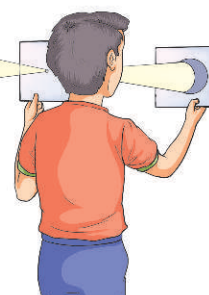
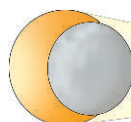


Steps

1. Take a sheet of paper and make a very small hole in the middle of it using the pin.



2. Stand with your back towards the sun. Now hold the paper with the hole above your shoulder.



3. Hold the second sheet of paper at a small distance. Adjust it so that an inverted image of the sun is projected on it through the pinhole.