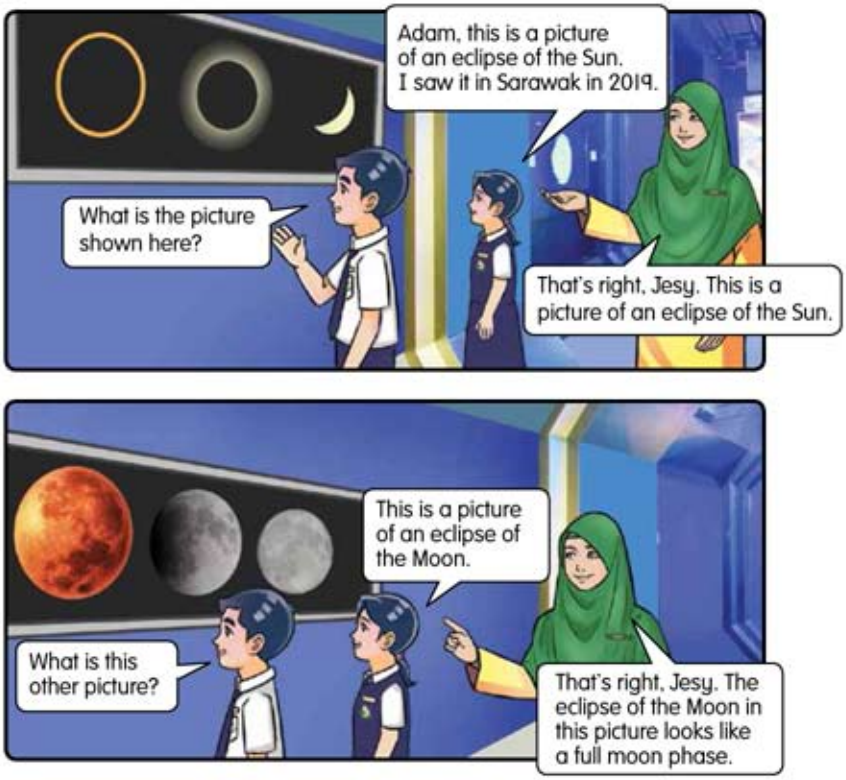
UNIT 10 ECLIPSE

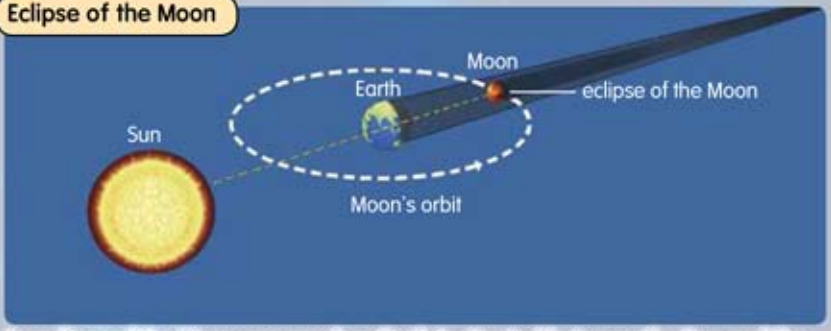


Miss Ema and her pupils visited the National Planetarium in Kuala Lumpur. They were excited with the exhibition on the eclipse phenomena. Do you know how an eclipse occurs? What are the differences between an eclipse of the Sun, an eclipse of the Moon, and phases of the Moon?

Eclipse of the Moon

The picture above shows the changes that can be observed on the surface of the Moon during an eclipse of the Moon. Do you know how an eclipse of the Moon occurs?

Eclipse of the Moon



An eclipse of the Moon occurs when Earth is situated between the Sun and the Moon in a straight line. Earth prevents some or all of the sunlight from reaching the Moon. Thus, the shadow of Earth will be formed on the Moon's surface during an eclipse of the Moon. An eclipse of the Moon only occurs during the full moon phase.

The figure above is not according to actual scale and distance.

Why does an eclipse of the Moon not occur every month during the full moon phase?

During the full moon phase, an eclipse of the Moon does not necessarily occur. This is because the Moon's orbit around Earth is tilted about 5° from Earth's orbit around the Sun.

Tilting of the Moon's orbit causes the Moon to be either above or below Earth's shadow. Thus, an eclipse of the Moon does not necessarily occur every month during the full moon phase.

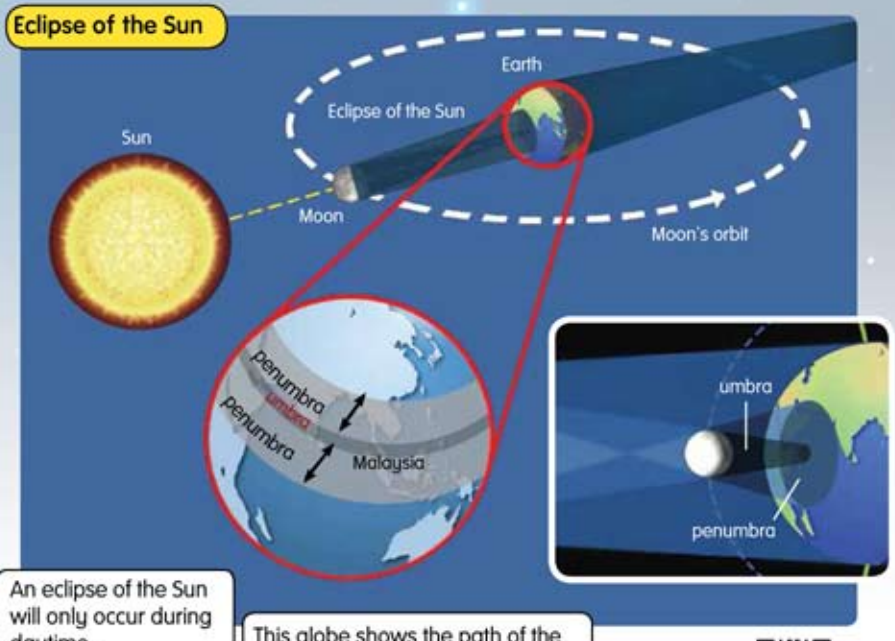
The position of the Moon above Earth's shadow

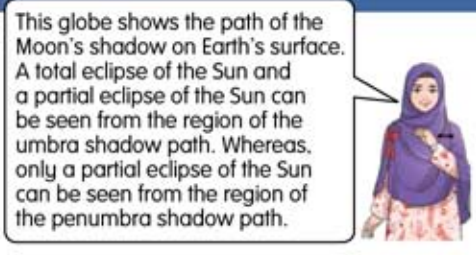
The position of the Moon below Earth's shadow

The pictures above show that the Sun, Earth, and the Moon are not always in a straight line during the full moon phase. An eclipse of the Moon can occur twice a year.

Eclipse of the Sun

An eclipse of the Sun occurs when the Moon is situated between the Sun and Earth in a straight line. The Moon prevents some or all of the sunlight from reaching Earth's surface. Thus, the shadow of the Moon will be formed on Earth's surface during an eclipse of the Sun. Observe the picture below.





simulation of an eclipse of the Sun

Based on the positions of the Sun, the Moon, and Earth as shown above, an eclipse of the Sun only occurs during the new moon phase.

SCIENCE INFO

Umbra is the darkest part of a shadow. The penumbra is a partially dark area that forms around the umbra.

An eclipse of the Sun does not necessarily occur during every new moon phase because the Moon's orbit around Earth is tilted about 5° from Earth's orbit around the Sun.

The tilting of the Moon's orbit prevents the Moon's shadow from forming on Earth's surface. This is because the tilting of the Moon's orbit causes the Moon to pass above or below Earth. Thus, an eclipse of the Sun does not necessarily occur every month during the new moon phase.

The position of the Moon's shadow below Earth

The position of the Moon's shadow above Earth

The pictures above show that the Sun, Earth, and the Moon are not always in a straight line during the new moon phase. An eclipse of the Sun can occur twice a year.

SCIENCE INFO

In astronomy, the new moon phase occurs when the Moon is situated between the Sun and Earth in a straight line. During this phase, the Moon's surface is completely dark and invisible to the naked eye.

EXPERIMENT

Eclipse Simulation Model

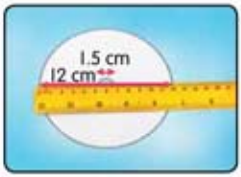
Group Activity

Aim: To describe the eclipse phenomena

Apparatus and materials: torch, a pin, scissors, ruler, protractor, transparent plastic, modelling clay, skewer stick, white-coloured card

Steps:

Be careful when using scissors and pins.

1. 

Cut the transparent plastic into a circle with the diameter as shown in the picture.

2. 

Shape the modelling clay into a sphere. Then, stick the sphere to the centre of the rounded plastic.

3. 

Stick a pin to the edge of the transparent plastic using modelling clay.

4. 

Insert the skewer stick into the sphere at an inclined angle of about 30°.

5. 

Conduct the activity in a dark room. Place the torch on the table.

6. 

Hold a piece of white card facing the eclipse model and the torch. Observe the formation of the shadow of the model.

7. Conduct the eclipse simulation and describe the occurrence of an eclipse of the Sun and an eclipse of the Moon.

Questions:

1. What do the pin, spherical modelling clay, and torch represent in the simulation above?
2. What positions of the Moon, Earth, and the Sun would cause an eclipse of the Moon and an eclipse of the Sun to occur?

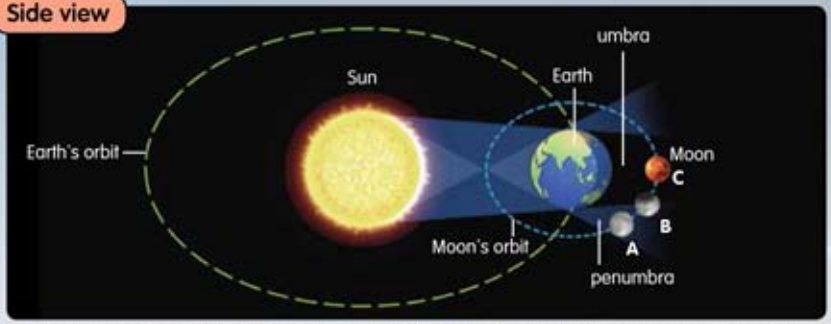
10.1.1,
10.1.2,
10.1.5

Relationship Between Eclipses and the Properties of Light

The Sun is the main source of light in our Solar System. Sunlight travels in a straight line and cannot pass through opaque objects such as Earth and the Moon.

During an eclipse of the Moon, the sunlight that passes through Earth will produce two types of shadows. They are known as umbra and penumbra.

Side view



When the Moon orbits along Earth's shadow from position A to position C, two types of eclipses of the Moon will occur.

View from Earth

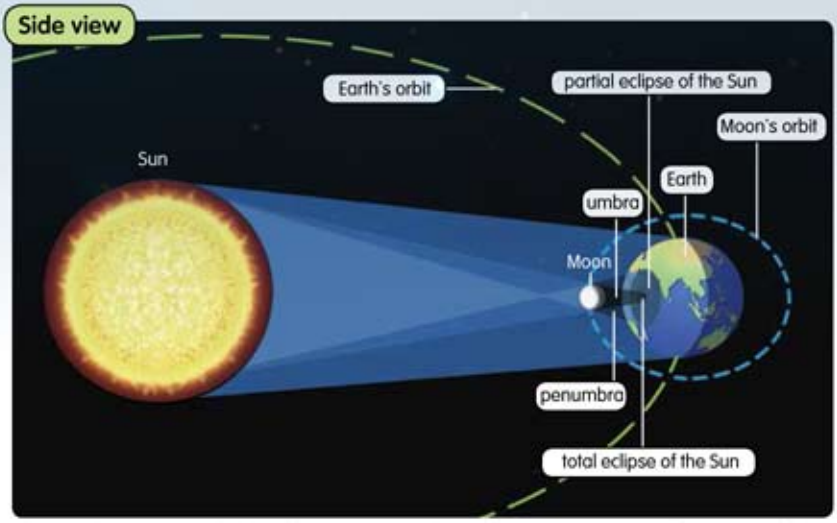
SCIENCE INFO

The reddish-brown colour during a total eclipse of the Moon is caused by the dispersion and refraction of sunlight through Earth's atmosphere. This effect can usually be observed during sunrise and sunset.

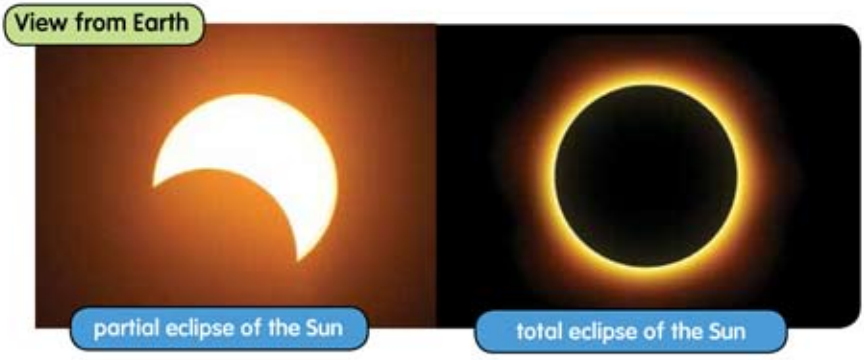
During an eclipse of the Moon, the light from the Moon is safe to be seen with our naked eyes. Why?

10.1.3

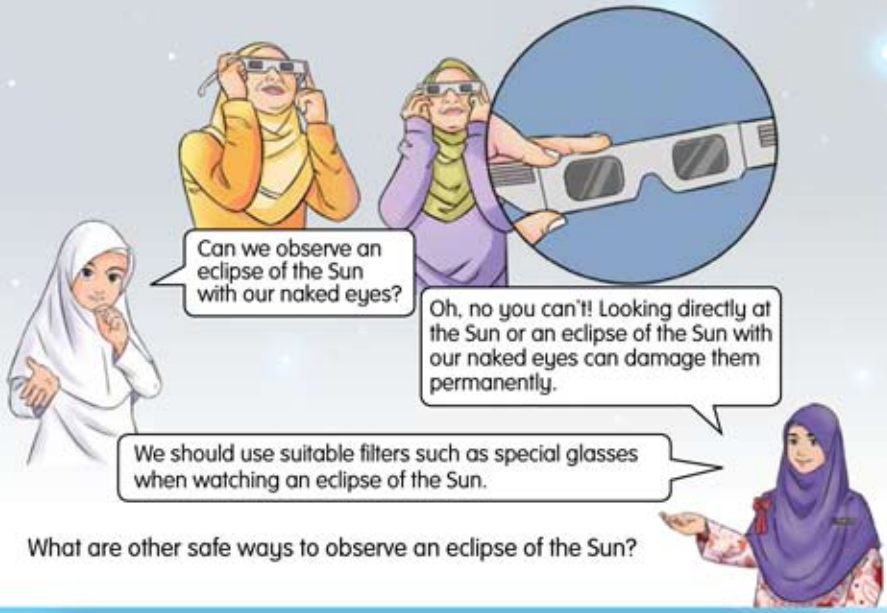
During an eclipse of the Sun, sunlight moving towards the Moon will produce two types of shadows known as umbra and penumbra. The umbra shadow is smaller and darker than the penumbra shadow.



When the Moon's shadow forms on Earth's surface, two types of eclipses of the Sun would occur. A total eclipse of the Sun and a partial eclipse of the Sun can be seen from the region of the umbra shadow path. Whereas, only a partial eclipse of the Sun can be seen from the region of the penumbra shadow path.



total eclipse of the Sun



What are other safe ways to observe an eclipse of the Sun?

FUN ACTIVITY

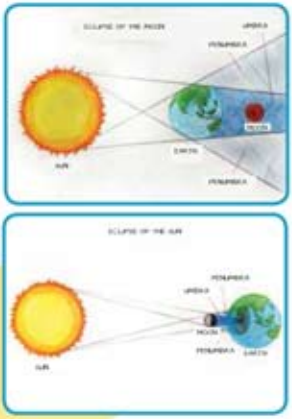
Sketches of Eclipses and the Properties of Light

Individual Activity

Apparatus and materials: ruler, coloured pencils, drawing paper

Steps:

1. Sketch and label the positions of the Sun, Earth, and the Moon correctly during an eclipse of the Moon and an eclipse of the Sun.
2. Colour your sketch.
3. Exhibit your sketch to the class.



Questions:

1. List the differences between an eclipse of the Moon and an eclipse of the Sun.
2. What is the relationship between an eclipse and the properties of light?

10.1.3, 10.1.5

The Conditions on Earth During an Eclipse

On 26 December 2019, the people in Malaysia, especially in Johor and Sarawak, had the opportunity to watch an eclipse of the Sun. The pictures below show the surrounding conditions before and during an eclipse of the Sun.

Brightness of the Surrounding

Before

During

The Reactions of Animals

Before

During

How do animals react during a total eclipse of the Sun?

What will happen to Earth during an eclipse of the Moon?

The pictures below show the difference in the level of the sea tide at a jetty during the crescent moon phase and an eclipse of the Moon.

During the crescent moon phase

During an eclipse of the Moon

What can you predict from the level of sea tides during an eclipse of the Moon?

FUN SCIENCE

Pinhole Camera

Make a pinhole camera using a pair of scissors, adhesive tape, pin, two pieces of white cardboard, and aluminium foil.

Be careful when using scissors and pins.

Steps:

1. 

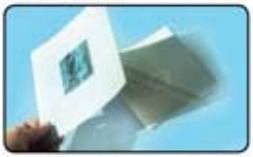
Make a square hole in the centre of the cardboard.

2. 

Paste an aluminium foil to cover the hole.

3. 

Make a few holes on the aluminium foil. The holes made are known as pinholes.

4. 

Allow the sunlight to pass through the pinholes until it forms a clear image on the surface of the other cardboard.

An eclipse of the Sun can be viewed safely using a pinhole camera.

MIND REFLECTION

1. An eclipse of the Moon will only happen:
   - when Earth is between the Sun and the Moon in a straight line.
   - during the full moon phase.
   - when the Moon enters the shadow's region of Earth.

2. An eclipse of the Sun will only happen:
   - when the Moon is between the Sun and Earth in a straight line.
   - during the new moon phase.
   - when the shadow of the Moon forms on Earth's surface.

3. An eclipse of the Moon or an eclipse of the Sun does not necessarily occur during the full moon phase or the new moon phase. This is because the tilted orbit of the Moon often causes the Moon to be above or below Earth.

4. Sunlight travels in a straight line and cannot pass through opaque objects such as Earth and the Moon.

5. A total eclipse of the Sun and a partial eclipse of the Sun can be seen from the region of the umbra shadow path. Whereas, only a partial eclipse of the Sun can be seen from the region of the penumbra shadow path.

6. Looking directly at the Sun or an eclipse of the Sun with our naked eyes can damage the eyes permanently.

7. During an eclipse of the Sun, the surrounding conditions become darker, the temperature decreases, and living things such as animals will return to their nests.

8. During an eclipse of the Moon, the level of the sea tides rise.

MIND TEST

Answer all questions in the Science exercise book.

1. State the types of eclipses shown in the following pictures.




2. Tick (✔) the correct statements about the eclipse of the Moon.

(a) An eclipse of the Moon only occurs during the full moon phase.
(b) An eclipse of the Moon occurs when the Moon is situated between the Sun and Earth in a straight line.
(c) An eclipse of the Moon cannot be seen with our naked eyes.
(d) When the Moon is in the umbra shadow of Earth, a total eclipse of the Moon will occur.

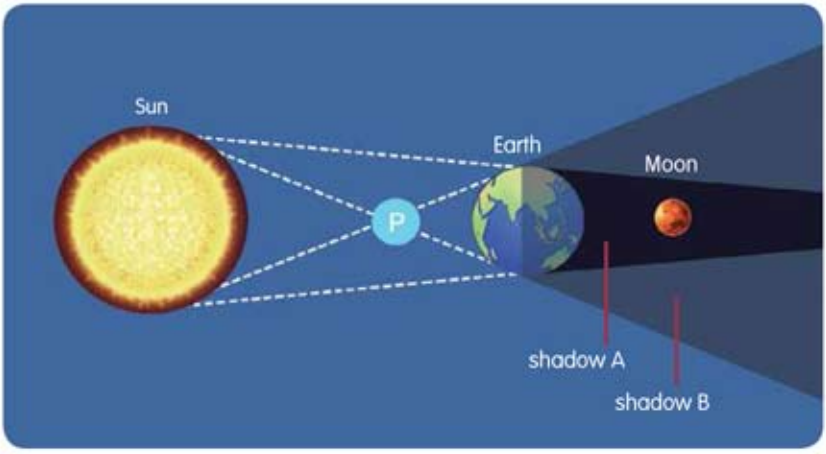
3. During eclipse A, the surrounding conditions become darker like night-time and the surrounding temperature also decreases.

Answer the following questions based on the statement above.
(a) What is the type of eclipse A that occurred?
(b) Explain your answer in 3(a).
(c) State suitable tools that can be used to observe eclipse A.

4. Fill in the blanks below with the correct answers.

When an eclipse of the _____ occurs, the Moon is situated between the Sun and Earth in _____ . This eclipse will only occur during the _____ phase.

5. The diagram below shows the positions of the Sun, Earth, and the Moon during an eclipse phenomenon. Answer the following questions.



(a) What is the type of eclipse phenomenon shown in the picture above?
(b) Name shadow A and shadow B.
(c) State the two properties of sunlight for the phenomena of shadow A and shadow B.
(d) Predict the phenomenon that can be seen when the Moon is in position P.

6. Predict the conditions on Earth during a:
(a) total eclipse of the Moon.
(b) total eclipse of the Sun.