

**GRADE 6**  
**NATURAL SCIENCE AND TECHNOLOGY**  
**TERM 4**

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# Natural Science: The Scientific Method

## Use this format to follow the scientific method for your experiments

### Question to investigate

What will my experiment answer?

### Hypothesis

What do I think the results of this experiment will be?

### Materials

What do I need to conduct this experiment?

### Method

How will I conduct this experiment?

Step 1

Step 2

Step 3

Step 4

Step 5

### Results and conclusions

What are the results of my experiment?

Was my hypothesis correct? [ ] Yes [ ] No

### Discussion

How can the results of my experiment be used?

What other questions does my investigation raise?



# Technology: The design process

## Use this format to follow the design process for your technology projects

### Investigate

What must my product do?

### Design and plan

**Specifications:** What are the specifications? (E.g. instructions, design brief)

**Constraints:** What are the constraints? (E.g. materials, time, tools)

**Materials:** What materials am I going to use?

**Equipment:** What tools do I have? What tools will I need?

**Final drawing** (What will my product look like?)



How am I going to make my product?

Step 1

Step 2

Step 3

### Evaluate

Does my product work properly? [  ] Yes [  ] No

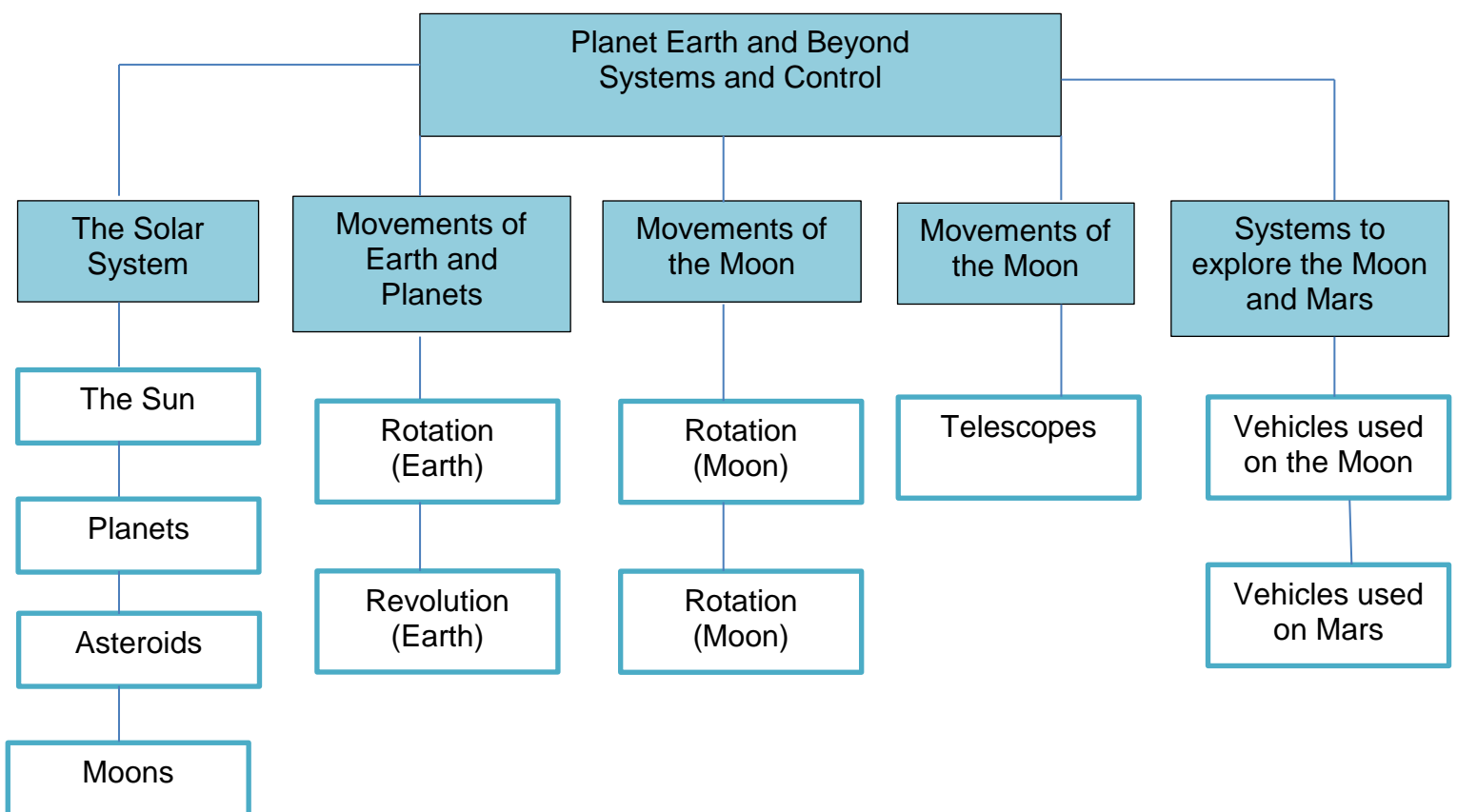
Does my product look like my drawing? [  ] Yes [  ] No

How can I make my product better?

## Strand 4: The Solar System

### Technology: Systems and control

You know that you live on a rocky body in space called Earth. The Earth is one of eight planets that travel round the Sun. a small body, the Moon, travels round the Earth. All the planets and the Moon are part of the Sun's family, called the solar system. The solar system also includes other moons, and asteroids.



## Unit 1 – The Sun, Planets and Asteroids

### Lesson 1: Sun, Planets and Asteroids

The Sun is a **star**. All stars are balls of very hot gas that give off heat and light. The Sun is the only star in our solar system. The other stars are all much further away and because they are so far away, we do not feel their heat or benefit from their light. The Sun is at the centre of our **solar system**.



## The solar system

The solar system consists of the Sun and all the planets that orbit around it. It also includes asteroids and the planets' moons.

In the solar system each object's **force of gravity** pulls on all the other objects. Gravity is a force of attraction between objects. The Sun is the biggest and heaviest object in our solar system and so it exerts the greatest force of gravity on all planets. The force of gravity makes all the planets move in a circle around the Sun.

The names of the planets in our solar system are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. Mercury is the planet closest to the Sun and Neptune is the planet furthest away from the Sun.

## The Planets and the Asteroid Belt

Planets are different from stars because they are not made of hot gas and cannot give out their own heat and light. There are eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

All the planets travel around the Sun in a patch called an **orbit**. Every planet has its own orbit around the Sun. The shape of each orbit is a bit like a flattened circle. We call a shape like this an ellipse. You can see the planets in their elliptical orbits around the Sun in the image below.

Asteroids are chunks of rocks that travel around the Sun. there are hundreds of thousands of **asteroids**. Most asteroids travel around the Sun between the orbits of Mars and Jupiter. This part of the solar system is known as the **asteroid belt**.



## Each planet is different

The planets are not all the same. Each planet has its own features. Planets are all different in size, move in different orbits and are different distances from the Sun. they also have different compositions: some are rocky like the Earth and others are gas planets. The

four inner planets are solid rocky bodies; the four outer planets are gas giants. They have different numbers of moons. A moon is a solid rocky object that travels around a planet.

## Activity 1

1. How many planets are in our solar system?
2. Name the planets in order starting at the Sun?
3. Which one is the biggest planet?
4. Which planet is the smallest?
5. What do we call the paths that the planets travel around the Sun?
6. There is only one star in our solar system. What is its name?
7. What are asteroids?
8. Earth is a moon. What is a moon?

### Vocabulary

Sun – the star in our solar system.

Solar System – The Sun and all the objects that travel around it.

Planet – A large object that revolves around the Sun.

Star – A huge ball of burning gas in space.

Orbit – The path of one object in space around another, such as the path of the Earth around the Sun.

Asteroid – Chunks of rocks that travel around the Sun.

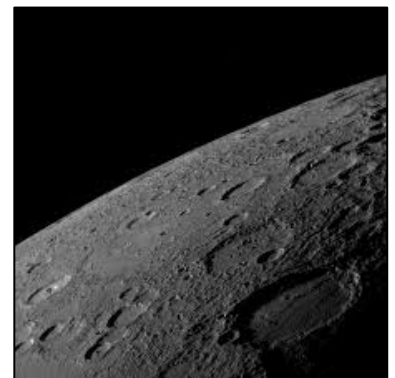
Moon – A solid rocky body that travels round a planet.



## Some Information about the Planets

### Mercury

Mercury is a rocky planet covered in a layer of fine soil. There are many large circular holes called craters. It is the only planet that has no atmosphere. Its average temperature is 168 ° C. There is evidence of ice near its North Pole, but none of water. It does not have a moon.



## Venus

Venus has a bare rocky surface, with many volcanoes. The thick atmosphere blocks the surface from observers from Earth. The atmosphere is made up of carbon dioxide. Its average temperature is 500 ° C. It has white clouds but they are not made of water. Venus has no moon.

## Earth

Earth is a very rocky planet but most of its surface is covered by soil and water. It also has an atmosphere. The atmosphere contains oxygen which animals breathe in and carbon dioxide which plants take in. The water in the oceans and atmosphere make Earth appear blue from space – it is known as the blue planet. It is the only planet in our solar system that supports life.

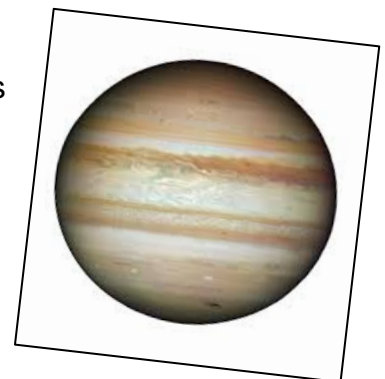


## Mars

Mars is often called the 'red planet' because its rocky surface is covered in red dust. It has many volcanic mountains, including Olympus Mons which is 28 km high. There is frozen water in deep craters near its poles. Dry river beds suggest that there was once liquid water in other places. The atmosphere is thin. The average temperature is - 55° C. Mars has two moons.

## Jupiter

Jupiter is so large that all other planets can fit inside it. It is a gas planet, made mainly from hydrogen and helium, like the Sun. Fast winds blowing from east to west around the planet give it a streaky appearance. It has a giant red spot which is a huge storm from swirling gases, with wind speed of over 800 km per hour.



Jupiter has 3 thin dark rings, made of dust. Jupiter has 64 moons. The temperature at its surface is about -145 °C.



### DID YOU KNOW?

In 1973, Pioneer 10 was the first spacecraft to travel to Jupiter. To get there, Pioneer 10 had to go through the asteroid belt. If an asteroid had hit Pioneer 10, the spacecraft would have been destroyed and smashed to pieces. However, Space is a very big place and asteroids are usually very far apart. Pioneer 10 got through safely and went on to take the first close-up photos of Jupiter.

### Saturn

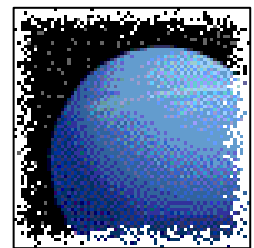
Saturn is a gas planet made up mainly of hydrogen and helium, like the Sun. Its gases make it so light that scientists think it could float on water. Its yellow bands are caused by winds blowing very fast through the grassy atmosphere. Its average temperature is  $-141^{\circ}\text{C}$ . Saturn has bright colourful rings around it, made of frozen water. Saturn has 62 moons. It is the furthest planet from the Earth that can be seen without a telescope.

### Uranus

Uranus is made mainly from frozen gas and is sometimes called an 'ice giant'. Its thick atmosphere is made mainly of hydrogen and helium, with some methane which gives it a green-blue appearance. Its axes are tilted so one pole away points to the Sun and it appears to lie on its side. It has 9 bright and 2 brightly coloured rings and 27 known moons. Its average temperature is  $-216^{\circ}\text{C}$ .

### Neptune

Neptune is an ice giant. It has a blue-green colour because of methane in its atmosphere. It has extremely fast winds reaching up to 1400 kilometres per hour. Neptune has 13 moons. It has several dark rings. Its average temperature is  $-218^{\circ}\text{C}$ .



### The Planets and Asteroids take different amounts of time to Revolve around the Sun.

The Earth takes  $365 \frac{1}{4}$  days to revolve around the Sun. Every fourth year we have an extra day to make up the missing quarter days. This longer year is called a leap year.

We use Earth days and years to measure the time it takes the other planets and the asteroids to revolve around the Sun.

Planet	Time to revolve around the Sun
Mercury	88 Earth Days
Venus	225 Earth Days
Earth	365 Earth Days = 1 Year
Mars	687 Earth Days
Asteroids	3-6 Earth Years
Jupiter	11.5 Earth Years
Saturn	22.5 Earth Years
Uranus	84 Earth Years
Neptune	164.8 Earth Years

Can you see that the time taken to revolve increases as the distance from the Sun increases? Planets closest to the Sun move faster and have shorter distances to go than those further away, so they take less time to revolve once around the Sun. The asteroids are all at different distances from the Sun, so they take different times to revolve around it.

## Summary

*The Sun, the Planets, their moons and the asteroids are members of the solar system. The Sun is a star at its centre and the other bodies revolve around it. There are 8 planets and hundreds of thousands of asteroids. Four of the planets are rocky bodies, and four of the planets are gas giants. They each have their own orbits and have different features and numbers of moons. Those planets furthest from the Sun take longer to travel around it.*

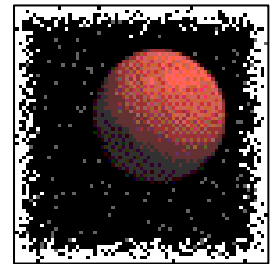




## The planets were a science puzzle

People who study the stars are called astronomers. The planets were a puzzle for ancient astronomers.

The Ancient people gave names to the planets. For example, Mars was named after the god of war. One planet was so beautiful that they called it Venus after the goddess of love and beauty. You can see Mars at some times of the year. Mars is orange-red, and at most times it looks smaller than Venus. Sometimes you have to look late at night to see Mars rising in the east.



Over hundreds of years, astronomers set up observatories in places like India, Egypt, Iraq, England and countries in Europe. An **observatory** is a building that has permanent measuring marks. These marks are always in the same position. The astronomers make notes of where stars and planets are compared to these fixed positions and they note the dates and times.

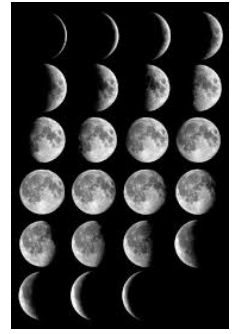
Over many years of careful observing, the astronomers kept records of where the planets moved. They used maths to predict where a planet would be on a future date. Then, on that date, they went to check if their prediction was correct. They became very good at measuring, doing maths and calculations with big numbers.

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## Unit 2 – Moons

### Lesson 2: Moons

Moons are rocky bodies that travel in an orbit around a planet. Scientists believe that they have not yet seen all the moons there are in our solar system.



### Moons do not give out their own heat and light

The Moon is a spherical-shaped rock that orbits the Earth. It is one-third the size of the Earth. The Moon does not contain any air or water. Moons differ a great deal in size and some moons have rocky surfaces while others are covered with ice. When you look at our moon and images of other moons, they seem to shine. The light you see does not come from the moon itself. Like planets, moons do not give out their own heat and light, because they are not made of hot gas. Only stars are made of hot gas and can give out their own heat and light.

#### DID YOU KNOW?

The footprints from the astronauts who first walked on the Moon are still there! There is no wind on the Moon to blow them away



### Moons of other planets

Other planets have Moons too. Mars has two Moons, and astronomers called them Daimos and Phobos. Phobos has deep craters showing that it has also been hit by fast-moving rocks.

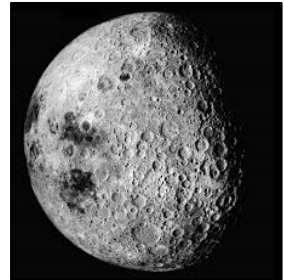
Jupiter has 66 Moons which we have identified, and each time another space probe has been sent to Jupiter, more Moons have been discovered. Jupiter's 4 biggest Moons are: IO, Europa, Ganymede and Callisto.

## Our Moon can be seen from Earth

The Moon seems to shine because light from the Sun shines onto its surface and lights it up. When we look up at the Moon we can only see the part lit up by the Sun. We would not be able to see the Moon from Earth without sunlight.

## On the Moon...

The Moon's surface is not flat and smooth. It has mountains, plains and craters. Craters are large circular holes. Scientists think that craters were formed by large rocky objects crashing into the surface of the Moon many years ago.



## Activity 2

Make a drawing of the Moon's surface features

1. Draw a big round shape to show the Moon.
2. Draw in the shapes of the plains, as in the picture. Colour them in with pencil. Label them.
3. Draw 5 craters, as seen in the picture. Notice how small they are in the image. Label them.
4. Shade the rest of your Moon lightly and in patches, so it is mostly white and bright.

## Summary

*Moons do not give heat or energy. We can see our Moon from Earth because the Sun shines on its surface. On the Moon we can see craters, flat plains and mountains.*



## Revision Activity

1. Which planet is closest to the Sun?
2. Is Venus or Earth closer to the Sun?
3. Write the names of the planets in order, beginning from the one that is closest to the Sun.
4. Which planet do you think is the coldest, state why you think so?
5. Why do the planets all keep on moving in orbits around the Sun?

## Unit 3 – Movement of the Earth and Planets: Rotation

### Lesson 3: Movement of the Earth and Planets

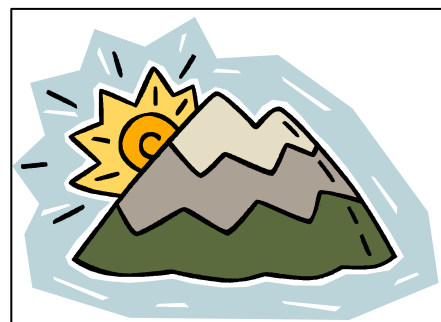
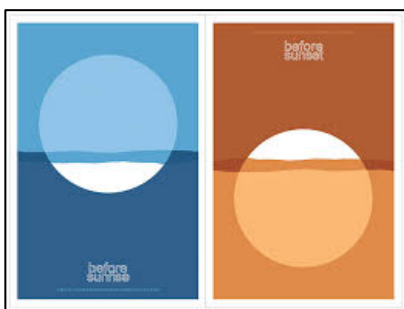
All the planets in our solar system rotate. A planet revolves around the Sun and spins on its own axis. The spinning of the Earth results in different events, such as sunrise and sunset and day and night.

#### Earth's own Rotation

The Earth rotates in a similar way to the wheels on a bicycle. It moves in place around an **axis**. An axis is an imaginary line through the centre of something. The axis runs from the North Pole to the South Pole. The Earth takes 24 hours to complete one **rotation**. This time period is the length of one day. We experience this as day and night. During the rotation, the side of the Earth facing the Sun experiences daytime. The opposite side then experiences night-time.

#### Sunrise and Sunset

From Earth it seems as if the Sun moves from one side to another. The Sun rises from the east and it sets in the west. In the middle of the day the Sun is right above us. We now know why day and night occur and that the Sun doesn't move. The Earth moves.



**Vocabulary**

Rotation – the turning movement of an object around its axis.

Axis – an imaginary line through the centre of something.

**Summary**

*Each planet in the solar system rotates on its own axis. The Earth rotates once in 24 hours. During this time, we experience daytime and night-time. During rotation one side of the Earth faces the Sun and the opposite side faces away from the Sun, experiencing night.*

**Revision Activity**

1. Does the Moon make its own light? Explain how the moon gives us light at night?
2. Can we see the Moon during the day?
3. Does the full Moon look bigger when it rises and then again smaller when it's high in the sky?
4. Is it easier to see the stars when the Moon is full or not full?
5. List 4 differences between the Moon and the Earth.

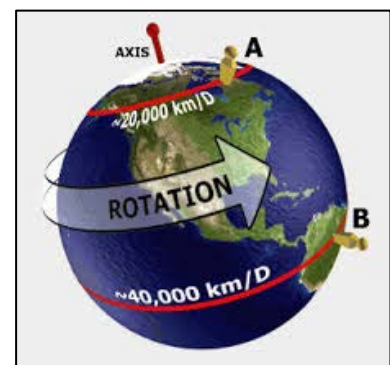
## Unit 4 – Movements of the Earth and Planets: Revolution (Earth)

### Lesson 4: Movements of the Earth and Planets

All planets revolve around the Sun in their own orbits. It takes the planets different time periods to complete their orbits.

**The Earth's Orbit**

Although it seems that the Sun moves around the Earth, it does not move at all. The Sun is a star at the centre of the solar system. The Earth moves around the Sun in an orbit, this movement is referred to as the revolution of Earth around the Sun. It takes Earth 365  $\frac{1}{4}$  days to complete one orbit





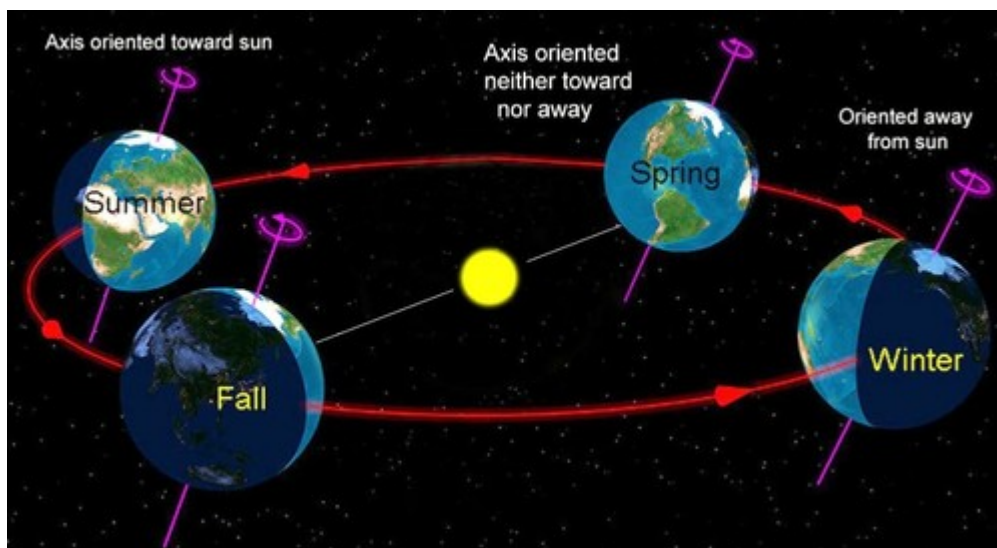
around the Sun. this time period is more commonly referred to as a year. A year is divided into 12 months and the 12 months are divided into four **seasons**.



We have different seasons because the Earth receives different amounts of heat and light during the year. This is because the Earth's orbit is not completely round. Orbits are **oval-shaped**. When the Earth is closer to the Sun, it is warmer, as when it is further Earth becomes colder. This way we experience winter and summer.

## The Four Seasons

Seasons are based on the rotation of the Earth around the Sun. The orbit of the Earth around the Sun is **elliptical** and Earth is **tilted**. The side that is facing the Sun is experiencing summer, while the other half is experiencing winter. This means that when it is summer in the southern hemisphere, it is winter in the northern hemisphere. The seasons change at the same time every year. They change on or around the 21<sup>st</sup> of June, September, December and March.





### DID YOU KNOW?

Did you know; a group of stars called Pleiades is only visible in summer in southern and West Africa. When people saw these seven stars they knew it was time to plant crops.

#### Activity 4

Draw the Earth's Orbit

1. Draw the orbit of the Earth around the Sun. Add the names of seasons to your drawing.

### Summary

*The Earth revolves once around the Sun in its own orbit in 365  $\frac{1}{4}$  days. We experience this as one year or 12 months. During this time period, Earth experiences both winter and summer. Earth experiences 4 different seasons.*

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## Unit 5 – The Movement of the Moon: Rotation

### Lesson 5: Rotation of the Moon

The Moon is the biggest and brightest object when we look up to the night-sky. The Moon reflects light from the Sun. The lit part of the Moon always points towards the Sun. the force of gravity between the Earth and the Moon holds the Moon's near side facing us.

### DID YOU KNOW?

Nobody knew what the far side of the Moon looked like until the Soviet Luna spacecraft went into orbit around the Moon in 1959 and photographed the far side.

### The Rotation of the Moon

From Earth we only see one side of the Moon. If you were to stand on the Moon and look at the Earth, you would see our planet in the same position every time. This is why many people think that the Moon does not rotate. The Moon rotates on its own axis in the same amount of time it takes to orbit the Earth once. It takes the Moon 28 days to complete one rotation and revolve around the Earth.

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## Unit 6 – The Movement of the Moon: Revolution

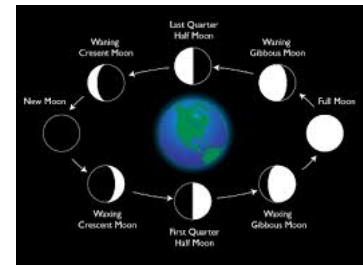
### Lesson 6: Revolution of the Moon

#### Let us check:

The Moon takes 28 days to complete one rotation.

There are 30/31 days in a month (except February which has 28/29 days)

The Moon is the Earth's only natural satellite.



### The Moon Orbits the Earth

The Moon rotates around its own axis. Rotation is the same as spinning. The Moon also revolves around the Earth in its own orbit. The rotation and revolution of the Moon around the Earth happens at the same time. The Moon is a sphere-shaped rock that orbits the Earth. It is closer to Earth than the Sun or any other planet.

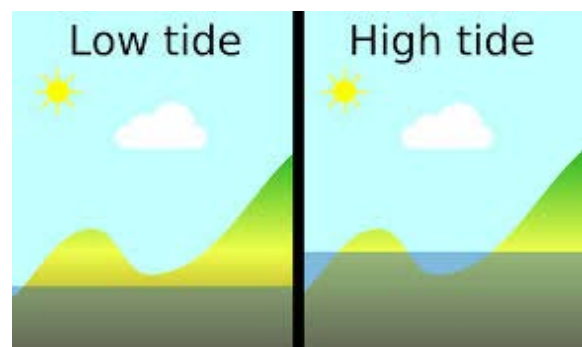
### The Rising and Setting of the Moon

The Moon rises and sets like the Sun. it rises in the east and sets in the west. We can tell direction by looking where the Sun is during the day and where the Moon is at night.

### The Moon and the tides

The Moon plays an important role in the high and low tides of the ocean. The **gravitational force** between the Earth and the Moon pulls on the surface of the water. The effect of gravity on water can easily be seen when we tilt a class of water. Gravity causes the water to move in the direction that the class is tilted. This is similar to what happens when the gravitational force of the Moon or Sun pulls on our oceans.

During full and new Moon, the gravitational forces of the Sun and Moon combine to produce the highest tide. This is called a **spring tide**. During quarter Moon, the gravitational forces of the Sun and the Moon oppose each other. This produces the lowest tide called **neap tide**.



**Vocabulary**

Gravitational force – pull between two or more objects.

Spring tide – the highest tide during the full and new Moon.

Neap tide – lowest tide during the quarter Moon.

**Activity 6**

Copy the sentences below into your workbook, choosing the correct word in each one.

1. The Moon rotates/revolves on its axis once in 28 days.
2. The Moon rotates/revolves around Earth once in 28 days.
3. We can see one/both sides of the Moon from Earth.

**Summary**

The Moon revolves around the Earth once in 28 days. The Moon takes the same time to revolve around the Earth as it takes to rotate on its own axis. The Moon does not revolve around the Sun in its own orbit. It revolves around the Sun together with the Earth.

**Summary**

*The Moon revolves around the Earth once in 28 days. The Moon takes the same time to revolve around the Earth as it takes to rotate on its own axis. The Moon does not revolve around the Sun in its own orbit. It revolves around the Sun together with the Earth.*

**Revision Activity**

1. Complete all the sentences using all the words from the word-box.
  - a. The Sun stays in \_\_\_\_\_.
  - b. The Earth rotates on its own \_\_\_\_\_.
  - c. The Moon revolves \_\_\_\_\_>
  - d. The \_\_\_\_\_ revolve together in a big circle around the Sun.
  - e. We only ever see \_\_\_\_\_ side of the Moon.

**Word Box**

Moon and the Earth

Around the Earth

One side

Axis

The same place

## Unit 7 – Systems for looking into Space: Telescopes

### Lesson 7: Telescopes

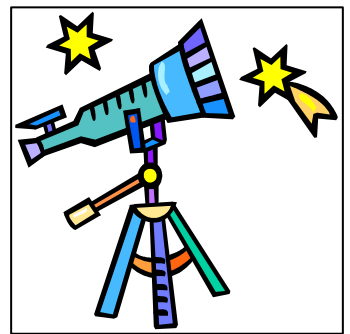
Let us check: distance in space is measured in light years.

There are many objects in space that are too far away to see with the human eye.

People have been studying the night sky for centuries. Different groups of people each had their own beliefs about the stars, the Moon and the Sun.

#### A simple Telescope

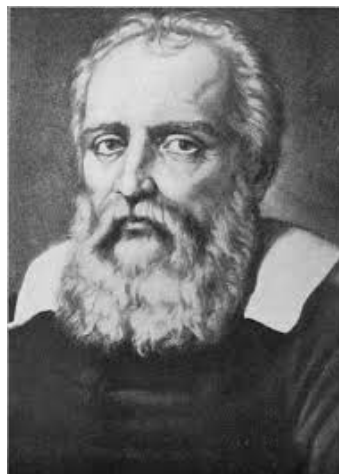
**Telescopes** are used to look into space and gather information. A Simple telescope is made of a pair of lenses placed in a tube; one in the front and one at the back. The lens in front is used to make images clearer. The lens at the back makes the image bigger. South Africa has built and uses some of the largest telescopes in the world. Telescopes allow people to see distant objects in much more detail.



Telescopes are mainly used for looking into space and gathering information about what space is like. Knowing about the history of the solar system helps us to understand the history of the Earth. Today we know many facts about the **bodies in space**, like what they are made of and how they move.

#### DID YOU KNOW?

In 1609 Galileo Galilei, an Italian scientist, first looked through his small homemade telescope at the stars.



**Vocabulary**

Telescope – instrument that magnifies distant objects and make them seem closer.

Bodies in Space – this is all the planets, stars, Moons and other objects.

Magnifies – makes bigger.

Optical – means it is used by our eyes.

**Activity 7**

## Case Study – Southern African Large Telescope

**SALT: Africa's eye on the universe**

On a hilltop in a nature reserve in the Northern Cape, near the small town of Sutherland, is a masterpiece of modern engineering. The Southern African Large Telescope (SALT) is the largest optical telescope in the southern hemisphere, and the same size as the largest telescope in the world.

SALT gathers more than 25 times as much light as any existing African telescope. It can detect objects as faint as a candle flame on the Moon. It is one of the leading systems for looking into space.

It allows local and international scientists to see distant stars and galaxies a billion times too faint to be seen by the human eye.

Answer the following questions in your workbook.

Explain what the acronym SALT stands for.

1. State where SALT is situated.
2. Explain why South Africans are not the only people who work at SALT.
3. State why you think SALT is special to South Africa.



## Summary

*Telescopes are used to look into space and gather information. Telescopes magnify objects so that we can see them better. We see through optical telescopes. South Africa has built and uses some of the largest telescopes in the world.*

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## Unit 8 – Systems to explore the Moon and Mars: Vehicles used on the Moon

### Lesson 8: Exploration of the Moon and Mars

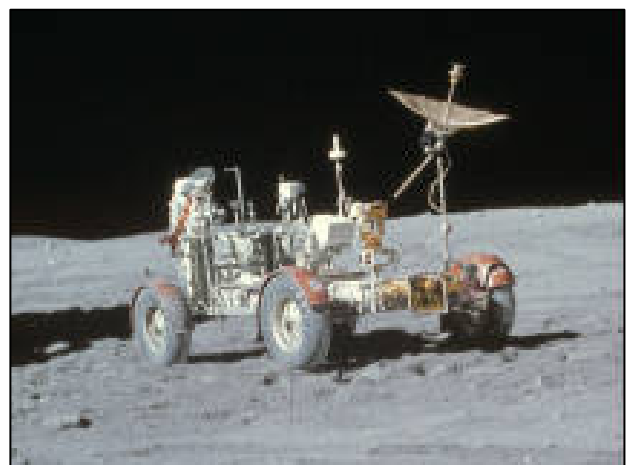
#### Let us check:

There is no water or air on the Moon.

The Moon is the Earth's only natural satellite.

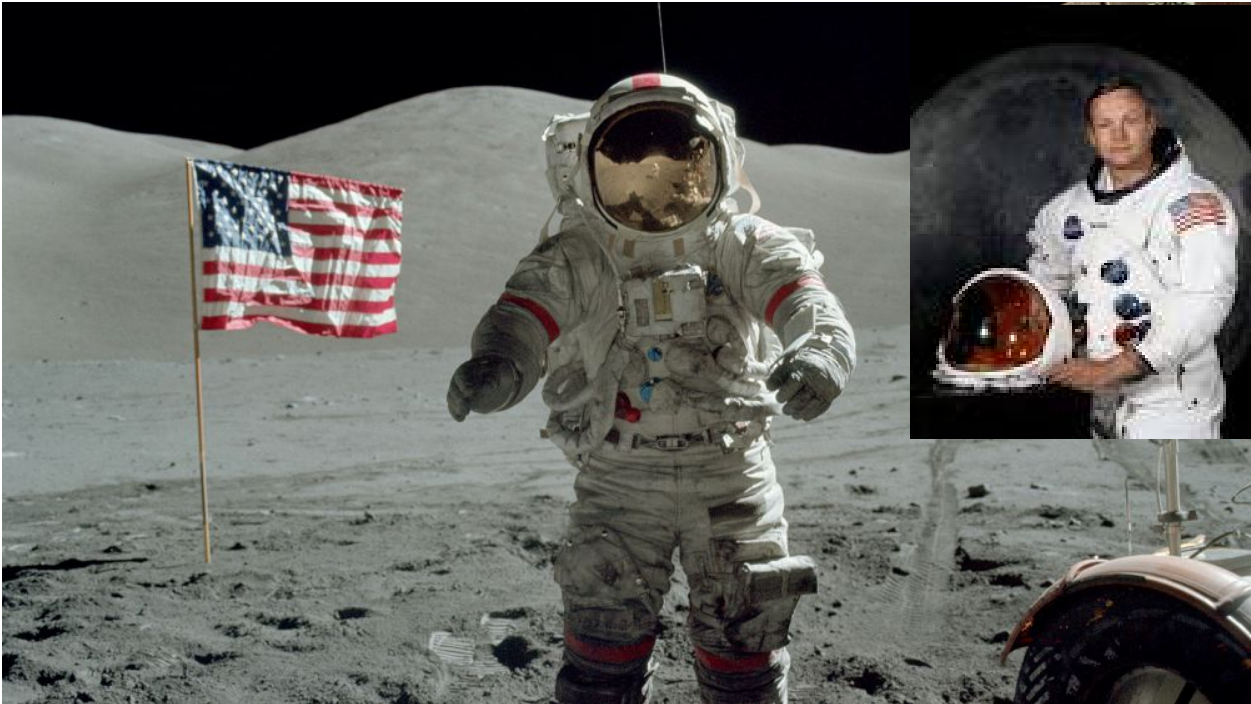
The surface of the Moon is rocky and dusty.

The first time people landed on the Moon was in 1969. The first people to walk on the Moon were two Americans by the names of Neil Armstrong and Buzz Aldrin. Since then, a few people have visited the surface of the Moon and have explored it using a vehicle called the **Moon Rover**.



**DID YOU KNOW?**

When he first stepped onto the Moon, Neil Armstrong said, "That's one small step for man; one giant leap for mankind."

**DID YOU KNOW?**

Pratley Putty is glue invented by a South African engineer, George Pratley. This special glue is so strong that it was used by NASA on the Eagle landing craft of *Apollo XI* in 1969.

## Unit 9 – Systems to explore the Moon and Mars: Vehicles used on Mars

### Lesson 9: Vehicles used on Mars

#### Let us check:

Mars is the fourth planet from the Sun.

Mars is made up of rock and is an interior planet.

There is no liquid water on Mars.

Mars is often called the Red Planet. It has not yet been visited by humans. Instead, vehicles called Mars Rovers have been used to explore the surface of Mars.



## Mars Exploration

The Mars rovers are designed to operate on Mars. Mars is quite different from Earth, so the rovers have to be planned and built very well. Each rover has several different cameras to view the landing are. This allows scientists to explore the surface of Mars from Earth. Some of the cameras are used for avoiding obstacles. In general, the rovers can travel up to 100 metres a day. They often travel less because they gather information about the soil and rocks on the surface.



Mars rovers even have heaters to keep the batteries warm. The temperatures on Mars can drop to well below freezing point.



## Activity 9

[Read the Case Study](#)

### The Curiosity Mars Rover

The Mars Rover called The Curiosity landed near the Martian equator on 5 August 2012. The rover can examine a rock on Mars with a set of tools at the end of its arm. These arms can extend to about two metres. Two instruments on the arm can study rocks up close. A drill can collect samples from inside the rocks and a scoop can pick up samples of soil. The arm can sieve the samples and deliver fine powder to instruments inside the rover for thorough analysis.



Answer the following questions in your workbook

1. Explain what the equator is.
2. Give a reason why the rover should examine rocks.
3. Describe what the word analysis means

