UNIT

1

Planet Earth and its representation

Objectives

In this unit you will learn about...

- the Universe, galaxies and astronomical objects.
- the Earth's movements and the phases of the Moon.
- the layers of the Earth.
- globes, maps and plans.
- geographic coordinates.

Our planet, Earth, is part of the Solar System. At the centre of the Solar System there is a star – the Sun. Earth is the third planet from the Sun. The Solar System is in the Milky Way galaxy. There are millions of galaxies in the Universe.

The Earth's atmosphere allows life to exist on the planet. The atmosphere is formed by layers of gases which contain the air we breathe and protect us from the Sun's harmful radiation.

Scientists think that the Universe started millions of years ago with a huge explosion called the Big Bang. According to this theory the Universe is still expanding.

The Universe contains millions of astronomical objects. In our Solar System there are planets, asteroids, comets and natural satellites, such as the Moon. The Moon influences life on Earth in many ways.

The Earth is constantly in movement. It moves in two different ways. It rotates on its axis, producing day and night, and it revolves around the Sun, producing the seasons.

Humans have always found ways to represent the Earth. Early maps were drawn by navigators and explorers, but were not very accurate. Nowadays very detailed maps are made using satellites and other advanced technologies.

1. Think, pair, share! **Look at the photos. In your notebook, write a sentence to describe each photo. Compare your sentences with a classmate.**

Photo 1 shows...

2. 2 **Listen and choose the correct option.**

a) The oldest world map is from the *1st century B.C./6th century B.C.*
b) Maps developed rapidly in Europe during the *early/late* Middle Ages.
c) The letters GPS stand for *Global Positioning System/Geographical Plotting System*.

3. **Read the information about the photos and answer the questions.**

a) According to scientists, how did the Universe begin?
b) Why is the Earth's atmosphere important?
c) Where in the Universe is the Earth located?
d) In what two ways does the Earth move?

The Universe

Read and think

1. Read and find out.

a) How old is the Universe?

b) What's the difference between a galaxy, a star and a planet?

The **Universe** is everything that exists. It contains millions of **galaxies**. These contain **stars**, **planets** and other **astronomical objects**.

Scientists believe that the Universe started with an explosion called the **Big Bang**, about 14 thousand million years ago. The explosion sent pieces of matter expanding in different directions. The different astronomical objects in the Universe today are made up of these pieces of matter.

The Milky Way

Galaxies are systems composed of dust, gas and thousands of millions of stars. They can have different shapes.
Our galaxy is called the Milky Way. It's spiral-shaped. Other galaxies are **elliptical** or irregular.

Stars are astronomical objects that produce heat and light. They're made up of burning gases. The Sun is the nearest star to Earth and it's essential to life on our planet. It's mostly made up of hydrogen and helium.

Planets are spherical astronomical objects that orbit a star. The Earth is 149 600 000 km away from the Sun.

Natural satellites are astronomical objects that orbit a planet. The Earth has one satellite, the Moon.

Asteroids are bodies of rock that are too small to be considered planets. **Comets** are balls of ice and dust that grow tails as they approach the Sun.

A comet

The Solar System

The **Solar System** is the part of the Milky Way galaxy where Earth is located. There are **eight** planets in the Solar System. The planets all orbit the Sun.

The Solar System also contains smaller astronomical objects, such as natural satellites, asteroids, meteorites and comets.

The **inner** Solar System has four small planets. In their order from the Sun these are: Mercury, Venus, Earth and Mars. They're made of rock.

The **outer** Solar System has four giant planets: Jupiter, Saturn, Uranus and Neptune. Some have rings and satellites. The outer planets are mostly made of gas and are colder than the inner planets.

Activities

2. **In your notebook, match to make sentences.**

a) Galaxies contain millions of stars...
b) Stars are astronomical objects ...
c) The Universe began with...
d) Astronomical objects which orbit a planet...
e) Pieces of rock that are smaller than planets...

1. are called asteroids.
2. an event called the Big Bang.
3. and can have different shapes.
4. that produce heat and light.
5. are called natural satellites.

3. 3 **Listen and answer the questions.**

a) What do scientists call Halley's Comet?
b) How often does it appear?
c) When did it last appear?
d) When will it appear again?

4. Create **Use Search and discover! or the Internet to find out more about a planet. Make a planet poster.**

5. 4 QUIZ **Check your learning.**

The Earth and the Moon

How do the Earth's movements affect us?

Read and think

1. **Read and find out.**

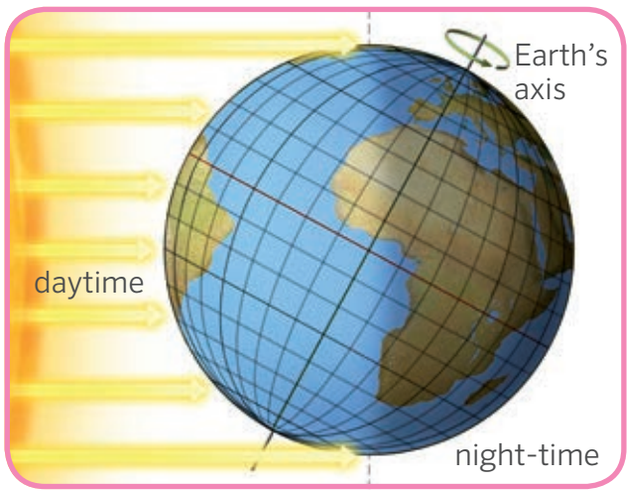
a) Which of the Earth's movements causes the seasons?

b) How long do you think a lunar month is?

The Earth moves in two different ways: **rotation** and **revolution**. Rotation is the movement of the Earth on its imaginary **axis**. Revolution is the movement of the Earth around the Sun.

Rotation

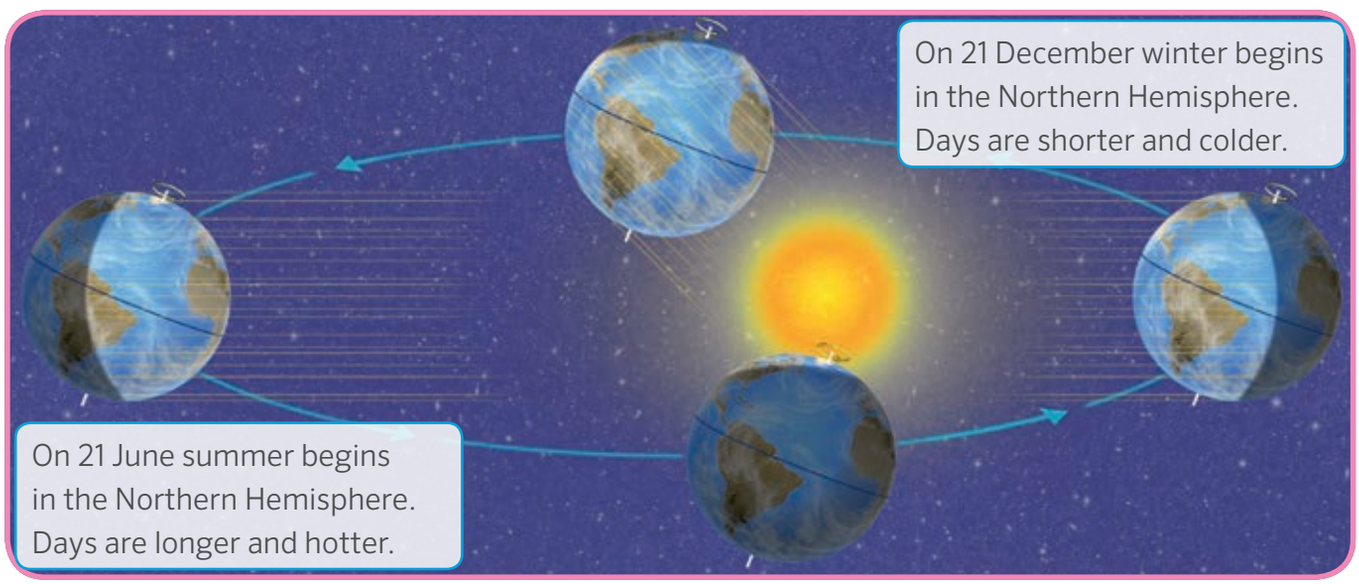
The Earth rotates on its axis in an **anticlockwise** direction. It takes 24 hours to complete one rotation. This movement causes day and night. The light of the Sun can't reach all the Earth's surface. It's **daytime** in the half of the planet that's facing the Sun and **night-time** in the half that is facing away from the Sun.



Revolution

It takes the Earth 365 days, six hours and nine minutes to complete one revolution around the Sun. This movement causes the **seasons**.

As the Earth revolves around the Sun, the seasons change. Because the Earth's axis is **tilted** and the Earth's orbit is elliptical, some parts of the Earth receive more light and heat than others at different times of the year.



Seasons in the Northern Hemisphere are opposite to the seasons in the **Southern Hemisphere**. When summer begins in the Northern Hemisphere, winter begins in the Southern Hemisphere.

The phases of the Moon

The Moon is the Earth's natural satellite. We can see the Moon because it reflects light from the Sun. The Moon rotates on its axis and also revolves around the Earth, taking approximately 28 days to complete one revolution.

The revolution of the Moon causes its appearance to change during the month. These changes are called the **phases of the Moon**.

New moon: we can't see the Moon at all.

Waning crescent: the Moon has almost disappeared.

Third quarter: we can see half of the Moon in the shape of a C.

Waning gibbous: the Moon starts to get smaller.

Waxing crescent: the Moon appears as a slim crescent.

First quarter: we can see half the Moon in the shape of a D.

Waxing gibbous: we can see most of the Moon.

Full moon: we can see the whole Moon.

Activities

2. **Copy and complete the sentences in your notebook.**

a) The movement of the Earth on its axis is called...

b) The movement of the Earth around the Sun takes ... and is called...

c) When we can't see the Moon, this is called a...

3. 5 **Listen and write *true* or *false*.**

a) Tides are caused by the gravitational pull of the Moon.

b) Spring tides have the smallest difference between high and low water.

c) Neap tides happen when the Sun and Moon are at right angles to the Earth.

4. Think, pair, share! **Use Search and Discover! to find out more about the Moon. Work with a classmate to answer the questions.**

a) How far is the Moon from Earth?

b) How does the Moon influence life on Earth?

c) How have humans explored the Moon?

5. 6 QUIZ **Check your learning.**

The layers of the Earth

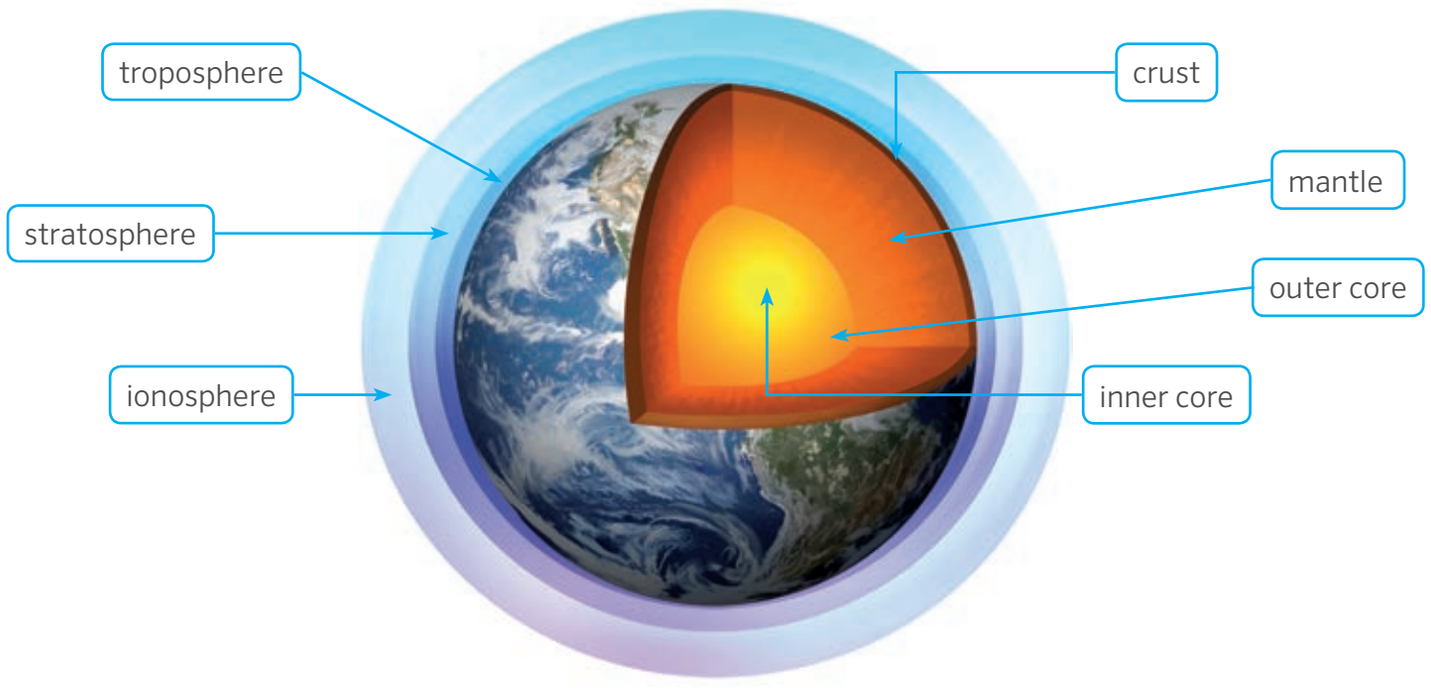
Read and think

1. **Read and find out.**

a) How many layers make up the solid part of the Earth?

b) Why is the atmosphere important for life on Earth?

The Earth is made up of different layers. The solid part of the Earth, the **geosphere**, is divided into three main layers. The outer part of the Earth is gaseous and is called the **atmosphere**. It's made up of three layers.



The geosphere

- The **crust** is the outer layer of the Earth. It's made of rock. It contains the continents, islands and the ocean floor. The crust is between 8 and 32 kilometres thick.
- The **mantle** is a hot layer of magma and other semi-liquid rocks and minerals. It's about 1 400 km thick.
- The **core** forms the centre of the Earth. The **outer core** is made of melted iron and other metals. The **inner core** is solid and contains different metals.

The atmosphere

- The **troposphere** is the layer of the atmosphere in which we live. It contains the air that living things need. It's the thinnest layer.
- The **stratosphere** is the next layer up. It contains the ozone layer and little air. The ozone layer is important because it protects living things from harmful radiation.
- The **ionosphere** has almost no air and is where we have artificial satellites.

Taking care of the atmosphere

The **atmosphere** is essential for life on Earth. It contains natural **greenhouse gases** which trap heat and maintain a temperature which makes life possible on Earth. The ozone layer helps protect us from harmful ultraviolet rays.

Human activity can affect the atmosphere. The burning of **fossil fuels** releases large amounts of greenhouse gases, including carbon dioxide, into the atmosphere. These extra gases trap more heat and the Earth gets warmer. This is known as **global warming**.

Man-made greenhouse gases are produced by industry, agriculture and transport.

The emission of gases from industry and vehicles can also cause air pollution. In some urban areas, **air pollution** is so bad that it causes people to have respiratory problems.

Activities

2. **In your notebook write *true* or *false*. Correct the false sentences.**

a) The outer core is made up of continents, islands and the ocean floor.

b) The ozone layer is located between the ionosphere and the troposphere.

c) Scientists think the Earth is getting cooler due to human activity.

d) The inner core is semi-liquid and made up of rock and minerals.

3. 7 **Listen and answer the questions.**

a) Which of these gases is not mentioned: carbon dioxide, methane or sulphur dioxide?

b) Which people suffer most from air pollution?

c) According to the doctor, how can individuals protect the atmosphere?

4. Think **What else can we do to protect the atmosphere? Discuss your ideas with a classmate.**

I think we could... To protect the atmosphere we should/shouldn't...

5. 8 QUIZ **Check your learning.**

Representing the Earth

Read and think

1. **Read and find out.**

a) Which provides a more realistic representation of the Earth's surface: a globe or a map?

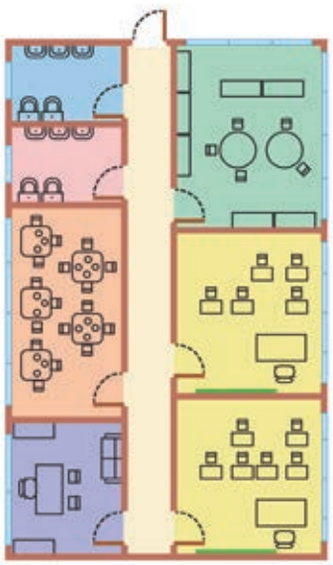
b) What's a map's scale used for?

There are different ways of representing the Earth. **Globes** imitate the real shape of the Earth in three dimensions. **Maps** and **plans** represent the Earth in two dimensions.

A **globe** is a spherical, three-dimensional representation of the Earth's surface. Areas and distances are not distorted.

A **map** is a two-dimensional representation of the Earth on paper or another flat surface. Geographical areas and distances are distorted. How they are distorted depends on the map's **projection**.

A **plan** is a two-dimensional representation of a room or building.



Physical maps represent landforms and relief. Elements such as mountain ranges, rivers and lakes are often shown using different colours.

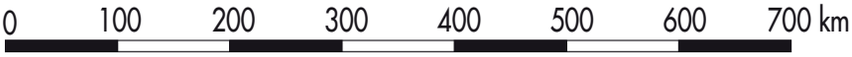
Political maps show the borders of countries, states, provinces and counties. They may show capital cities and other human settlements.

Scales

Distances on a map are much smaller than real distances. We can use a map's **scale** to calculate the real distances it represents. There are two types of scale: **numerical scales** and **graphic scales**.

A **numerical scale** shows a proportion, such as 1:50 000. This means that real distance is 50 000 times bigger than the distance on the map. One centimetre on a map represents 500 metres in real distance. That's 50 000 x 1 cm = 50 000 cm, or 500 m.

A **graphic scale** appears as a bar divided into centimetres. Each centimetre represents a real distance. For example, the scale below tells us that one centimetre represents 100 km.



Symbols

Maps also have **symbols**. These are small drawings or lines which represent different elements of a landscape.

Symbols can show man-made elements such as buildings, roads and railways, or natural elements such as relief, rivers and forests. Most maps include a **key** which shows what each symbol means. Most maps also include the **cardinal points** or an arrow that shows north.

Activities

2. **In your notebook, write simple definitions for these words.**

a) plan **b)** symbol **c)** globe **d)** key **e)** map

3. 9 **Listen, copy and complete the sentences.**

a) The girl likes her new app because she can change between ... and ... mode.

b) The map has a ... that changes when you zoom in or out.

c) The app uses ... to show places of interest.

4. Do! **Look at the maps on pages 74 and 76 and complete the activities.**

a) What are the similarities and differences between the maps? Write sentences.

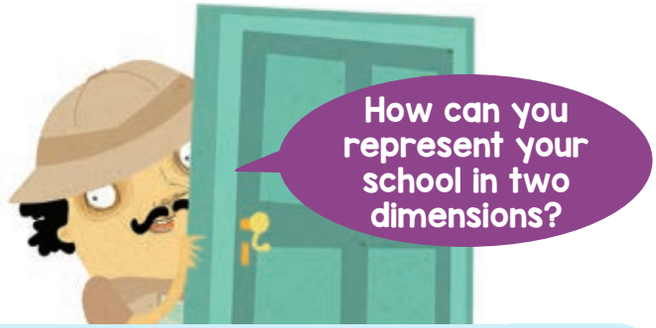
The physical map shows...

b) Which continents are these places in?

- The Himalayas
- Washington DC
- Beijing
- Lake Victoria
- The Great Dividing Range
- Mogadishu

5. 10 QUIZ **Check your learning.**

Project time!



RESEARCH

- Think, pair, share! **Work with a classmate. Talk about your school building. Imagine what it looks like from above. Describe it.**

  There is/are... The ... is next to/near/in front of...

- **In the same pairs, answer the questions.**

  a) Where are the boundaries of your school?

  b) What do you think is the longest distance from one point to another?

  c) Which are the largest areas? Think about the playground, gym and dining room.

  d) How many buildings are there?

  e) Where are some of the main areas, such as the entrance, reception and teachers' room?

- **Work together to draw a rough plan of your school on A4 paper. Use your break times to check your rough plan.**

DO

MATERIALS

- compass
- ruler
- coloured pens or pencils
- A4 paper
- A3 paper

1. Evaluate your rough plan with a classmate. Does it show all the main areas? Are they located correctly? Are they the correct size? Don't worry if some small details are missing.

2. Copy your rough plan onto the A3 paper. Use a ruler and a pencil so you can make changes. Draw the boundary and the entrance first.

3. Add the playground and the buildings. Start with the biggest buildings and then add smaller buildings and the rooms inside some of the buildings.

4. Colour all the classrooms the same colour. Colour the administrative rooms another colour.

5. Think of suitable symbols for the toilets, the dining room, the playground and other places on your plan.

6. Use a blank space on your plan to draw a key. Add a title.

7. Use a compass to find out which direction is north. Mark this on your plan.

8. If possible, include an approximate scale.

SHARE

- **Present your plan of the school to your class.**

  This is a plan of... Here you can see... This symbol represents...

- **After all the presentations have been made, answer the questions.**

  a) Whose plan was the clearest?

  b) Whose plan was the most detailed?

  c) Whose plan was the most accurate?

  d) How could you improve the plans?

Geographic coordinates

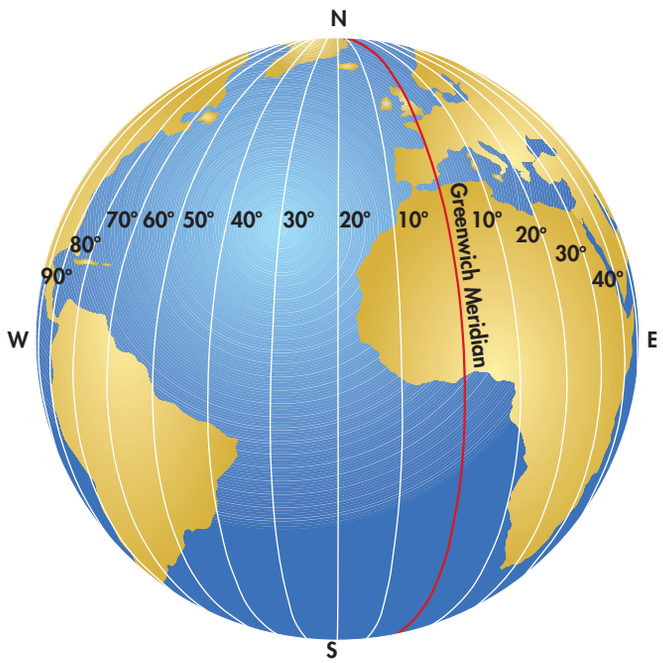
Read and think

1. **Read and find out.**

a) What are meridians and parallels?
b) What's the name of meridian 0º?
c) What are geographic coordinates?
d) Why are geographic coordinates important?

Meridians and parallels

Globes and maps have imaginary lines called **meridians** and **parallels**. We use the point where these lines cross to accurately describe a location on the Earth's surface.

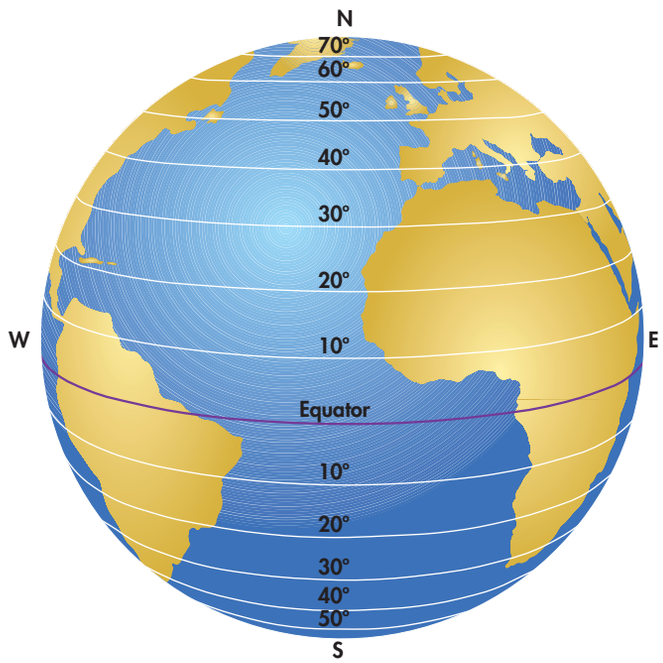


Meridians are the semi-circular lines which go from the North Pole to the South Pole.

Meridians measure **longitude** in degrees east (ºE) and degrees west (ºW).

Meridian 0º is called the **Greenwich Meridian**. It runs through London, in the United Kingdom.

The minimum number of degrees is 0 and the maximum is 180.



Parallels are the circular horizontal lines around the Earth.

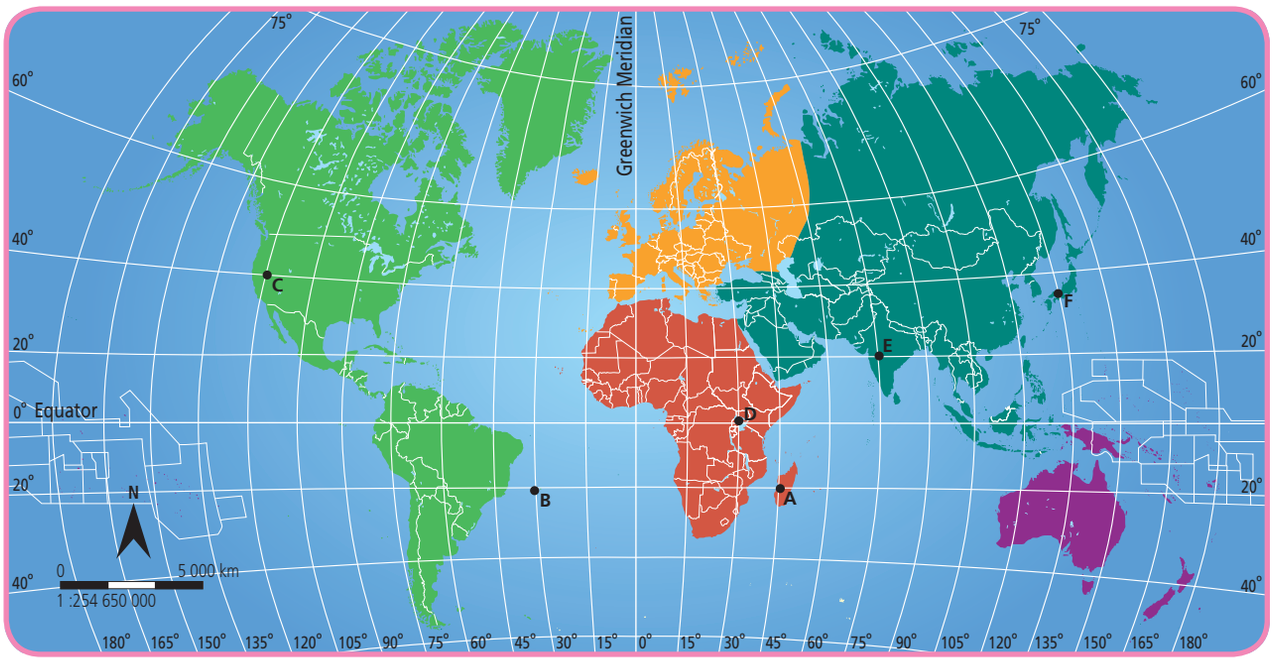
The parallel which separates the Earth into two equal hemispheres is called the **Equator**.

Parallels measure **latitude** in degrees north (ºN) or degrees south (ºS) of the Equator.

The minimum number of degrees is 0 and the maximum is 90.

We use **geographic coordinates** when we want to locate a point on the Earth's surface with accuracy. These coordinates give a numerical description of a point on Earth in relation to its latitude and longitude.

Geographic coordinates are given in **degrees** (°) and always show the latitude first (N or S) followed by the longitude (E or W). For example, the geographic coordinates for New York are 40° N 74° W.



Activities

2. **Copy and complete the sentences in your notebook.**

a) ... are measured in degrees north (°N) and south (°S).

b) The points where parallels and ... cross are called...

c) Longitude is measured in ... east (°E) or west (°W) of the...

3. 11 **Look at the map above and answer the questions.**

4. Think, pair, share! **Look at the maps on pages 74 and 76 and the map on this page. Answer the questions with a classmate. Then write two more questions for another pair.**

a) Which countries does the Equator pass through?

b) Name one river, one lake and one mountain range that the Equator crosses.

c) At what approximate latitudes are the Tropic of Cancer and the Tropic of Capricorn?

5. 12 QUIZ **Check your learning.**

Search and discover!

Touchdown on the red planet!

12 December 2018

After a 56 000 000 km journey lasting seven months, NASA's InSight lander finally arrived on the surface of our nearest neighbouring planet, Mars. And what was the first thing it did on arrival? It took a selfie! This isn't the first time that NASA has put a lander on Mars to send photos back to Earth. However, this time InSight has also sent audio recordings – the first sounds ever from Mars.

Ever since 1610, when Galileo Galilei discovered Saturn's rings using a telescope, people have wondered what they're made of. Are they solid? Are they gaseous?

Today, more than 400 years later, we know that the rings aren't solid, as they appear from Earth, but are instead made up of floating chunks of ice, rock and dust. These chunks can be as small as tiny specks or as big as houses. We also know that Saturn has seven main rings, each one made up of thousands of tiny ringlets. The rings are huge – the biggest ones are 273 588 km in diameter.

How do we know all this? Well, Saturn has been 'visited' by several spacecraft, including the *Pioneer* and *Voyager* missions in the 1970s and 1980s. On the most recent mission, the *Cassini-Huygens* spacecraft spent 13 years exploring Saturn – and even landed a probe on Titan, one of Saturn's moons.

What can *The Martian* tell us about Mars?

In the 2015 science-fiction film *The Martian*, actor Matt Damon plays an astronaut who has to survive alone on Mars while his fellow astronauts try to rescue him. The film raises some interesting questions about the exploration of Mars.

- **Has Mars got an atmosphere?** Yes, but it's only 1% as thick as Earth's and it only contains 0.1% oxygen. Keep your spacesuit on, Matt!
- **Is there gravity?** Yes, but it's only about 33% as strong as Earth's gravity, so walking around in a big heavy spacesuit should be easier!
- **Is there water?** Yes, but probably not in liquid form. There's ice and permafrost in the soil, especially near the poles.

	Neptune	Uranus	Saturn	Jupiter	Mars	Earth	Venus	Mercury
Distance from the Sun	4.5 billion km	2.88 billion km	1.43 billion km	779 million km	225 million km	150 million km	108 million km	57 million km
Rings	Yes	Yes	Yes	Yes	No	No	No	No
Axial tilt	28.3°	97.8°	26.7°	3.1°	25.2°	23.5°	177°	2°
Natural satellites	14	27	62	67	2	1	0	0

Did you know?

The Greek astronomer and mathematician Hipparchus was one of the first people to calculate the distance from the Earth to the Moon. He did this in the 2nd century B.C.! The actual distance varies, but the average distance is about 384 400 km.

Animals and the Moon

Have you ever wondered why your dog or cat behaves strangely at the time of a full moon? On full moons...

1. Pets have more accidents. Vets report far more visits to their clinics on nights when the Moon is full.
2. Lions hunt in daylight. Lions usually catch their prey at night, but they sometimes kill during the day, especially after a full moon.
3. Scorpions glow blue. Some species of scorpions glow in the dark when the Moon's ultraviolet rays are strongest.
4. Corals spawn. During a full moon, corals release millions of tiny eggs. This event, which takes place off the coast of Australia, can even be seen from space.

Moon exploration timeline

- **2019** – Chinese Yutu 2 rover – first soft landing on the far ('dark') side of the Moon.
- **2007–2009** – Japan, India, the US and China launch Moon orbiters.
- **1994** – Clementine mission – NASA project maps large parts of the Moon.
- **1972** – Apollo 17 – last manned landing of the Apollo programme.
- **1969** – Apollo 11 – astronaut Neil Armstrong becomes the first human on the Moon.
- **1968** – Apollo 8 – NASA spacecraft; first manned flight to the Moon, circling it 10 times before returning to Earth.
- **1966** – Luna 9 – first soft landing on the Moon.
- **1964** – Ranger 7 – NASA spacecraft; first close-up TV pictures of the Moon's surface.
- **1959** – Luna 2 – Soviet spacecraft; first to reach the Moon.
- **1753** – Roger Joseph Boscovich – proves the Moon has no atmosphere.
- **1610** – Galileo Galilei – first observation of the Moon using a telescope.

Let's revise!

1. **In your notebook, write the odd one out. Explain why.**

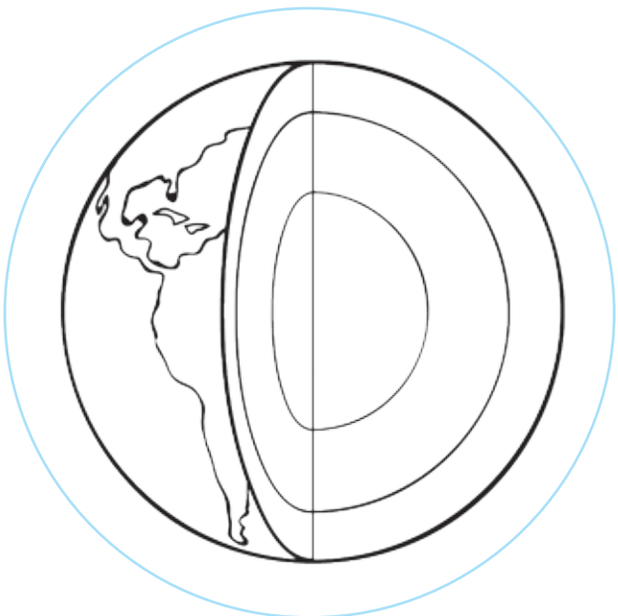
a) Earth Sun Mars Jupiter

The Sun is a star; the others are planets.

b) Mercury Saturn Earth Mars

c) Venus Jupiter Neptune Uranus

2. Do! **Copy the diagram in your notebook. Colour and label the Earth's layers.**



3. **Copy and complete the sentences about the layers of the Earth.**

a) The core is made up of...

b) The ... is made of rock and forms the ... and the ocean floors.

c) The ... is a layer of semi-liquid rock, minerals and ... between the outer core and the crust.

d) The ... contains the ozone layer.

e) Without the ... , life on Earth would be impossible.

4. **Write *true* or *false* and correct the false sentences.**

a) The Earth rotates on its axis in a clockwise direction.

b) Revolution is the movement of the Earth around the Sun.

c) One rotation of the Earth takes 365 days, six hours and nine minutes.

d) When it's winter in the Northern Hemisphere, it's spring in the Southern Hemisphere.

5. **Match the phases of the Moon with the correct pictures. Put them in order, starting with the new moon.**

waxing crescent waning crescent waning gibbous first quarter
full moon waxing gibbous third quarter

a) 

1. new moon

c) 

e) 

g) 

b) 

d) 

f) 

h) 

6. **Copy and complete the text.**

A good map should be clear and well-organised and have at least six basic ingredients. The map should use colours, lines and _____. These are small drawings or icons that represent features on the map, such as buildings or trees. To know what the symbols mean, there has to be a _____. The cardinal points, or an indication of which direction is _____, helps you to orientate the map. Another important feature of a map is its scale. This shows how the map represents real distances. A scale can be _____ or _____.

7. **Find these coordinates on the map on page 17. Write the name of the country. Use the map on page 76 to help you.**

a) 40° S 70° W
b) 60° N 120° W
c) 60° N 105° E
d) 60° N 15° E
e) 30° S 135° E
f) 45° S 170° E

8. 13 QUIZ **Check your learning.**

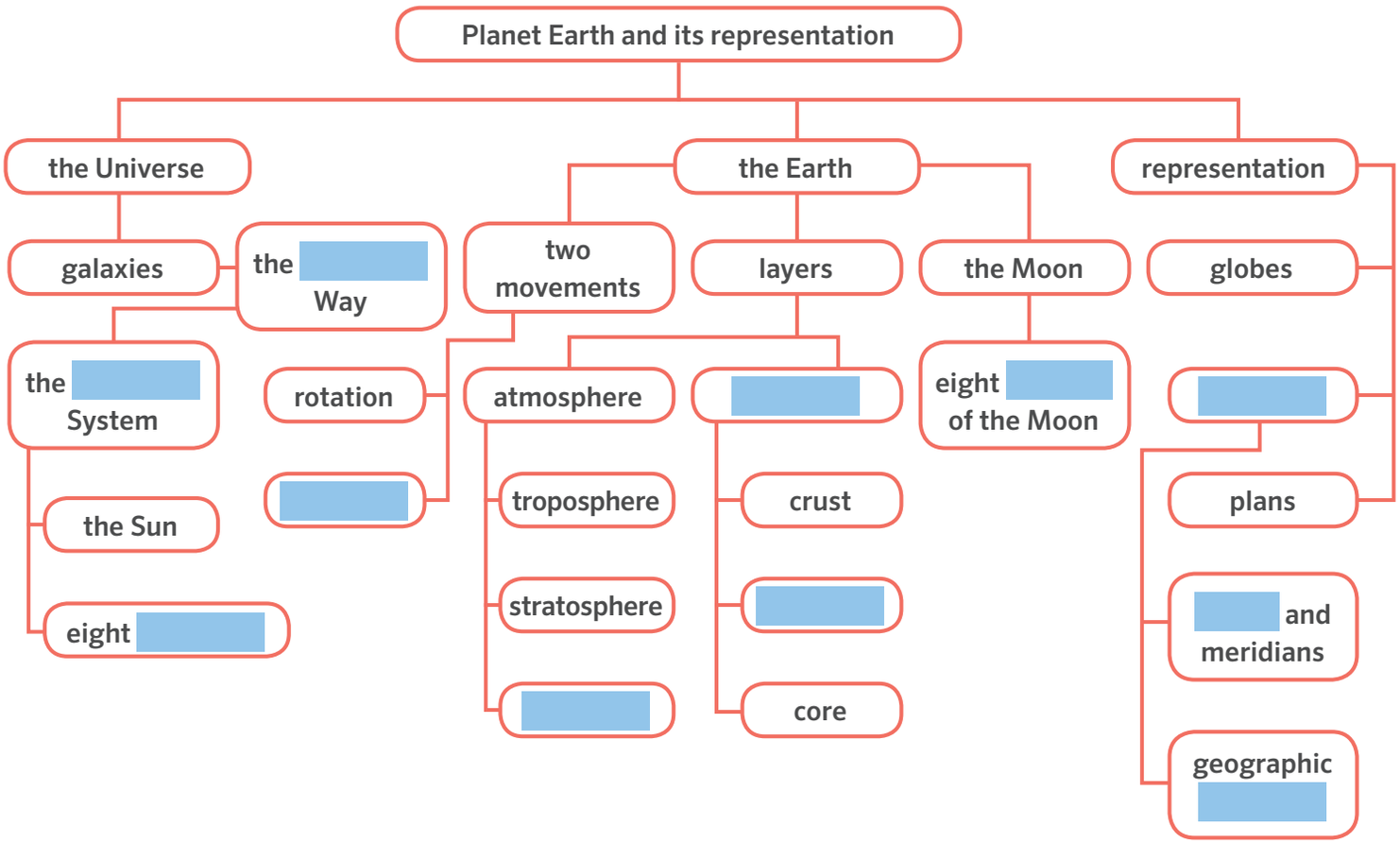
My work in this unit

Write a sentence in your notebook describing the most surprising thing you learned in this unit.

Study skills!

1. **Copy and complete the concept map to summarise the unit.**

coordinates geosphere ionosphere mantle maps Milky parallels phases planets revolution Solar



2. Collaborate **Test a classmate.**

a) In pairs, take turns to choose a word from the concept map or the glossary for this unit.

b) Say the word out loud to your partner. They then write the word and a definition for it.

c) Repeat five times. Then check the all the spellings and definitions together.

d) Choose three words each and write sentences using each one.

3. Do! **Test your memory.**

a) Choose a lesson from the unit. Study the pages for one minute.

b) Close your book. How much you can remember? Make a list.

c) Check your list. Add anything you forgot in a different colour.

GLOSSARY

anticlockwise: turning in the opposite direction to the hands on a clock or watch.

atmosphere: layer of gases around a planet.

axis: imaginary line on which a planet or satellite rotates.

core: central part of the geosphere.

crust: hard, outer layer of the geosphere.

elliptical: having an oval shape.

Equator: parallel which divides the Earth into the Northern Hemisphere and Southern Hemisphere.

galaxy: system of millions of stars, together with gas and dust.

geosphere: solid part of the Earth.

global warming: increase in the average temperature of the Earth.

globe: spherical, three-dimensional representation of the Earth.

Greenwich Meridian: meridian at 0° longitude.

ionosphere: outer layer of the Earth's atmosphere.

latitude: distance north or south of the Equator, measured in degrees.

longitude: distance east or west of the Greenwich Meridian, measured in degrees.

mantle: hot layer of magma and other semi-liquid rocks and minerals under the crust.

meridians: imaginary lines of longitude that go from the North Pole to the South Pole.

parallels: imaginary lines of latitude that circle the Earth parallel to the Equator.

phases of the Moon: changes in the appearance of the Moon during a lunar month.

projection: way a three-dimensional object is represented on a map.

revolution: circular movement around another object.

rotation: circular movement around a central point called the axis.

scale: relationship between distance on a map and real distance.

Solar System: the Sun, planets and other astronomical objects that orbit it.

stratosphere: layer of the atmosphere that contains the ozone layer.

tilted: inclining at an angle; the Earth's axis is tilted.

troposphere: first layer of the atmosphere, above the Earth's crust.

Universe: everything that exists, including galaxies, stars and planets.