

Planet Earth

What do you remember?

- In this photo, what does each colour correspond to?
- Is the Earth an outer or an inner planet?
- What is the interior of the Earth like?
- Where does life exist on Earth: in the geosphere or the biosphere?



Content objectives

In this unit you will ...

- Learn about the Earth's characteristics
- Identify lunar phases
- Describe the geosphere
- Learn about the Earth's "spheres"
- Reproduce conditions of solar and lunar eclipses

Key language

Describing

Water exists in three states.

It takes 28 days to orbit the Earth.

Expressing cause and result

This causes the sequence of day and night.

This makes the seasons occur.

Comparing

The days get shorter.

Ocean trenches are the deepest areas.

1. What is the Earth like?

The Earth is special for many reasons. The Earth is the only planet with:

- an atmosphere containing oxygen
- an average temperature of 15°C
- a water cycle
- life as we know it

All these characteristics make the Earth a unique planet in the Solar System.

- The **atmosphere** consists of a mixture of gases. **Nitrogen** and **oxygen** are the most abundant. Oxygen is essential for plant and animal respiration. There is also **carbon dioxide**, essential for photosynthesis.
- The **average temperature is 15°C** on the Earth's surface. This is possible because of the distance from the Sun and the composition of the atmosphere.
- Water exists in three states (ice, liquid, water vapour) due to temperature variations. These variations make the **water cycle** possible.

Activities

1. Draw a diagram of the Earth, as seen from space. Draw two people: one at the North Pole and one at the South Pole.
2. Find out the mixture of gases and the average temperatures of Venus and Mars. Why do you think life is only possible on Earth?

- The Earth has a relatively large **natural satellite**, the Moon. The gravitational attraction of the Moon causes ocean tides.
- The Earth's **magnetic field** protects living beings from dangerous solar radiations.
- Conditions exist for **life**. Thousands of millions of years of evolution have produced the variety of species there are today. This includes humans.
- There is considerable **geological activity** on the Earth: earthquakes, volcanoes, mountain building, erosion, etc.



Photo of the Earth and the Moon taken by satellite.

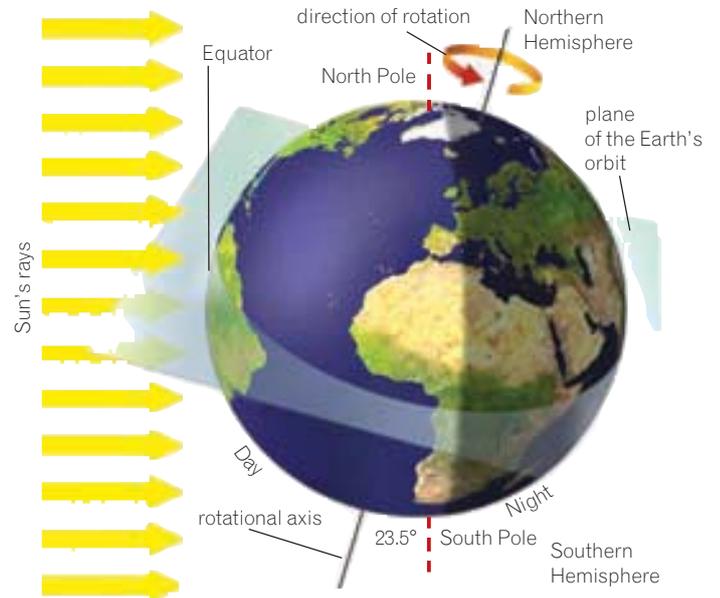
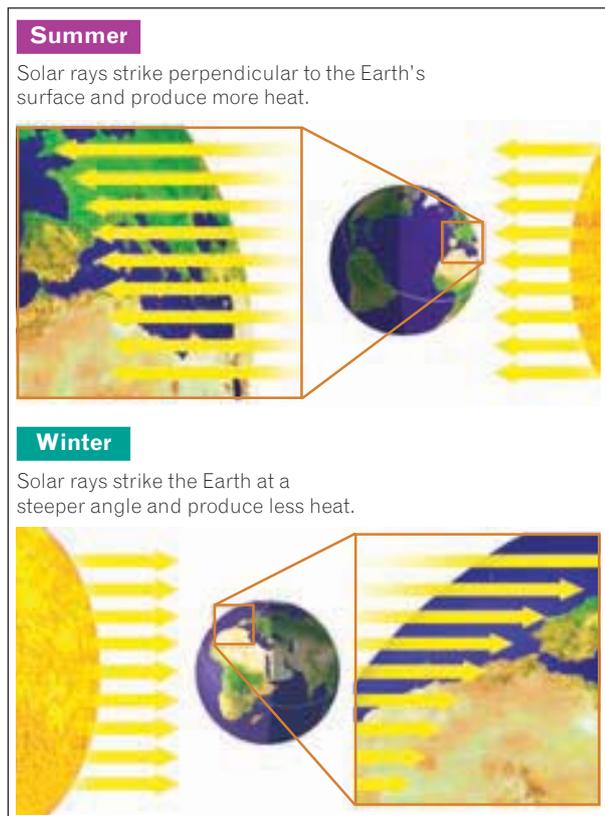


Volcanoes are proof of intense geological activity.

2. How does the Earth move?

The Earth moves in two different ways:

- **Rotation:** The Earth rotates on a slightly tilted axis, always in the same direction. This rotation causes the sequence of **day** and **night**.
- **Revolution:** The Earth's revolution around the Sun is an ellipse. It takes $365 \frac{1}{4}$ days to complete the revolution. This is one year.



The rotation of the Earth. It is day on the half of the Earth facing the Sun. It is night on the half facing away from the Sun.

What causes the seasons on Earth?

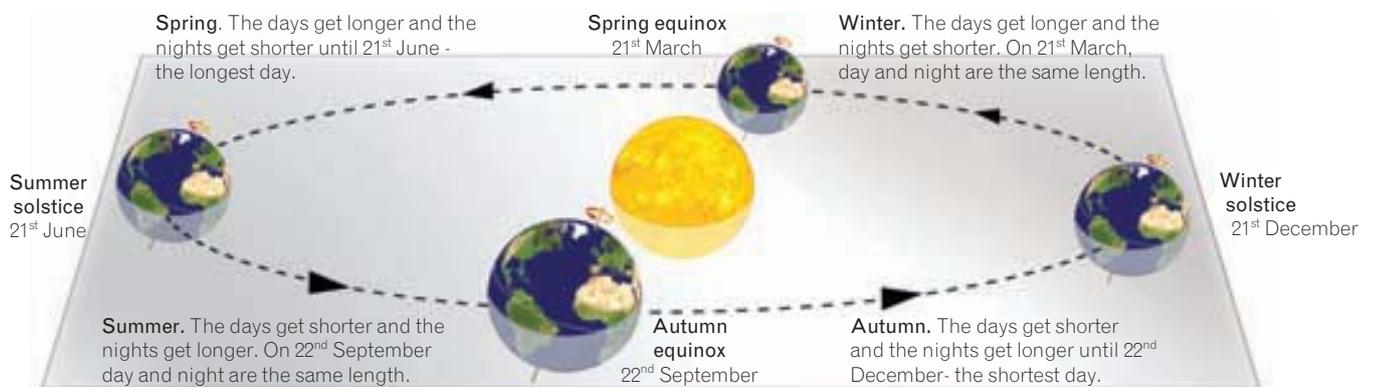
Two factors combine to cause the seasons:

- the revolution of the Earth around the Sun
- the Earth's axis is tilted at an angle of about 23.5°

The tilt of the axis causes differences in temperature and in the duration of day and night.

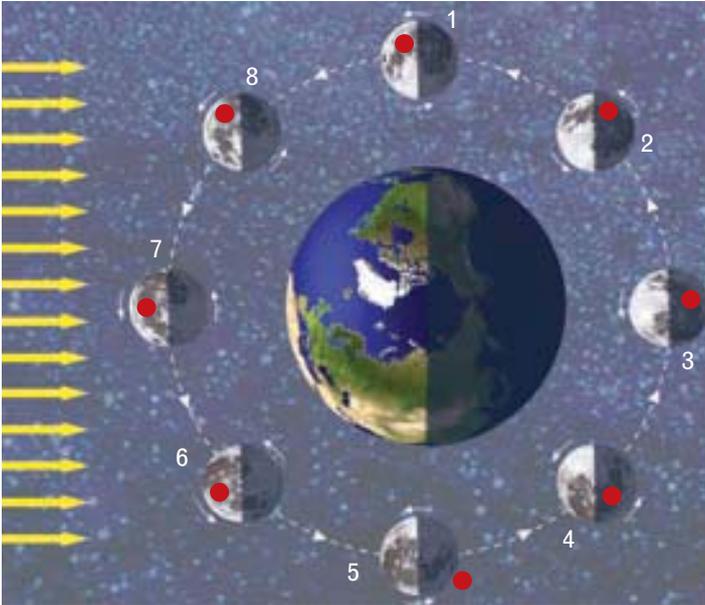
The Sun's rays strike the Earth in different ways depending on the seasons.

The tilt of the axis makes the seasons occur at different times of the year in the Northern and Southern Hemispheres.



The seasons in the Northern Hemisphere

3. How does the Moon move?



The same side of the Moon always faces the Earth. The red dot indicates the dark or hidden side. It is never visible from Earth.

The Moon moves in two different ways:

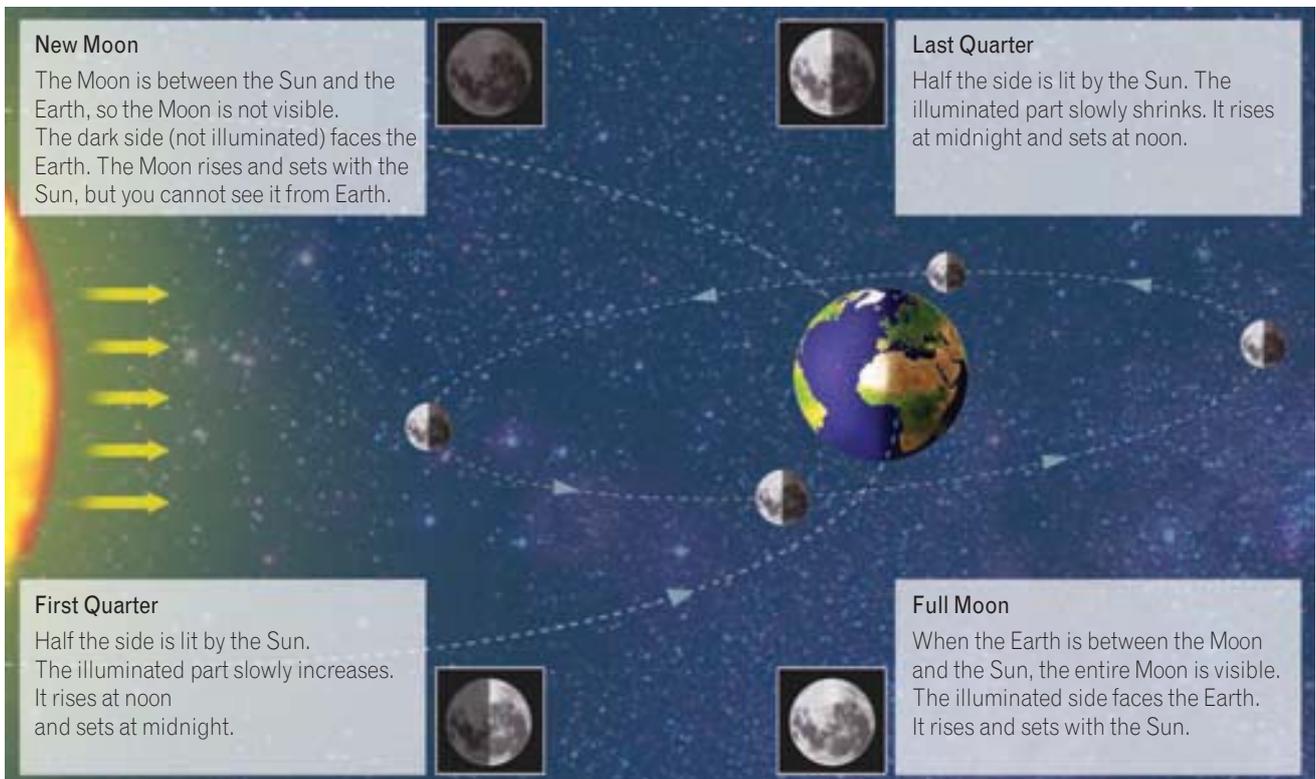
- **Rotation.** The Moon takes 29.5 days to **rotate** once on its axis: a “lunar day”.
- **Revolution.** The Moon takes about twenty-eight days (twenty-seven days and eight hours) to **orbit** the Earth once.

A “**lunar month**” is the period of time between two new moons. It is about 29.5 days. A “lunar day” is as long as a “lunar month”. As a result, the same side of the Moon always faces the Earth.

Activities

3. Draw a diagram to show the phase of the Moon in the Northern Hemisphere today.
4. When is there a New Moon?
5. Draw a diagram of the phases of the Moon in the Southern Hemisphere.

The phases of the Moon



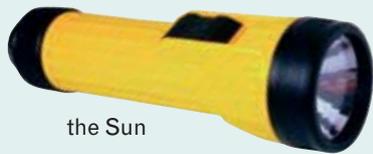
Hands on

Reproducing eclipses

If the Moon passes between the Sun and the Earth, and blocks off the sunlight, a **solar eclipse** occurs.

If the Moon passes behind the Earth, so the Earth prevents sunlight from reaching the Moon, a **lunar eclipse** occurs.

Materials



the Sun

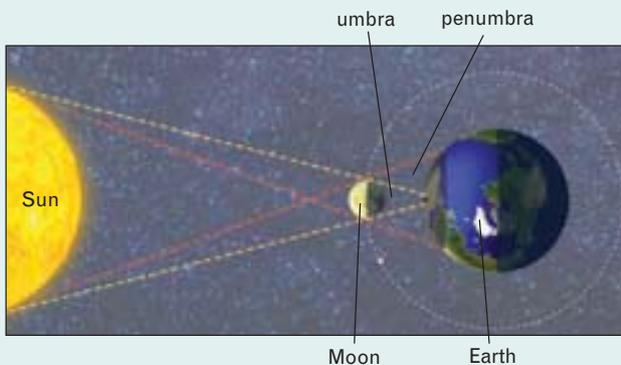


the Moon

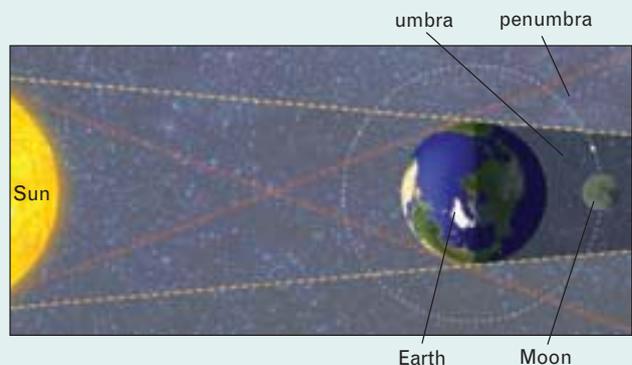


the Earth

1. Reproduce a solar eclipse. Position the planets: the Moon should block the Sun's light and project a shadow on the Earth.
2. Reproduce a lunar eclipse. Position the planets: the Earth should block the Sun's light and project a shadow on the Moon. Remember: a lunar eclipse can only take place during a full moon.
3. In your notebooks, copy the diagrams for both eclipses.



Solar eclipse



Lunar eclipse

Activities

6. Find out when the next solar and lunar eclipses will take place.
Visit this site:
<http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>
7. How must you protect your eyes when observing a solar eclipse?

4. How many “spheres” make up the Earth?

The Earth is the only known planet which contains water and living things. It is made up of four interrelated parts or “spheres”. These are:

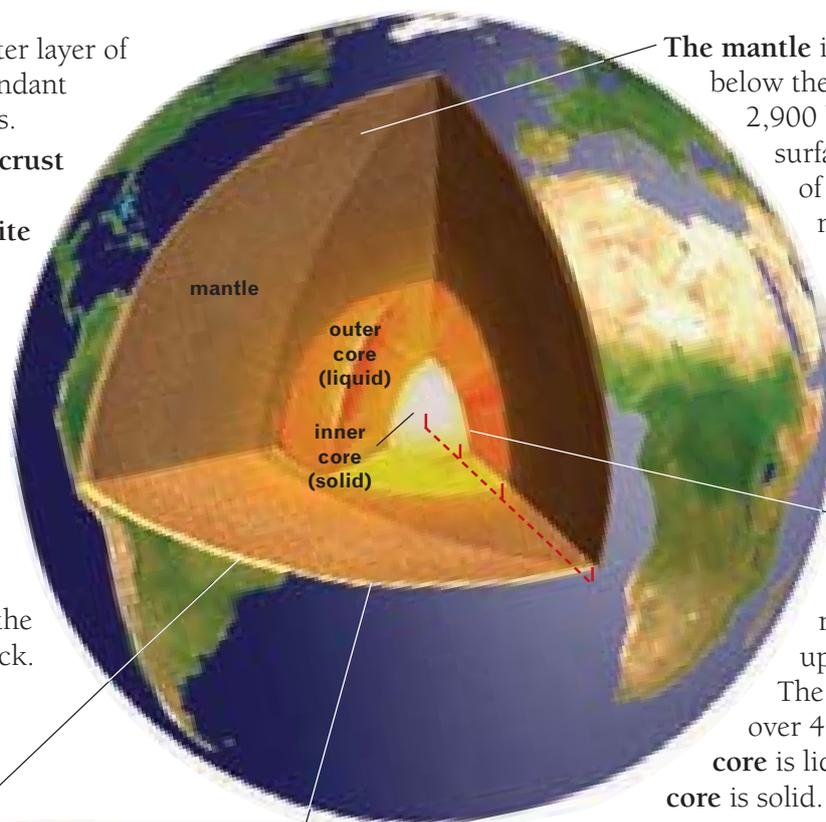
- **The geosphere.** The solid part which includes the crust, mantle and core. The upper 100 km of the geosphere is called the **lithosphere**: it is the most rigid part.
- **The atmosphere.** The air: a layer of gases which envelops the Earth.
- **The hydrosphere.** All the water on the Earth.
- **The biosphere.** All the living things which inhabit the Earth.

The geosphere

The geosphere consists of three concentric layers: the crust, mantle and core. The crust and the upper mantle make up the **lithosphere**.

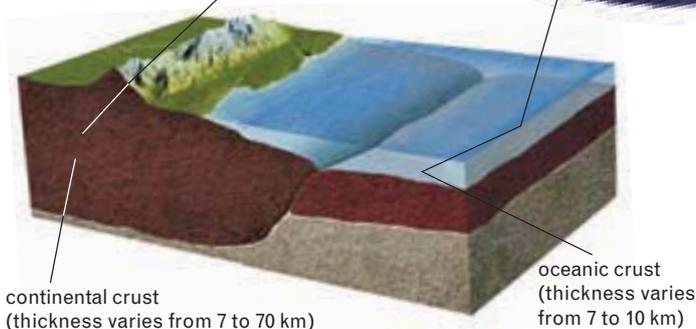
The crust is the outer layer of rock. The most abundant minerals are silicates.

- The **continental crust** makes up the continents. **Granite** is the most common rock.
- The **oceanic crust** makes up the ocean floor. It was created by intense volcanic activity at **mid-oceanic ridges**. **Basalt**, a volcanic rock, is the most common rock.



The mantle is the middle layer, below the crust. It lies 2,900 km below the surface. It is made up of mostly solid rock material. The temperature is higher here, from 1,000°C to 4,000°C, so some areas are melted rock.

The core is the centre of the Earth, below the mantle. It is made up mainly of iron. The temperature is over 4,000°C. The **outer core** is liquid. The **inner core** is solid.



continental crust
(thickness varies from 7 to 70 km)

oceanic crust
(thickness varies from 7 to 10 km)

Activity

8. Show the three layers of the geosphere in a diagram. Label each layer: main components, temperature and state: *solid or liquid*. Label the two types of crust.

5. What is the surface of the Earth like?

From outer space, the Earth looks blue because of the vast expanses of water on its surface.

The distribution of materials that make up the Earth's crust form the different types of land relief.

Continental relief features

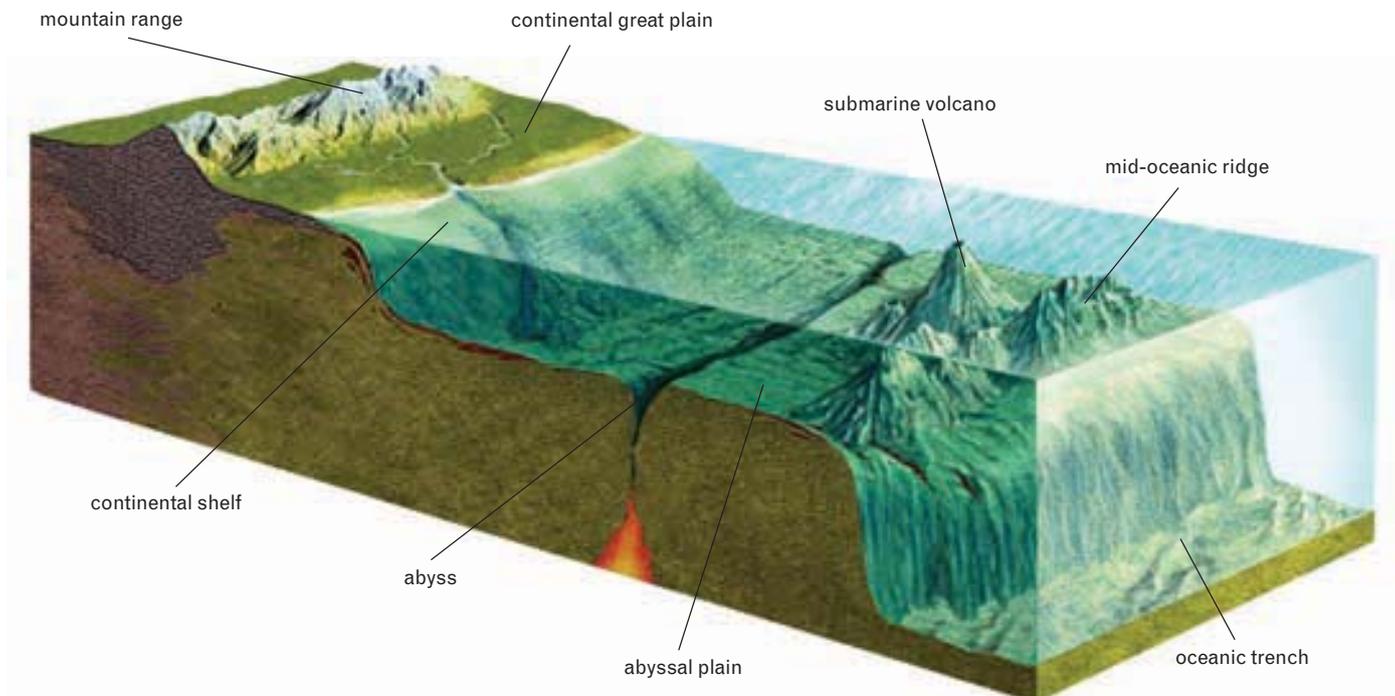
- The average altitude is 600 m.
- The three main relief features are:
 - **Mountain ranges.** Chains of high mountains. Examples: the Himalayas in Asia or the Andes in South America.
 - **Great plains.** Large extensions of flat land. Examples: the Amazon plain in South America or the Sahara desert in Africa.
 - **Continental shelves.** The areas near the coastline, under the sea, that are made of continental crust, not oceanic crust. These areas slope down from the coastline to a few kilometres out to sea, to a depth of about 200 metres.

Ocean floor relief features

- The average depth is 4,500 m.
- The main relief features are:
 - **Oceanic (mid-oceanic) ridges.** Chains of submarine mountains with intense volcanic activity. Example: the Mid-Atlantic ridge.
 - **Oceanic trenches.** The deepest areas of the ocean. Example: Mariana Trench: 11,034 m deep.
 - **Abyssal plains.** The largest plains on the planet: 4,000 or 4,500 m deep.
 - **Submarine volcanoes** may create **volcanic archipelagos**. Examples: the Canary Islands, the islands of Hawaii.

Oceanic relief forms can rise up to 2 km from the ocean floor. In some places they appear above the water to form islands. Example: Iceland.

Cross-section of the Earth's surface



6. What are the other three Earth “spheres”?

Apart from the geosphere, the other three Earth “spheres” or systems are the atmosphere, the hydrosphere and the biosphere.

The atmosphere

The atmosphere is the layer of air which surrounds the Earth. Air is a mixture of gases. The main components are: **nitrogen** (78 %) and **oxygen** (21 %). Oxygen is one of the necessary conditions for life. There are also small quantities of **carbon dioxide** (CO₂) and other gases.

The hydrosphere

The hydrosphere is all the water on, under and above the Earth.

The hydrosphere is made up almost exclusively of liquid water, but also snow and ice. Other materials in the hydrosphere are the mineral salts in water. **Sea water** is very rich in mineral salts, but **fresh water** has few salts.

The biosphere

The biosphere includes all the living things which inhabit the Earth. Living things influence the physical and chemical changes in the Earth. For example:

- **In the Earth’s crust:** Animals live in the ground and plants take mineral salts from the soil. Plant roots can break up rocks.
- **In the atmosphere:** Microorganisms which live in the soil produce nitrogen. Oxygen is produced during photosynthesis by plants, algae and some bacteria. Many living things cause evaporation.
- **In the hydrosphere:** Living things contain water. Plants take water from the ground. Many organisms live in aquatic environments.

Did you know that...?

The **water cycle** refers to how water evaporates, rises, condenses, falls to the Earth as rain or snow and moves around.

This cycle was described 2,500 years ago by Thales.

Coral produces exoskeletons which accumulate to form a rocky shelf. This atolon in Tahiti is made up of living things.

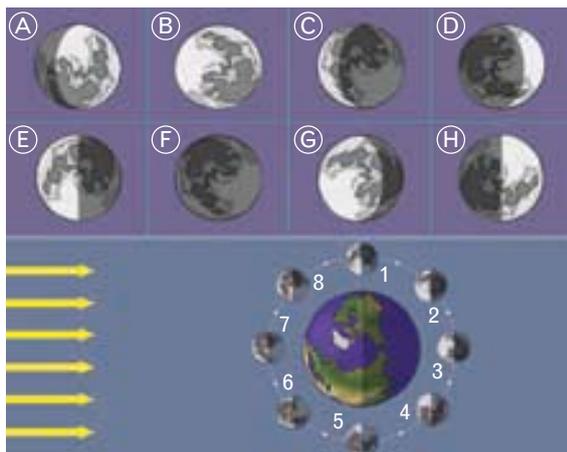
Activities

9. Say a relief feature. Your partner says if it is continental or ocean floor.
10. Which continental feature is under the sea?
11. Describe the four different spheres that make up the Earth. List examples of features in each sphere.



Activities

- 12.** Draw the Earth. Include an arrow pointing in the direction in which it revolves. When does the Sun rise where you live?
- 13.** Draw the Earth and its orbit. Show four positions.
- Indicate the **solstices** and the **equinoxes**. Divide the orbit into four parts: one for each season in the Northern Hemisphere.
 - Colour each season a different colour. Tip: summer begins with the summer solstice and ends with the spring equinox.
- 14.** Why is the Sun higher over the horizon at noon in summer than in winter? Does this occur at the same time of year in both hemispheres?
- 15.** Think about the seasons. Use this information:
- Solstices.** summer / winter
- Equinox.** spring / autumn. The Sun is above the Equator. Day and night are the same length.
- When it is summer in the Southern Hemisphere, what season is it in the Northern Hemisphere? And when is it spring there?
 - What causes this difference in the seasons?
- 16.** Match each picture of the Moon with a number in the diagram below.



- 17.** The ecliptic is an imaginary plane. It passes through the centre of the Earth and the centre of the Sun.
- Does it go through the centre of the Moon?
 - Does it pass through only sometimes? How often? When?

- 18.** The Moon has a dark side because each time it completes a turn around the Earth, it rotates on its own axis. This takes 28 days.

With a partner, demonstrate the movement of the Moon around the Earth.

- 19.** What are the main differences between the continental crust and the oceanic crust?
- 20.** Match each phrase to: geosphere, hydrosphere, atmosphere or biosphere.

- water in a river
- waves in the sea
- sand on a beach
- fish, birds, plants or other living things
- the air you breathe
- clouds

- 21.** Two friends are collecting rocks. Who is right? Why?

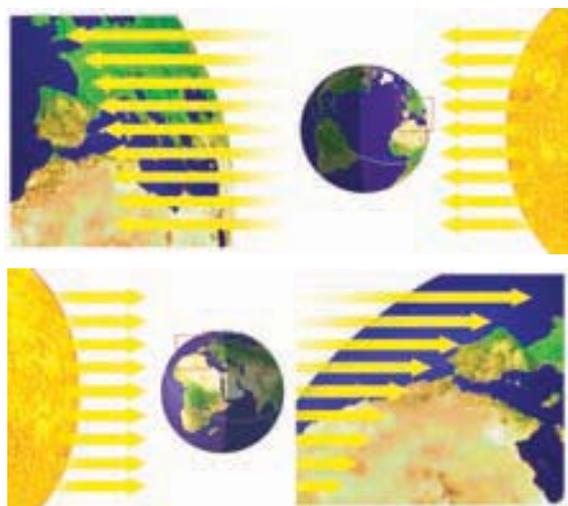
Girl: These rocks belong to the geosphere.

Boy: No, they belong to the lithosphere.

- 22.** Think about the Earth's rotation and answer.

- Why are days longer in the summer?
- Why do days and nights last for six months at the poles?
- How are day and night produced? Make a drawing to show this.

- 23.** Identify: summer solstice, winter solstice. Explain your answer.



What should you know?

2

THE EARTH

Special characteristics of Earth

- It has an intense magnetic field.
- The atmosphere contains mainly nitrogen, oxygen and carbon dioxide.
- The average temperature is 15°C.
- Water exists on Earth in solid, liquid and gaseous states. There is a water cycle.
- The Earth has one large natural satellite, the Moon.
- Life exists on Earth.



Movements

- Rotation. The Earth rotates on its axis. The axis is tilted 23.5°. This rotation creates day and night.
- Revolution. The Earth revolves around the Sun. Its orbit is elliptical. These two movements and the Earth's tilt cause the seasons. Other consequences are the differences in the length of day and night.



The Moon, the Earth's satellite

The Moon takes almost 28 days to orbit the Earth. It takes the same length of time to rotate once on its axis.
Lunar phases: New Moon, First Quarter, Full Moon and Last Quarter.

- Solar eclipse: the Moon blocks the light from the Sun.
- Lunar eclipse: the Earth blocks the light from the Sun so it does not reach the Moon.

The gravitational attraction or "pull" of the Moon on the oceans causes the tides.



The four Earth "spheres"

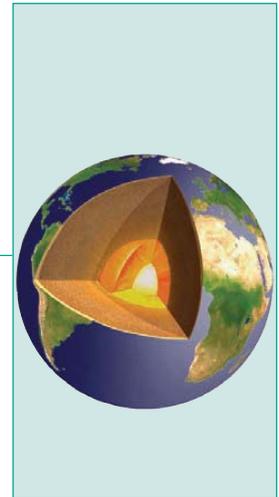
Geosphere: the solid part of the Earth. It consist of the:

- Lithosphere: the crust and the upper mantle.
 - Continental crust: makes up the continents.
 - Oceanic crust: makes up the ocean floor. The Earth's surface is made up of continental features and ocean floor features.
- Mantle: the middle layer of the Earth, made of rock.
- Core: the centre of the Earth, made up of metals. Outer core: liquid. Inner core: solid.

Atmosphere: the layer of air which surrounds the Earth. It consists of a mixture of gases.

Hydrosphere: all the waters on the Earth.

Biosphere: the part of the Earth where living things exist. Living things can be aquatic or terrestrial.



Projects

EXPERIMENT: Think about the geosphere.

- Shake together a mixture of gravel, cork and water. Allow this to settle. Observe the separation in layers by density.
- Compare with the diagram of the geosphere on page 23. Identify the *crust*, *mantle* and *core* represented in your experiment.

WEB TASK: Find out about artificial satellites.