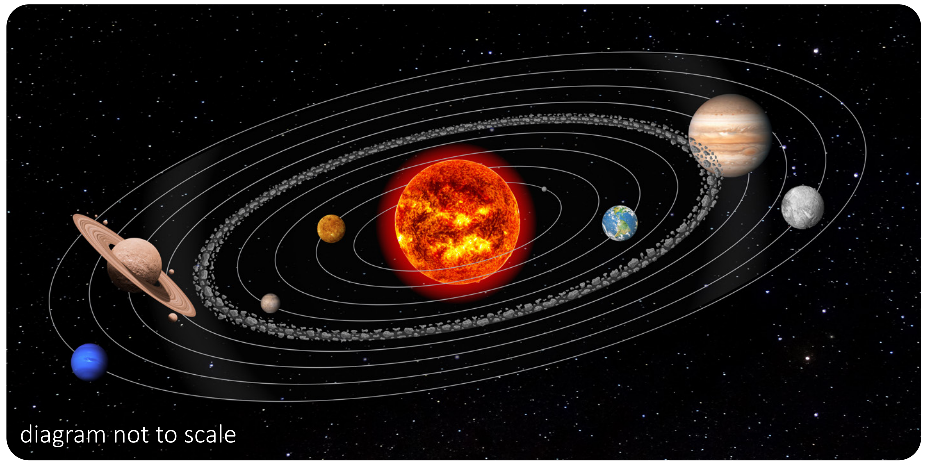
Earth and Space

The Solar System

The Solar System consists of eight planets that orbit around the Sun.



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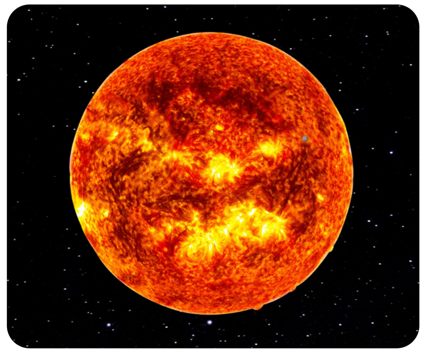
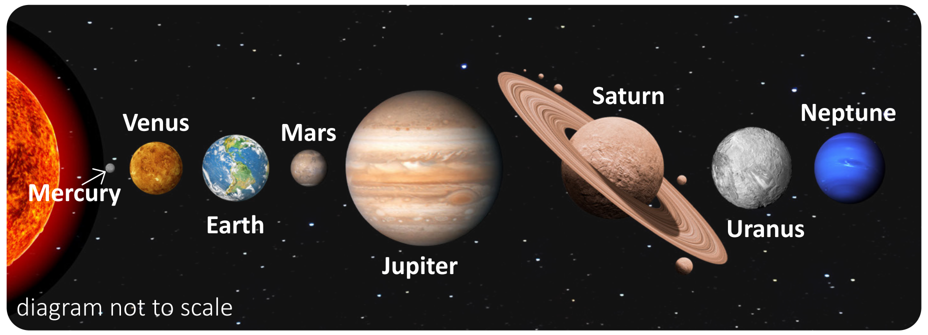
The Sun



The Sun is a 4.5 billion-year-old star. It is a huge, hot ball of gas that rotates on its axis once every 27 Earth days. The Sun is the only source of light and heat in the Solar System. Without it, life as we know it would not exist on Earth.

The planets

There are eight planets in the Solar System. The planets closer to the Sun (Mercury, Venus, Earth and Mars) are terrestrial planets because they are made of rock. They are hotter and have a shorter orbit and a shorter year than the planets farther away. Planets that are farther from the Sun (Jupiter, Saturn, Uranus and Neptune) are made of gas and are called gas giants. They are colder and have a larger orbit and a longer year than the closer planets.



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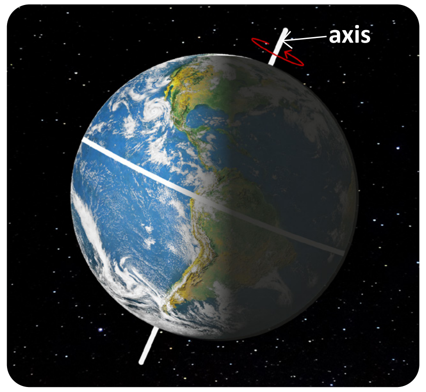
The Earth



The Earth is the third planet from the Sun in the Solar System and is the only one to support life. The Earth rotates on an axis at a tilt of 23.5°. One rotation takes 24 hours, which is one day. The Earth orbits the Sun once every 365.25 days, which is a year.

Models of the Solar System

Geocentric model

In the past, many philosophers and scientists believed the Solar System was geocentric, meaning that the Earth was at the centre, orbited by the Sun and the other planets. The observations and common sense of Aristotle, the mathematics of Ptolemy and the scientific methods of Alhazen supported this theory. The geocentric model was accepted for 1500 years.

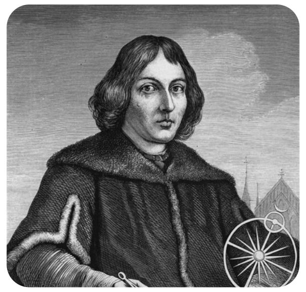
Aristotle, c384–c322 BC

Claudius Ptolemy, AD c100–c170

Alhazen, AD c965–c1040

Heliocentric model

In the 16th century, Nicolaus Copernicus suggested the heliocentric model, with the Sun at the centre of the Solar System and the Earth and other planets orbiting around it. Even though this was an unpopular theory at the time, the observations of Galileo Galilei and the scientific laws of Sir Isaac Newton proved that the heliocentric model was correct.



Nicolaus Copernicus, 1473–1543

Galileo Galilei, 1564–1642

Sir Isaac Newton, 1643–1727

The planets and stars are spheres

Each planet and star is spherical because gravity, created by their large mass, pulls all material towards their centre and compresses it into the most compact shape, a sphere.

Beliefs about the shape of the Earth

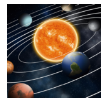
Many ancient civilisations believed the Earth was flat and shaped like a floating disc, a cylinder or even a square.

In ancient Greece, around 500 BC, the philosopher, Pythagoras, thought a sphere was the perfect shape, so the Earth must be a sphere.

Aristotle proved the Earth was a sphere when he observed a ship sailing away to sea. He noticed that the bottom of the ship disappeared first and the sail last. If the Earth were flat, the whole ship would have looked gradually smaller as it sailed away.

Modern technology has provided further evidence that the Earth is spherical. For example, the famous *Earthrise* photograph was taken from the spacecraft *Apollo 8* during the crew's first orbit around the Moon.

Earthrise, 1968

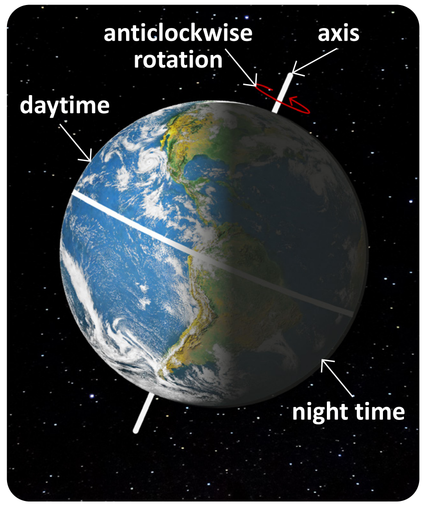


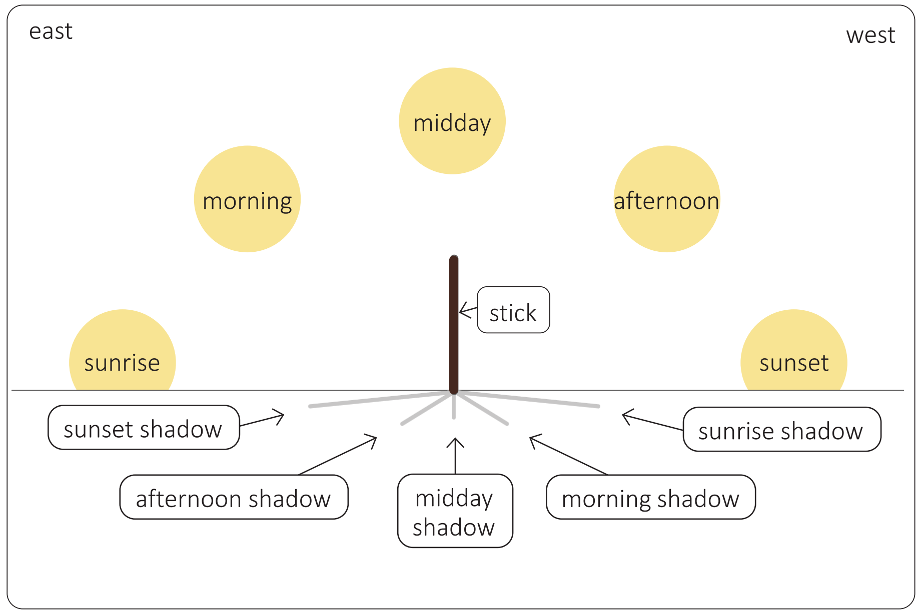
Daytime and night time

As the Earth rotates, it is daytime in the places that face towards the Sun, and night time in the places that face away from the Sun.

During the day, the Sun appears to rise in the east, move across the sky in an arc and set in the west. However, this is due to the Earth rotating and not the Sun moving.

The changing angle of the sunlight during the day changes the direction and length of shadows cast by objects on Earth.





Sundials

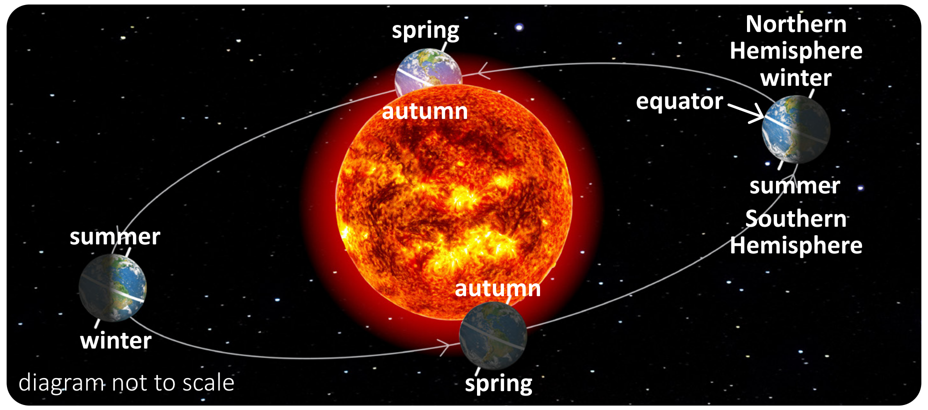
Sundials are the earliest form of timekeeping device. They have two parts, a flat **dial plate** marked with Roman numerals or numbers, and a **gnomon** that tilts at the same angle as the Earth's axis and points to true north. Sundials are placed outside and the shadow cast by the gnomon falls on the dial plate and shows the time.

Day length and seasons

The tilt of the Earth on its axis, its daily rotation and its yearly orbit also create different day lengths and seasons.

When the Northern Hemisphere is tilted away from the Sun, it gets little direct sunlight, so daytime is short, night time is long, and the weather is cold. In the Arctic Circle, it never gets light.

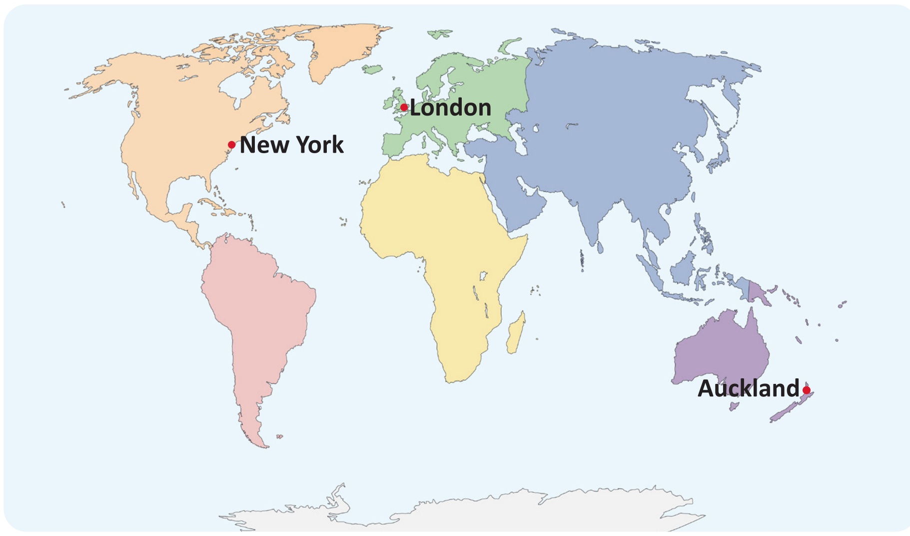
At the same time, when the Southern Hemisphere is tilted towards the Sun, it gets a lot of direct sunlight. Daytime is long, night time is short, and the weather is warm. In Antarctica, it is always light. As the Earth continues its orbit, the seasons change throughout the year.



During Earth's orbit, countries in the tropics that are on or near the equator have the same amount of direct sunlight all year round. This means the length of daytime and night time is similar, and they have warm temperatures all year. They only have two seasons: a rainy season and a dry season.

Times around the world

The Earth's rotation on its axis creates different times around the world. For example, if it is 12:30 on Friday in London, United Kingdom, it is 07:30 in New York, United States of America. At the same moment, it is 00:30 on Saturday in Auckland, New Zealand.

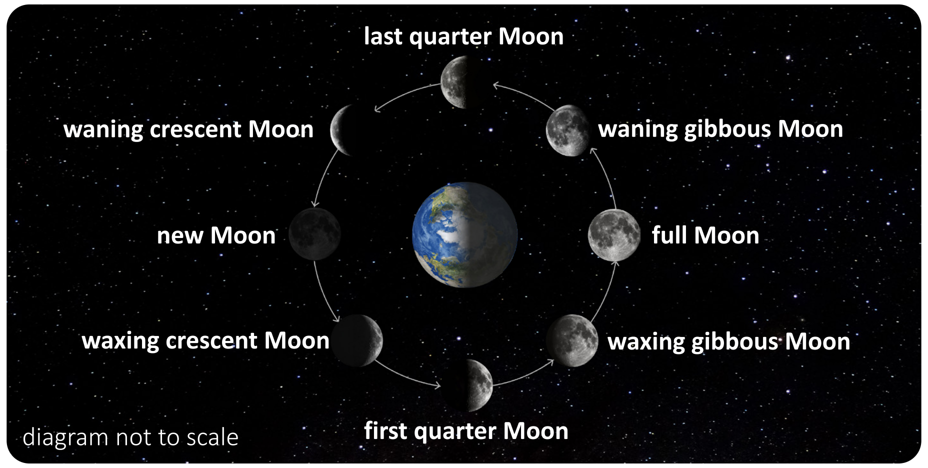


The Moon

The Moon is 385,000km away from Earth and has a diameter of 3500km. It orbits the Earth once every 27.3 days, which is around one month. It also rotates on its axis once every 27.3 days, so we only see one side of the Moon from Earth. The Moon is not a natural light source; it reflects the Sun's light.

Phases of the Moon

As the Moon orbits, we see differing amounts of the Moon's lit side from Earth. These are known as the phases of the Moon.



Solar and lunar eclipse

A **solar eclipse** is when the Moon passes directly between the Earth and the Sun, blocking our view of the Sun and casting a shadow on part of the Earth.

A **lunar eclipse** is when the Earth is in line between the Moon and the Sun and casts a shadow on the Moon.

Glossary

axis	An imaginary line that runs through the centre of an object, such as a planet, about which it rotates.
orbit	The stable, circular path of an object revolving around a central mass with gravitational force, such as the planets revolving around the Sun, or the Moon revolving around the Earth.