

In partnership with



Space, Sports, Sun and Safety

KS 2/3 Project 6 – Sunrise & Sunset

For us, here on the Earth's surface, the Sun has a regular pattern of rising and setting, which depends on our latitude and the seasons. The length of our day is 24 hours. The length of daylight hours varies according to the latitude and time of year. At sunset or sunrise the Sun and sky can appear very red. This is because when the Sun is in that low position on the horizon the light is travelling a long way through the atmosphere which scatters a lot of the blue light and just leaves the red light to reach our eyes.

The International Space Station, ISS, takes about 90 mins to orbit the Earth. Hence, the astronauts see about 16 sunrises and sunsets per Earth day.

OBJECTIVES

- To learn how the rotation of the Earth and its orbit around the Sun give rise to sunrise and sunset at different times at different latitudes and seasons.
- To learn that the north and south poles have several months of darkness in the winter and several months of daylight in the summer.
- To learn about the orbit of the ISS and how many sunrises and sunsets per day the astronauts experience.
- Learn what can be seen from the ISS at night time.
- Learn about aurorae, which are caused by solar storms.

RESOURCES

- Balls of varying sizes to illustrate the orbits of the Earth and other planets around the Sun, and Moon around the Earth.
- Globe to show the tilt of the Earth's axis.
- Source of light which could represent the Sun.
- Photos of sunrise from Antarctica and on the ISS (see resources).
- Clock which shows the time in different countries.
- Glass beaker or plastic bottle, light source, water and milk.
- Anglepoise lamp.
- Stick and instrument for measuring the length of a shadow.



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FACT FILE

The Earth can be seen from the ISS in the daytime, but also at night time. The lights from Earth at night shine bright, for example from London, but also from other countries (see the photo from the ISS of the Nile delta). Some countries (for example Africa) have large areas of darkness. Some parts of the world have very few people, but in some poor regions of the world, there is no electricity. Charities like 'Solar Aid' are trying to help these remote regions.

Storms from the Sun can sometimes head towards the Earth. They can produce beautiful lights (greens and pinks) in the sky (like fireworks, but quieter and shimmering), called an aurora (the Latin word for 'dawn'). Aurorae are seen in the Arctic (called the 'Northern Lights') and Antarctica. The astronauts can also see aurorae from the ISS, which is very exciting. There are some beautiful images and movies of aurorae from Earth and the ISS.

Antarctica is a very special and beautiful place. At the south pole, the Sun is above the horizon for about six months (in the summer) and below it for six months (in the winter). On the Antarctic circle (latitude 66.5 degrees south), the Sun skims along the horizon all day on mid-winter's day, just touching the horizon even at midday. In between the Antarctic circle and the south pole, the number of days with constant sunshine varies from one day to six months. This photo in the resources shows the Sun returning after three months of darkness at Concordia base (75 degrees south in Antarctica) after the winter. It gets very cold in the winter time and temperatures can drop to -80°C . This sunrise is very welcome and everyone is very happy!

ACTIVITY

Explore the variation in daylight hours across the Earth, in particular with latitude and time of year. Explore the colour of the sky. Explore the concepts of latitude and longitude.

The students could:

- Fill a glass beaker with water and add a small amount of whole milk. Shine a torch through it to explore what colour the water looks. Shine the torch through the bottom and look from the side and from the top. It should appear bluish from the side and reddish from the top. The blue light is scattered more by the milk particles than the red light. Think about how this relates to the sky during the daytime and at sunrise and sunset. A similar effect is possible with an opalescent polished gem.
- Find out what the time is in other parts of the world, and find out what the longitude of these places is. (MATHS EXTENSION: make spread sheet and work out how time changes with longitude)
- Where on Earth is the longitude zero? (Hint: Greenwich, London)
- Explore what causes the seasons and whether all countries have the same seasons as the UK.
- Think about how the daylight hours and seasons might affect sporting activities in the UK and elsewhere.
- Find out about Antarctica, what it is like to live there, the birds, animals, what winter there is like, how dark and cold it gets.
- Find out about the ISS, how many orbits it makes around the Earth per day.

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- Think about what it would be like with no electricity at nighttime.
- Explore the length of a day on other planets. For example, Jupiter's day is about 10 hours, while Mercury's day is over 4200 hours, with other planets somewhere in between.

Other questions to explore

- If you wanted to phone someone in Australia, USA, India what time of day would you choose?
- What time zone is used on the ISS? Hint: Greenwich Mean Time (Coordinated Universal Time). Why? Hint: best time for science operations co-ordinated in both Russia and the USA.
- If Tim wanted to read his children a bedtime story when they are at home in Houston when would he need to call?
- What would happen if we didn't have a common policy on timezones across the UK, or indeed across the world. Maybe take the USA as an example. Hint: it would be chaotic for travel, trains, flights etc.
- The ancient Egyptians thought that the Sun was carried by a boat across the sky in the daytime and beneath the Earth at night times. Get the children to think about what people might have thought about the Sun before we knew that the Earth goes around the Sun

SAFETY

NEVER LOOK DIRECTLY AT THE SUN.

WEB LINKS

There is further information and lots of other images from the ISS (inside and outside) on the ESA website:
http://www.esa.int/Our_Activities/Human_Spaceflight/Astronauts

Ra, the Sun god in ancient Egyptian mythology:
<https://en.wikipedia.org/wiki/Ra>

Orbit of the ISS
<http://www.isstracker.com/>

There is information on the 'Reason for the seasons' and timezones on Sun|trek:
<http://www.suntrek.org/earth-beyond/spinning-orbiting-earth/spinning-orbiting-earth.shtml>

There is a great App called 'Living Earth' which shows 'night and day' at current time.

Find out more about life and science in Antarctica from:
http://www.esa.int/Our_Activities/Human_Spaceflight/Concordia

British Antarctic Survey:
<https://www.bas.ac.uk/>

Experiment to find out why the sky is blue and sunsets are red:
<http://www.webexhibits.org/causesofcolor/14F.html>

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Some information about aurorae:

<http://www.suntrek.org/blog/northern-lights-magic-light-display>

Beautiful photos of aurorae in the Arctic by Ole Salomonsen:

<http://www.arcticlightphoto.no/>

Solar Aid

<http://www.solar-aid.org/>