THE EARTH AND BEYOND

INTRODUCTION

In this module children develop their knowledge of the Earth's (and other planets') place in the solar system, and their relationships with other bodies in space, in particular with the Sun.

The module draws on children's previous use of the calendar to calculate the duration of events (Year 4 Mathematics) and solve problems involving units of time (Year 5 Mathematics). Children also learn how the Earth's orbit determines the length of a year and why we have leap years.

Key Stage 1 observations of the Sun's movement across the sky and Year 3 work on shadows provide a sound basis for investigating how the Earth's rotation causes night and day, and is responsible for the apparent movement of the Sun across the sky, and its changing height in the sky. Children also learn how the Earth's rotation and tilt affect the direction and length of shadows, and how to use shadows for telling the time.

Children learn about time differences around the world and investigate time differences using resources including the internet. They will find out about how time was standardised around the world, about the need for scientists to choose a starting point in the continuous process of cycles of sunrise and sunset, and investigate longitude. They are introduced to the International Date Line and the Greenwich Meridian.

Children extend their awareness of seasonal changes through the year, which they developed during Key Stage 1, to understand that it is the Earth's tilt on its axis that causes the seasons. This draws on their learning about the Sun and shadows to develop an understanding of the role of latitude in day length and seasons.

National Curriculum:

Describe the movement of the Earth and other planets in the solar system relative to the Sun

Use the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky

Describe the movement of the Moon relative to the Earth

Working Scientifically:

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs

Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations

Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs

Identifying scientific evidence that has been used to support or refute ideas or arguments

Using test results to make predictions to set up further comparative and fair tests

Scientific Enquiry:

Finding things out using a wide range of secondary sources of information

Noticing patterns

Observing changes over different periods of time

Key vocabulary:

Aldebaran, Arctic, Antarctic, British Summer Time, Earth, Greenwich Meridian, International Date Line, Jupiter, Mars, Mercury, Milky Way, Moon, North Pole, Saturn, South Pole, Sun, Neptune, Universe, Uranus, Venus, asteroid, autumn, axis, compass, crescent, dawn, degrees, dusk, equator, equinox, fixed stars, Full Moon, galaxy, gibbous, hemisphere, horizon, illuminate, leap year, longitude, lunar month, meridian, nebula, New Moon, northern, orbit, planet, reflect, rotate, rotation, solar system, solstice, southern, spin, spring, star, summer, sunrise, sunset, telescope, temperature, tilt, time zone, waning, waxing, winter, year, change, compare, draw conclusions, explain, explanation, investigation, line graph, measure, model, observations, plan, predict, prediction, presentation, question, record, review, scientific diagram, table

FACT FILE:

Stars are held together in a galaxy by gravity. (Our star, the Sun, is in the Milky Way galaxy.) ‘Constellation’ is not a scientific term but is commonly used for a pattern of stars in a clearly defined area of the sky. These stars may be vast distances apart and in different galaxies. The stars are called fixed because they were long believed not to move. Galaxies rotate: the distances between them are so great that this can only be detected using modern scientific equipment. The sky today looks as it did thousands of years ago and many of the constellations were named in ancient times.

When viewed from above the North Poles of the Sun and the Earth, the Earth and other planets orbit the Sun anticlockwise, causing an apparent shift in the positions of the stars over the year. This is not to be confused with the apparent rotation of the stars around the North Star Polaris, which is caused by the Earth’s rotation.

The ancient Sumerians (3rd millennium BCE) based time around the number 60 – the smallest number divisible by every number from 1 to 6. This simplifi es fractions based on 60: an hour can easily be divided into segments of 30, 20, 15, 12, 10, 6, 5, 4, 3, 2 and 1 minute. The measurement of angles is based around 60 for the same reasons, making the analogue clock face ideal for measuring time.

The cereal box clock children make in Lesson 4 is based on an ancient Egyptian sun clock from before 1500 BCE, which was rotated once a day at noon in order to tell the time in both morning and afternoon.

Places that are close to each other have sunrise and sunset at different times so, historically, cities and villages agreed local times, but this caused problems as industrialisation and rail travel developed. Great Britain and Ireland adopted the local time of London (Greenwich) as standard time. In the United States and Canada the times of sunrise and sunset differ enormously across the country, so railway companies specified junctions where changes in time were made.

Increased communication and travel brought the need for global agreement on dates and times. An international congress met in Washington DC in 1884 where the world was divided into 24 time zones (one for each hour of the day), each covering 15° of longitude. The time for each zone is that of the meridian (line of longitude) that passes through its centre. As the Earth’s rotation, and with it sunrise and sunset, is a continuous process, a starting point was established. This is the meridian that passes through the Greenwich Observatory (the zero or prime meridian).

Children might think seasons occur because the Earth is nearer to the Sun in the summer and farther away in winter. The slight variation in the Earth’s distance from the Sun, due to the Earth’s elliptical (rather than circular) orbit, is not the cause. It makes no detectable difference because of its vast distance from the Sun. The tilt of the Earth’s axis angles either the northern or southern hemisphere towards the Sun in the summer and away from it in winter, with midway points in spring and autumn. Day and night are the same lengths on the equinoxes: September 22nd/23rd and March 20th. The solstices are the ‘longest’ and ‘shortest’ days (with the longest or shortest period of daylight): June 20th/21st and December 22nd/23rd. Arctic and Antarctic regions have 24-hour, or almost 24-hour, daylight or night. Days and nights in tropical and equatorial regions are equal, or almost equal, in length throughout the year. Daylight Saving, in which clocks are adjusted by an hour (for example, British Summer Time), affects times in many countries.