TOPIC 1 Out of this world

About this topic

Curriculum link: Year 5, Earth and space

SUMMARY:

In this topic, children learn about space. Starting with the Solar System, they look next at how ideas about space have changed over time before they explore what causes us to experience night and day on Earth.

UNITS:

1.1: Our Solar System
1.2: Meet the scientists
1.3: Day and night

ACTIVITY RESOURCES

- 1.1: What's in our Solar System?
- 1.2: Let's make a Solar System
- 1.3: Universe address cards
- 1.4: Solar System data

ONLINE RESOURCES:

Teaching slides (PowerPoint): Out of this world
Interactive activity: Out of this world
CPD video: Out of this world
Pupil video: Out of this world
Word mat: Out of this world
Editable Planning: Out of this world
Topic Test: Out of this world

Learning objectives

This topic covers the following learning objectives:

- Describe the movement of the Earth and other planets relative to the Sun in the Solar System.
- Describe the movement of the Moon relative to the Earth.
- Describe the Sun, Earth and Moon as approximately spherical bodies.
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the Sun across the sky.

Working scientifically skills

This topic develops the following working scientifically skills:

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present 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.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

CROSS-CURRICULAR LINKS

This topic offers the following cross-curricular opportunities:

English

- Create mnemonics for the planets in our Solar System.
- Ask questions about space and decide best way to answer them.
- Write instructions on how to make a model of day and night.
- Create fact files on the planets.
- Research, perhaps email, for information about living on the International Space Station (ISS).

- Hot seat key historical figures in space exploration.
- Explain the terms 'heliocentric' and 'geocentric' and argue a point with evidence.
- Design and write postcards from different planets and galaxies.
- Write a sci-fi story based on research about planets and fiction.
- Produce a glossary, e.g. planet, orbit, moons, rings, probes, meteorites.

Numeracy and mathematics

- Create an excel spreadsheet of planetary data.
- Big numbers: use them to calculate distances between planets, day lengths, etc.
- Use precise measurements when making a card clock, i.e. angles.

Computing/ICT

- Use search engines to find out information about the Solar System and present it to classmates.
- Log onto Astronomy Picture of the Day (see Useful Websites on *My Rising Stars*).
- Access interactive space puzzles.
- Create PowerPoint presentations about, e.g. the ISS Pluto.

History

- Research the history of space exploration and create a timeline of events
- Research how ideas have changed, e.g. prior to Galileo, Newton.
- Research when each of the planets were discovered and find out who discovered them.

Geography

- Locate space centres around the world.
- Create a map of day and night across the world.
- Use a map of the Moon.
- Map the stars – locate stars and constellations.
- Plot the orbit of the ISS around the Earth.

PE

- Exercise and nutrition for astronauts.
- Design a fitness routine for astronauts on the ISS.
- The implication of zero gravity in space on movement.

Music

- Create space music.
- Listen to 'Nasa Sounds of Saturn' (see Useful Websites on *My Rising Stars*).
- Listen to a range of space-themed songs.
  - Elton John – 'Rocket Man'
  - David Bowie – 'Space Oddity'
  - Gustav Holst – 'The Planets'

Design technology

- Build a model of the Solar System.
- Design a planet.
- Design and make a rover for Mars or a lunar vehicle.
- Make papier-mâché planets.
- Use different media to paint planets, e.g. oils, pastels, watercolours.
- Create collages of planets using different materials.

PSHE

- Recognise how scientific discoveries affect how people think, create, behave and live.

STEAM (SCIENCE TECHNOLOGY ENGINEERING ART AND MATHS) OPPORTUNITIES

Invite into class

- Someone from the local community who remembers watching the first Moon Landing in 1969 – children can interview the person.
- Astronomer from a local university or amateur astronomy group.
- Arrange for an inflatable planetarium to visit the school.
- ESERO-UK network of space ambassadors.
- Book some Moon Rocks http://www.stfc.ac.uk/public-engagement/activities-for-schools/borrow-the-moon/.
- Artists to create a range of artwork linked to the planets.
- Local Astronomers / STEM ambassador to run a 'night sky' family evening.

Visit

- Local planetarium.
- National Space Centre, Leicester.
- Science museums, e.g. London or Manchester.

TEACHER SUBJECT KNOWLEDGE

Our Solar System has a large star, the Sun, at its centre and eight planets and their moons, which orbit the Sun. All planets have almost circular orbits that lie within a nearly flat disc called the ecliptic plane. The vast majority of the Solar System's mass is in the Sun, with most of the remaining mass contained in Jupiter.

The planets in order of their distance away from the Sun are:

> Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

The four smaller inner planets, Mercury, Venus, Earth and Mars, are mainly composed of rock. The four outer planets, called the 'gas giants', are substantially more massive. The two largest, Jupiter and Saturn, are composed mainly of hydrogen and helium.

The Solar System also contains many other objects such as the Asteroid Belt. This sits between the orbits of the planets Jupiter and Mars. It is made up of thousands of objects too small to be considered planets. Some are no larger than a grain of dust, while others, like Eros, can be more than 160 km across. A few, like Ida, even have their own moons. Some large objects, like Pluto, are now classified as dwarf planets.

Discovering the Solar System

The model of the Solar System has been refined over many centuries.

Aristotle (384 BC–322 BC) proposed the geocentric model, with Earth at the centre of the Universe. The five known planets (Mercury, Venus, Mars, Jupiter and Saturn), the Moon, the Sun and the stars moved around Earth in perfect spheres.

Ptolemy (*c.* 90–168 AD) refined the geocentric theory. Ptolemy said they did not travel in exact spheres but moved around the spheres on elliptic orbits, turning around on themselves.

Alhazen (965–1038 AD) first used maths to describe the motions of the planets.

Nicolaus Copernicus (1473–1543) made accurate observations of the Moon and the planets. He used maths to show that their movements could be explained much better if he put the Sun at the centre of the Solar System.

Johannes Kepler (1571–1630) used maths to show that the orbit of a planet is an ellipse with the Sun at its focus and that it moves faster when it is closer to the Sun than when further away.

Galileo Galilei (1564–1642) championed the heliocentric model and used telescopes to show that Jupiter had moons. A devout Roman Catholic, Galileo came into conflict with the church by challenging its doctrines. Hence, the biggest argument in history.

In medieval times and before, it was commonly accepted that Earth was flat. Nowadays, we have photographic and other evidence to show that, like other planets and the Moon, Earth is spherical in shape.

Earth and the Moon both move. Earth orbits the Sun once every 365 $\frac{1}{4}$ days and spins on its axis once a day. Although when you look up into the sky the Sun seems to move around the Earth, this is an illusion: in fact the Earth spins and causes night and day. The part of the Earth that faces the Sun is in daylight and the part that is not facing the Sun is in darkness.

Before modern calendars, people used to keep track of the days by watching the phases of the Moon. One full cycle of the Moon's phases is approximately 28 days, which is very close to the amount of time we now know as one month. Its regular movement around Earth, as seen by its phases, gives rise to one 'month of time'.

CHILDREN'S MISCONCEPTIONS

Children might think…

- That there is only one Solar System – there are lots.
- That the Earth is at the centre of our Solar System.
- That there are stars in our Solar System other than the Sun. In fact, the Sun is the only star in our Solar System.
- That all planets have rocky surfaces. Some do, but the outer planets are gas giants.
- That planets can only be seen with a telescope. In fact, you can see Mercury, Venus, Mars, Jupiter and Saturn without a telescope.
- The Sun moves around the Earth and causes day and night (the spinning Earth causes it).
- That night-time is caused because the Sun goes to the back of the Earth. In fact, it is the Earth that moves.

Children already know...

- That Earth and space are not covered in Key Stage 1 or lower Key Stage 2 at all. However, the children will be aware of our Sun and be familiar with the names of some of the planets.
- The study of light and shadows in Year 3 introduces children to the Sun's apparent movement across the sky.

SCIENTIFIC VOCABULARY

You can download a Word mat of essential vocabulary for this topic from *My Rising Stars*.

daytime: the time when part of the Earth is in daylight

geocentric: (Earth-centred) the Earth is at the centre of the Solar System

heliocentric: (Sun-centred) the Sun is at the centre of the Solar System. The belief that the Sun is at the centre of the Solar System is heliocentrism

night-time: the time when part of the Earth is in darkness

orbit: the path of a planet or moon around another celestial object

planet: a celestial body that orbits a star, is round and has cleared smaller objects away from its orbit

solar system: a series of planets that orbit a star

star: an astronomical body that produces its own energy

Sun: the star at the centre of our Solar System

time zone: a geographical region where the same time is set