

Subject: Science Year 5: Earth and Space

NC/PoS:

- 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.

Prior Learning (what pupils already know and can do)

Forces: Knowledge of pushes and pulls (Year 3).

Seasonal Changes: Knowledge of the four seasons, change in daylight hours and the weather associated with each season (EYFS & Year 1).

- Space: This is the first instance of this topic within the curriculum, but an understanding of day and night is explored in Year 1 when looking at nocturnal and diurnal animals.

End Goals (what pupils MUST know and remember)

- Know that our solar system consists of our star, the Sun, and everything bound to it by gravity – the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune
- Know Mercury, Venus, Earth and Mars are terrestrial planets
- Know Jupiter and Saturn are giant gas planets and Uranus and Neptune are giant ice planets
- Know that the Earth is a sphere, spins on an axis as it travels round the sun, when one side faces the sun the other faces space
- Know that the side facing the sun is bathed in light and heat (daytime) and the side facing space is cooler and darker (night)
- Know that a day on Earth last 24 hours – how long it takes for the Earth to make one complete rotation
- Know that the Earth's tilt on its axis is what causes the 4 seasons. Sometimes it points towards the sun and other times it points away from the sun.
- Know that the moon moves around the Earth in an approximately circular orbit, once around the Earth in approximately 27.3 days
 - Know the phases of the moon and that they are caused by the changing position of the Earth and the moon in relation to the sun.

Key Vocabulary: solstice, planets, revolve, sphere, solar system, spherical, terrestrial, Jovian, orbit, orbital path, axis, tilt, rotation, shadows, lunar month, lunar cycle, phases of the moon - full moon, gibbous moon, half-moon, crescent moon, new moon, waxing , waning

Session 1: Recap previous learning: That we have day and night and seasons. In the UK (United Kingdom), the day length is longest in the summer and shortest in the winter. Suggested resources:

<https://www.youtube.com/watch?v=btcTfor-j-c> what is a solstice? National Geographic

<https://www.youtube.com/watch?v=UiAUG1HtWIM> summer vs winter solstice: side by side time lapse

Use resources from Kapow Lesson 1: Models of our Solar System

LO: To describe the heliocentric model

Watch the flight through our Solar System and explain the following points:

- The Earth is part of the Solar System.
- Earth has one moon.
- The Solar System is a group of celestial bodies (natural objects in space) that includes the Sun, eight planets, moons and other objects like asteroids.
- The planets each have unique characteristics; some, such as Saturn, have rings and others have moons that orbit them.
- Pluto used to be considered the ninth planet but is now classified as a dwarf planet. It is still part of the Solar System, just in a different category.

Look at heliocentric model of the Solar System (Nicholas Copernicus).

- Focus on the gravitational pull of the Sun at the centre of the Solar System

Children write a short explanation as to why the Sun is at the centre of our solar system.

Vocabulary: planets, revolve, sphere, solar system, spherical, celestial bodies

Session 2: Use resources from Kapow Lesson 2: Our Solar System

Recap and recall: Play the animation from the *Presentation: The heliocentric model* and ask the children to explain why the planets orbit around the sun.

LO: To describe the movement and shapes of celestial bodies in our Solar System.

Children learn that the sun is a star at the centre of our solar system and the Earth is one of eight planets in the solar system. The Sun and the eight planets are all roughly spherical and the order of planets from the sun is: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

The Sun accounts for 99% of the mass of the Solar System and its diameter is 109 times that of Earth's.

- **Which planet is likely to have the shortest year (orbit)?** (Mercury.)
- **Which planets are made from rock?** (Mercury, Venus, Earth and Mars.)
- **Which force keeps the planets in their orbits?** (Gravity.)

Rocky (terrestrial) planets: Mercury, Venus, Earth, Mars Gas (Jovian) planets: Jupiter, Saturn, Uranus and Neptune which each have many moons. They are much bigger than the rocky planets and are balls of hydrogen and helium. The Jovian planets are much larger planets compared to the rocky ones.

Children create a mnemonic to remember the order of the planets e.g. 'My Very Easy Method Just Speeds Up Naming'

Vocabulary: planets, revolve, sphere, solar system, spherical, terrestrial, Jovian

Session 3: Use resources from Kapow Lesson 2: Our Solar System

Recap and recall: Order the planets from the Sun (recall their mnemonics). Which planets are terrestrial or Jovian? What shape roughly are the planets?

Working scientifically LO: To develop a model to represent the Solar System.

Children learn the Earth and the other planets orbit the sun and the Sun is much bigger than the planets, so its gravitational pull is larger.

Model: Children become the planets and orbit the sun. Focus on time taken to orbit- Mercury orbits the fastest and Neptune takes the longest. The Earth takes about 1 year to orbit the sun.

NB: The Solar System is disc-like in shape. The Sun is at the centre, and the planets follow individual paths called orbits around it. They all travel in the same direction but move at different speeds and take different times to complete one orbit. The fact that the Earth travels around the Sun has been accepted for less than 400 years.

Vocabulary: orbit, orbital path

Session 4: Use resources from Kapow Lesson 3: The Moon

Recap and recall: how long does it take the Earth to orbit the sun? Which planet has the longest orbit? (Neptune as furthest from Sun) Which planet has the shortest orbit? (Mercury as closest to the Sun)

LO: To describe the movement of the Moon relative to the Earth.

Children learn it takes about 28 days for the moon to orbit the earth and that the moon appears to change shape. Use the *Presentation: The Moon*, which shows the phases of the Moon and discuss the explanations provided- all of which are misconceptions. (Revisit these statements at the end of the lesson and together come up with an accurate statement.)

Play the *Pupil video: The Moon*, which explains the phases of the moon and children draw or label the different phases of the moon.

Other resources: <https://www.youtube.com/watch?v=1sj2otIjZfM> Phases of moon explained using an orrery <https://www.youtube.com/watch?v=wz01pTvuMa0> Moon phases demonstration

Vocabulary: lunar month, lunar cycle, phases of the moon - new moon, waxing crescent, first quarter, waxing gibbous, full moon, waning gibbous, third quarter and waning crescent

Session 5: Use resources from Kapow lesson 4: Day and Night

Recap and recall: How long does it take for the moon to orbit the Earth? (approx. a month) Why does the moon appear to change shape? (the position of the Earth, Sun and moon)

LO: To explain the causes of day and night

Working scientifically LO: To draw a diagram to explain day and night.

Children learn that the Earth spins on an axis as it travels round the sun and when one side faces the sun, the other faces space. They understand that the side facing the sun is bathed in light and heat (daytime) and the side facing space is cooler and darker (night)

Display the *Presentation: Movement of the Sun* showing the Sun's apparent movement across the sky from East to West. Discuss: **What makes the Sun appear to move across the sky?**

Model day and night using the torch to represent the sun and a polystyrene ball with a toothpick through the middle to represent Earth and its axis. Mark a small 'X' somewhere on the Northern hemisphere so they can observe its movement.

Use slides 1-4 of the *Presentation: Day and night and seasons diagrams* to develop their understanding of the causes of day and night and the sun's apparent movement across.

Children should draw/label a diagram of day and night to demonstrate their understanding.

Other resources: <https://www.bbc.co.uk/bitesize/topics/zkbbkqt/articles/zn34r2p> Day and night

If weather permits, or later in the year if necessary: Children learn to use the idea of the Earth's rotation to explain the apparent movement of the Sun across the sky. The focus now is trying to enable the children to make a link between the direction and length of the shadows throughout the day with movement of the Earth on its axis. By placing a rounders pole on the playground throughout a sunny day the children can measure the length of the shadow every hour. They could also note down the compass direction of the shadow.

Vocabulary: axis, tilt, rotate, season

Session 6: Use resources from Kapow lesson 4: Day and Night

Recap: Why does it look like the sun is apparently moving across the sky?

LO: To explain the causes of the seasons

Model the seasons using the torch, ball and toothpick from yesterday's lesson.

Start with the Earth (ball) in its summer position for the Northern Hemisphere; the top of the toothpick should be tilted towards the Sun (with the torch shining upward). Point out that because the Northern Hemisphere is tilted towards the Sun, it receives more light than the Southern Hemisphere. Explain that the daylight hours are the longest in this season and the weather is the warmest.

Move the Earth around the Sun slowly, noting to the children that the Earth orbits the Sun in an anticlockwise direction. Pause at each quarter of the way around the sun and discuss the position of the X (Northern hemisphere) is on the ball and which season it is in/length of days etc.

Use slides 5 and 6 from the *Presentation: Day and night and seasons diagrams* to clarify understanding and address any misconceptions.

Explain that one orbit of the Earth around the Sun takes 365.25 (or one Earth year). Inform them that because we cannot have a quarter of a day, an average year is 365 and every four years, there is a leap year with an extra day to make up for the 'point two five'.

Use the *Presentation: What is wrong with this diagram?* Ask the children to discuss the mistake made on the diagram with a partner.

Vocabulary: rotation, season, year

Link to career scientist: Astronomer, physicist

Scientists who have helped develop understanding in this field: Aristarchus (310 – 230 B.C.). He was the first to figure out that the Earth travels around the Sun. Nicolas Copernicus (1473 – 1543). Had the idea that Earth revolves on its axis and the Earth and other planets orbit around the Sun