Astronomy (Physics)

Year 5

End Points:

- Astronomers believe the universe started with the Big Bang 14 billion years ago and that the universe is still expanding today
- Galaxies are groups of stars held together by gravity
- Our galaxy is the Milky Way and our nearest neighbour is Andromeda galaxy
- Gravity is the force which pulls all objects towards each other
- Although all objects attract all others by the force, gravity, it is too weak to notice unless one object (like the Earth) is huge
- The Earth's gravity holds us to the Earth's surface; the Sun's gravity holds the Earth in orbit around it
- The Sun is at the centre of our solar system
- Our solar system contains 8 planets, 4 terrestrial planets and 4 Jovian planets
- There are trillions of smaller rocks called asteroids, as well as dwarf planets like Pluto and Ceres
- The moon is the Earth's natural satellite
- The moon is a planet, it does not make its own light
- Depending on the position of the Sun, we see all, part or none of the Moon; these are known as the phases of the Moon
- Neil Armstrong and Buzz Aldrin were the first humans to land on the moon
- Our home supercluster is called Laniakea and contains over 100,000 galaxies

In this unit, children will study astronomy. They will learn that the word astronomy comes from the Greek word astron meaning 'star'. Therefore, astronomy is the science that studies the laws of the stars and everything in universe beyond the Earth's atmosphere. The substantive concepts of this unit are **motion, force, energy, matter** and **space**. In this unit, the children will learn about the evolution of the universe, gravity, the solar system, lunar phases and about galaxies.

The study of astronomy is complex, and it is connected to many elements of science, mathematics, technology, history and philosophy. Modern physics, as we know it, is a relatively new concept in comparison to chemistry and biology. However, across the science disciplines, changes in natural phenomena are to be observed. For this reason, in order for our children to gain disciplinary knowledge, we recommend that teachers encourage their pupils to keep a moon diary for a month, starting from the very first lesson. Perhaps even having a class moon diary, where each child is responsible for observing the moon on a particular day. Then, by Lesson 4, the pupils can share their scientific observations. This will encourage the children to think more like astronomers and physicists, and search for patterns, make observations and predict outcomes.

As mentioned, modern physics is a relatively new concept which has been advanced by Western Culture, in search for further understanding of the universe and why objects behave and exists as they do. However, although not a physicist, Aristotle's work began to study the general principles of change and motion. Aristotle (384-322 BCE) believed that physical changes in natural objects were not signs of decay, but instead serving a higher purpose. He believed that everything was in motion, a constant, evolving change, which was never-ending. The universe follows a similar principle, in that all objects in space are constantly in motion. Newton (1643-1727) went on to devise the concept of the laws of motions, including the laws of gravity, he also created a new brand of mathematics (the calculus) as a way of calculating a change in gravitational force. Newton was able to bring mathematical logical into empirical observation. Throughout the 19th century, knowledge in physics advanced, especially during the Industrial Revolution. Now, modern day astronomers are able to push the boundaries of human knowledge, utilising modern technology, astronomers are able to manipulate and plot data onto computers to create theoretical models. Most observations are now done using satellites.

In Lesson 1 of this unit, children will learn that the universe contains everything in existence, including all the energy and matter that there is. They will learn that universe is in motion, constantly expanding, which is what led astronomer, scientists who study outer space, to theorise how the universe began: The Big Bang Theory. In Lesson 2, children will learn that gravity is a force that holds objects together, the bigger the objects the bigger the force of gravity. They will learn that the Earth's gravity holds us to the Earth's surface; and the Sun's gravity holds the Earth in orbit around it (children will have previous knowledge of gravity from our Yr5 unit on Forces). In Lesson 3, the children will learn that the Sun is at the centre of our Solar System. They will learn about the planets in our solar systems, including both the terrestrial planets (Mercenary, Venus, Earth and Mars), and the Jovian planets (Jupiter, Saturn, Uranus, Neptune). In Lesson 4, the children will learn that the Moon is the Earth's natural satellite. They will also learn about the phases in the moon, and how depending on the position of the Sun, we see all, part or none of the Moon. Finally, in Lesson 5, the children will learn about our galactic neighbourhood, and how our solar system is just a small part of our universe.

Overall, this unit build on the children's substantive knowledge concepts of **motion, force, energy, matter** and **space**, which will further be built upon in later secondary schooling.

Lesson Sequencing:

In lesson one, pupils will learn about the theory of the Big Bang and that the universe is still expanding today. Lesson two will develop pupil's understanding of gravity by looking at gravity's affect within our solar system. In lesson three, pupils will expand further on this by looking at the celestial bodies within our solar system, including the different types of planets. Lesson four will look at the phases of the Moon and the role that the Sun plays in this. Tying all this knowledge together, lesson five will look at our galactic neighbourhood, looking at the Milky Way, Andromeda and Laniakea. In the assessment lesson, pupils will order things in our galactic neighbourhood or explain how astronomers think the universe started.

Misconceptions:

- The universe has stopped expanding
- The Moon has zero gravity
- Confusing mass and weight
- Pluto is a planet
- The Sun is a planet
- The Sun rotates around the Earth
- Earth is at the centre of the solar system
- Earth, the Sun and the Moon are a similar size
- The Moon only appears at night
- Earth's shadow is responsible for the phases of the Moon
- The Moon is a similar size to Earth
- Night is caused by the Moon getting in the way of the Sun
- The only planets that exist are in our solar system
- The Milky Way is the only galaxy

Working Scientifically criteria met in this unit:

- 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