



Year 5 - Astronomy Reading Booklet

Lesson Series:

1. The Big Bang and the expanding universe.
2. Gravity.
3. Our solar system.
4. The Moon.
5. Our galactic neighbourhood.

Name: _____

Class: _____

Lesson 1 - The Big Bang and the expanding universe

When you look up into the sky, you see the moon, the stars, and space. For every star you see, there are billions more you can't, they all make up the universe. The universe stretches out in all directions, farther and bigger than anyone imagines. The universe contains everything in existence, all the energy and matter there is from the smallest atom to the largest galaxy. It is a big, open space and stretches out in all directions. From Earth, outer space is approximately 62 miles away (100km). Technically, living on planet Earth means that we are in space right now.



The stars in the universe are grouped into huge galaxies, which are groups of stars held together by gravity. Our Sun is only a single star among the billions of stars that make up the galaxy we live in, the Milky Way. It is called that because it appears to be a milky band of light like a cosmic road, stretching across the dark sky. Beyond the Milky Way, there are billions more stars in the galaxies that are our closest neighbours. One of our close neighbours is the Andromeda galaxy, but it is 2 1/2 million light-years away.

Astronomers, scientists who study outer space, have discovered that the billions of galaxies are flying out and away from each other, the universe is expanding. This led them to a theory for how the universe began. Their idea is called the Big Bang Theory.

About 14 billion years ago, all the matter in the universe was packed into a super-dense ball. No one knows what it was or why, but something caused this ball to explode with a big bang. The explosion sent chunks of matter flying out into space. Eventually this matter became the stars, planets and everything else in our universe. All matter came from that super-dense ball that exploded billions of years ago. Since we are made of matter, that means we are made of the stuff of stars.

Useful link: <https://www.nationalgeographic.com/science/article/origins-of-the-universe>



The milky way - The galaxy we live in



The universe

Lesson 2 - Gravity

Gravity is a force between bits of matter, attracting every object to every other object. The bigger the object the bigger the force, we only feel the effect of gravity as the Earth's pull on us (because the Earth is so huge).



Gravity is the force that keeps your feet on the ground. Gravity affects objects all the time, when you throw a ball up into the air, no matter how high you throw the ball it always comes back down. The gravitational force between the Earth and the ball pulls the ball to the ground. If there was no gravity, the ball would keep going up. Earth's gravity pulls on the Moon, the Moon's gravity pulls on Earth.

The moon is moving fast enough not to fall down and hit the Earth but not so fast it disappears off into space. Those forces keep the Moon in orbit around the Earth. In the same way, the Sun's gravity pulls on Earth and the other planets and keeps them in their orbits around the Sun. The power of the pull of gravity between objects depends on two things: how far apart the objects are and the mass of each object – that is, how much matter each object contains.

Objects that are close together and objects that have lots of mass attract each other strongly. Things that are far apart and things with small mass attract only weakly. If you were on the Moon, you could jump much higher than when you are on Earth. This is because the Moon is much smaller than earth and contains much less matter than Earth, its gravitational pull is weaker than Earth's, with gravity pulling more weakly, and you can jump higher. This means you weigh less on the Moon- only about one-sixth of what you weigh here on Earth.

The Moon's gravity still affects us. The gravity of the Moon (with some help from the Sun) pulls on the waters of the oceans here on Earth. The gravitational pull causes tides, which are the regular patterns by which the ocean's water level rises and falls. There are places in the universe where gravity is so strong that not even light is able to escape it: these are called black holes.

Useful link: <https://www.nationalgeographic.org/video/black-hole-101/>



Issac Newton 25 December 1642 – 20 March 1726/27 was an English mathematician, physicist, astronomer, theologian, and author was a physicist who came up with the theory of gravity when we saw an apple fall from a tree.

Lesson 3 - Our Solar System

The 'Solar System' is all the planets, moons and other matter that circle the Sun. 'Solar' comes from Latin word 'sol', which means 'sun'. 'System' means a group of things that move or interact with each other. So the 'solar system' is the group of planets that move in circles around our Sun.



Hundreds of years ago, people believed that the Sun, the stars and the other planets circled the Earth, which made sense because we saw everything crossing the sky every night. Greek astronomer Aristarchus suggested the Earth circles the Sun, but the idea didn't catch on. In 1500s, Polish astronomer Nicolaus Copernicus argued that the Sun appeared to move across the sky because the Earth was spinning right round every day. The planets were in a system with the Sun, not the Earth, in the middle.

Forming 99.8% of the mass of the entire system, the Sun sits at the centre of The Solar System, surrounded by eight planets. The Sun is the closest star to Earth, but is still 93 million miles away. It takes eight minutes for light travel from Sun to earth. The Sun is a giant ball of churning, glowing, expanding gas. The surface of the Sun is 5,500 degrees Celsius, and astronomers believe the deeper core might be almost 16 million degrees. The natural world depends upon the energy that comes from the Sun. Without the light and heat we get from the Sun, life on Earth wouldn't exist.

The closest planet to the Sun is the tiny, rocky planet, Mercury. Next is Venus: a boiling, rocky planet, covered in clouds of carbon dioxide. Third is the Earth. Mars is next, made of reddish rocks. Following this, is a diffuse belt of rocks and icy comets called the Asteroid Belt; before reaching Jupiter – the largest planet and the first of the gas giant worlds. After Jupiter is Saturn, the next biggest planet, famous for the rings that surround it. Next come Uranus and Neptune, also gas giants. Finally Pluto – a tiny, frozen, dwarf planet, around 6 billion kilometres from the Sun.

The final edge to the Solar System is a thousand times further out than Pluto. This is a sphere of asteroids called the Oort Cloud, which extends almost a light year out into space. If you imagine that light takes 8 minutes to travel the 150 million kilometres from the Sun to Earth, and a year to reach the Oort Cloud, you get a sense of how vast and spaced out the Solar System really is.

Useful links: <https://www.nationalgeographic.org/video/space-101-solar-system/>
<https://www.nationalgeographic.org/activity/planetary-size-and-distance-comparison/>
<https://www.jpl.nasa.gov/edu/learn/video/solar-system-size-and-distance/>



Lesson 4 - The Moon

Earth orbits the Sun. The Moon orbits Earth. Another way of saying this is that the Moon is a satellite of earth. You may think of a satellite as a device that gets blasted by a rocket and orbits the Earth, sending down radio signals and scientific measurements.



In astronomy, the word 'satellite' can mean any heavenly body that orbits another. The word 'satellite' comes from Latin for 'attendant', meaning someone who waits on an important person. The Moon often looks bright in the night sky, but it does not make its own light, as the Sun does. The Moon reflects the light cast on it by the Sun. There are nights when it does not appear in the sky at all, even if the sky is clear. That's called a new moon.

When it's a new moon, the Moon is overhead during the day, but the bright sunlight makes it impossible to see from Earth. The moon appears to change shape, but it doesn't actually change. The Moon reflects the light of the Sun. Depending on the position of the Moon and Sun to our eyes, we on earth see all, part or none of the Moon. It takes 29 days for the Moon to go through all its phases, from new moon to full moon and back to new moon again.

When more of the Moon is becoming visible each night, we say the Moon is waxing. As the Moon orbits the Earth, it sometimes moves right between the Earth and the Sun. Then the Moon blocks our view of the Sun and casts a shadow on Earth. That is a solar eclipse.

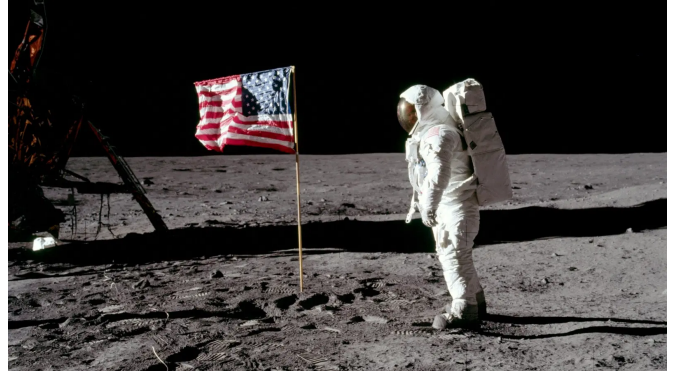
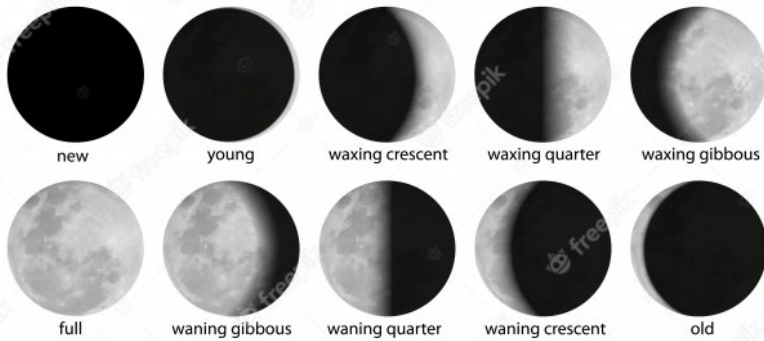
As a solar eclipse begins, it looks as if a dark disc is creeping slowly across the face of the Sun. The Moon seems as big as the Sun, but that is because the Moon is closer to the Earth than the Sun. As more and more of the Moon blocks the light of the Sun, day seems to turn to night. A solar eclipse only lasts a few minutes.

When the Earth moves between the Moon and the Sun, the Earth blocks sunlight from reaching the Moon. Earth casts a shadow on the Moon so it will become invisible for a little bit. This is a lunar eclipse. When less of the Moon is becoming visible each night, we say it is waning.

The Moon is mostly a big ball of rock. There is no atmosphere on the Moon-no air, no water, no clouds, and no rain. Nothing grows on the Moon. Humans have visited the Moon and walked on its surface. On 20 July 1969, Neil Armstrong on the Apollo 11 space mission became the first person to set foot on the Moon. 'That's one small step for a man, one giant leap for mankind' were his words when he stepped on the Moon.

Useful links: <https://www.nationalgeographic.org/video/moon-101/>
https://www.nasa.gov/mission_pages/apollo/apollo11.html

Phases of the Moon



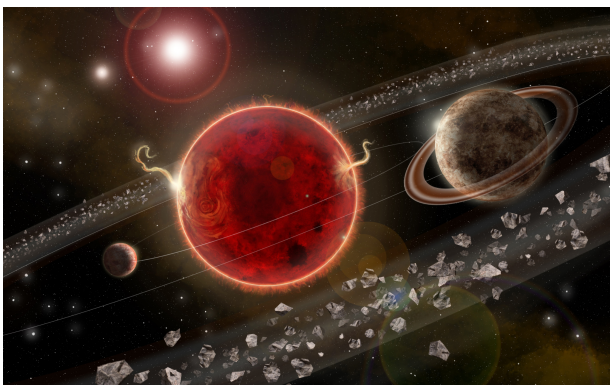
Lesson 5 - Our Galactic Neighbourhood

Our Solar System seems huge. Even our closest planets, Venus and Mars, are too far away for us to send humans in a space ship. When we look out across the cosmos, we realise what a tiny part of it our Solar System really is. Even our Sun, many thousands of times bigger than Earth, is only a small to medium sized star.



The largest stars are billions of times larger than the Sun. Our nearest neighbour star, Proxima Centauri, is 4.25 light years from the Sun. Even this huge distance is in our cosmic backyard. Our home galaxy, The Milky Way, is 100,000 light years across; whilst our nearest neighbour galaxy, Andromeda, is 2.5 million light years away! Just as stars clump together into galaxies, so galaxies clump together into clusters and superclusters. Our home supercluster is called Laniakea and contains over 100,000 galaxies!

Useful links: <https://sservi.nasa.gov/articles/laniakea-our-home-supercluster/>
<https://www.youtube.com/watch?v=i93Z7zljQ7I>
<https://www.nationalgeographic.com/science/article/galaxies>



Proxima Centauri



Andromeda Galaxy



KEY VOCABULARY

Astronomy

Astronomer

Universe

Galaxy

Star

Solar System

Orbit

Light year

Big Bang Theory

Gravity

Satellite

The Milky Way

The **study of the universe**, stars and galaxies

A scientist who **studies the planets**, stars and galaxies

All of **space, time, matter and energy**

Huge "**cities**" of stars bound together by gravity

A massive **ball of super-heated gas**

The name for our **sun and planets**, including Earth

A **regular and repeating path** that an object in space takes

The **distance light travels in one year**: roughly 9.5 trillion kilometres

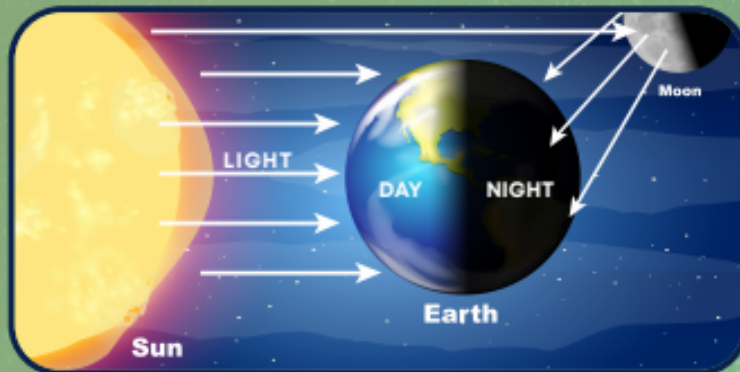
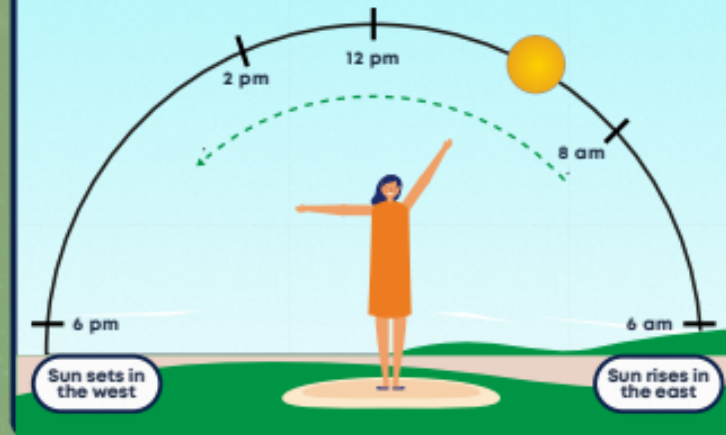
An explanation about **how the universe began**

A **force which pulls things to the ground** on Earth

Something that **orbits the Earth** or another planet

Our galaxy which contains our solar system

THE POSITION OF THE SUN IN THE SKY



THE SOLAR SYSTEM

