Meden School Curriculum Planning							
Subject	Physics	**Year Group**	9	**Sequence No.**	10	**Topic**	Gravity and Space

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'

K2 Gravity is an example of a pulling force, it pulls objects towards the centre of the Earth. The size of gravity remains constant all over the Earth. **KS3 Y7 Forces** Gravity is an example of a non-contact force. **KS2** Planets orbit a star, The Earth orbits the Sun because the suns gravity is much greater. The moon orbits the Earth because it is closer enough to be attracted by Earth's gravity. **KS3 Y7 Forces** forces including push, pull, friction, gravity, air resistance, reaction, weight, upthrust, magnetism and electrostatic. Non-contact forced can exert a force on an object without physical contact with it. **KS3 Y7 Forces** Hooke's law states that the extension of an elastic material is directly proportional to the force applied. All this means is that as the force applied increases, the extension will increase in proportion. KS2 Solar system and Y7 Solar System.	**L1: Mass and Weight.** **Mass** is different to **weight**. Mass is the **amount of matte**r, ie the total number of **atoms** present. It is measured in **grams and kilogram**. The **SI unit** for mass is the kilogram. **Weight** is a **force** due to **gravitational field strength**. It is measured in **Newtons**. The equation to calculate weight is **weight = mass x gravitational field strength.** However, mass cannot really be measured directly, weight is measured and converted back to kg. **L2: What is Gravity** Gravity is a **non-contact force**, Gravity is a pulling force On Earth gravity pulls objects down towards the ground, but really it is trying to pull objects to the centre of the planet. No matter where you live on Earth gravity pulls objects towards the ground. People on the other side of the planet are NOT upside down, they are just stand up on their side of the planet. Every object has gravity…an invisible force that pulls things towards its centre. The bigger the object, the bigger the gravity. The Sun is huge, so its gravity keeps the planets in our Solar System orbiting it. All objects with mass have gravity. Gravity is the **force of attraction** between two objects with mass. The larger the mass the larger the gravitational field strength. Only objects with a really large mass have a **gravitational field strong** enough to affect other objects. Sir Isaac Newton is credited with identifying and name the force we now call gravity. The unit used to measure forces is named after him, eg the Newton, it is why it has a capital letter as a unit. **L3: Measuring Forces** A **newton meter** is used to measure the pulling force due to gravity. Inside a newton meter is a spring. The spring stretches by a specific amount per unit force. This is based on the **Hooke's Law principle**. Different strength springs are used to weigh objects of different masses. The stronger the spring the heavier the mass it can weigh. 1ON is the approximate force exerted by 1kg of mass on Earth. **L4: Can you jump higher on the moon?** **Galileo** was the first scientist to consider the effect of gravity on a falling object, he realised that gravity causes falling objects to **accelerate**. Gravity on Earth is 9.8m/s2, gravity on the moon is much less, it is 1.6m/s2. A weaker force of gravity means objects take longer to fall the same distance on the moon. It also means that objects thrown upwards on the moon take longer to slow down and then fall back to the surface. You can jump higher on the moon. **L5: Measuring Gravity** Gravity causes falling objects to accelerate. This means that gravity can be expressed by using two units, N/kg and m/s^2 . **Light gates** can be used to **electronically** measure the speed of a moving object. Gravity can be measured by measuring the speed of an object as it falls using his equation: **$v^2 = 2gh$** Repeating experiments increases the **validity** of results by allowing for the calculation of a mean and the identification of **anomalous** results. **L6: How have our ideas about space changed over time?** In 140BC **Claudius Ptolemy** studied **astronomy** and created a mathematical model of the observable **celestial** objects which put the other at the centre and all other objects orbiting it. This is known as the **geocentric** model, "geo" is Greek for Earth. This model was accepted for the next 1500 years. In the 1500's **Copernicus** established that the sun	It is important to remember that our concept of the historical events leading to the identification of gravity by Isaac Newton is based on the writings and journals of Europeans. Other cultures have their own historical documents. Once such document show us that fifth century Indian astronomer-mathematicians Aryabhatta and Bhaskara carried extensive work on planetary work and exploration of outer planets. The equation of Aryabhatta was used and demonstrate a knowledge of gravitational field,

	was at the centre of the observable universe and called his model **heliocentric**. "Helios" was the name of the sun god in Greek. It is also where the element Helium gets its name, as helium was first detected in the corona of the sun before being detected in the Earth's atmosphere. Coperincus's work was not accepted, it went against the teachings of church. **Galileo** used an early **telescope** to observe a new planet given the name Jupiter. Galileo saw moons orbiting Jupiter, this proved that the Earth was not at the centre, he used this evidence to support the work of Coperincus. **Keplar** was in correspondence with Galileo, he collected evidence that planets moved in **elliptical orbits** not circles. He developed three principles of planetary motion that were later proved to be accurate by Isaac Newton. **Halley** observes comets, noting that it was not just planets that orbited the sun. **L7: Why are we made from star dust?** A **nebula** is a cloud of **interstellar** dust and hydrogen. A very large cloud will collapse under the force of its own gravity forming a **protostar**. The temperature will rise as the particles are compressed together this eventually leads to **nuclear fusion** reactions occurring between **hydrogen nuclei** creating **helium nuclei**. The star enters a **main sequence** where the inward force of gravity is balanced by the outward pressure of **fusion** reactions. The main sequence of a star lasts for billions of years. When the supply of hydrogen starts to run out, fusion between helium starts and this is the beginning of the **death sequence** for a star. The star will grow in size and become a **Red Giant** or **Red Super Giant.** The forces are now unbalanced and the other layers cool down changing the colour of the star. During the Red Giant or Red Super Giant phase elements from helium to iron are made in the fusion reactions. A Red Super Giant will eventually exploded into a **supernova** this is where elements heavier than iron are formed. This means that all of the elements on planet earth were created inside a star and are the remnants of a star dying, hence star dust. **L8: How big is the universe?** The **universe** consists about 1.2 trillion **galaxies** which are collections of billions of solar systems. Our galaxy is a called the Milky Way, from the Greek word Galaxias meaning Milky Circle. There are lots of different shaped galaxies. The term universe means all of the existing matter, **antimatter,** energy and space, it is about 13.8 billion years old. The universe is measured in light years. One l**ight year** is the distance light can travel in one year. Light travels at 300,000,000m/s. A light year is about 9.5 trillion km. Our closest star, **Alpha Centauri** is 4.4 light years away. **Andromeda** is our closest galaxy and is 2.5 million light years away. **Red-shift** tells us galaxies are moving away, blue shift tells us galaxies are moving towards us. **Constellations** are collections of stars in a set pattern in the sky that have been given names by ancient civilizations. Star signs are based on the constellation in the sky when someone is born, the same constellation is in the sky at the same time of year due to the Earths orbit around the sun. Cave paintings in Europe suggest humans were recognizing constellations as early as 17,000 years ago. **L9: Are we Alone in the Universe** **Exoplanets** are planets orbiting other stars. The distance to these planets is so huge, the first detected exoplanet occurred in 1992. Space exploration is very challenging due to the extreme distances, we are only just learning about the other planets in our solar systems using probes. It is estimated that there are up to 400 billion stars in our galaxy, any of these could have an Earth-like planet orbiting it. Exoplanets are being detected using several different	even if they didn't name it gravity... Newton named it some 1500 years later Space travel may seem very e citing and adventurous but questions need to be asked about the money spent on space exploration when there are millions of people living in poverty around the world.

	methods: **wobbly stars,** these are stars being forces to orbit in little circles due to the force of an undetectable planet orbiting it. **Transit Curve** method, this method uses the periodically drop in brightness of a star due to a planet passing across its face. Space travel is limited by many factors: cost, resources, biology, radiation, distance, technology **L10:** Revision **L11:** EOTT **L12:** GPA	India - Space or Poverty. What should come first? - AstrotalkUK