Science at The Mead Academy Trust

'The important thing is to never stop questioning' Albert Einstein

'Science is a way of thinking' C Sagan

'I have not failed, I have successfully discovered 10,000 things that won't work' Thomas Edison

Science Intent	• At The Mead Academy Trust we intend to develop young scientists' understanding, natural curiosity and wonder about the world around them, through scientific enquiry in the specific disciplines of biology, chemistry and physics. • **The curriculum is organised so that working scientifically (disciplinary knowledge) is embedded within scientific knowledge and conceptual understanding (substantive content).** Working scientifically includes developing an understanding of the nature, methods and processes of science through different types of scientific enquiry. • Science at The Mead Academy Trust is cohesive, so that children develop a cumulative understanding of science within and across each key stage. • Scientific knowledge and understanding is reinforced and embedded across many different subject disciplines including Mathematics. • At The Mead Academy Trust, pupils are taught the transferability of science-related knowledge, attitudes, experiences and resources that you acquire through life (science capital).
Science Implementation	• The Mead Academy Trust children are taught how to be scientists by using and applying disciplinary knowledge. • **They will think, and behave like scientists, learning through understanding of the nature, processes and methods of science. These processes include:** ○ **Asking questions and recognising that they can be answered in different ways.** ○ **Observing over time.** ○ **Seeking patterns.** ○ **Comparative and fair testing.** ○ **Identifying, classifying and grouping.** ○ **Researching using secondary sources.** • Children will build and extend their substantive knowledge of science by making connections between scientific concepts, other subjects and the world in which they live. • Children will retain this knowledge due to the recurring concepts and vocabulary in a well sequenced and coherent spiral curriculum. This helps them make connections between prior learning and help them make sense of future learning.
Resources	Cornerstones Explorify The Mead Academy Trust planning CLEAPPS

Substantive Conceptual Knowledge (Revisited over time)		
Biology • Plants (EYFS, Y1 2 3) • Animals including humans (EYFS, Y1 2 3 4 5 6) • Living things and their habitats (EYFS, Y2 4 5 6) • **Evolution and Inheritance (Y6)**	Chemistry • **Everyday materials (EYFS, Y1)** • **Use of everyday materials (Y2)** • **States of matter (EYFS, Y4)** • **Properties and changes of materials (y5)**	Physics • **Earth and Space (EYFS, Y5)** • **Seasonal changes (EYFS, Y1)** • **Rocks (Y3)** • Light (Y3 6) • Forces and magnets (EYFS, Y3 5) • **Sound (Y4)** • Electricity (EYFS, Y4 6)

Substantive Conceptual Knowledge	Core Knowledge – Revisited over time in these topics	Specific knowledge
Plants	Y1 2 3 EYFS Explore the plants in the surrounding natural environment Explore plants and animals in a contrasting natural environment Y2 Plants grow from seeds and bulbs. Seeds and bulbs need nutrients from soil, water and warmth. Y3 Plants need air, light, water, minerals from the soil and room to grow, in order to survive. Different plants have different needs depending on their habitat. Examples include cacti, which need less water than is typical, and ferns, which can grow in lower light levels. Flowers are important in the life cycle of flowering plants.	Y2 Plants need water, light and a suitable temperature to grow (germinate) and stay healthy. Without any one of these things, they will die. As the plant grows bigger, it develops leaves and flowers. Y3 Water is transported in plants from the roots, through the stem and to the leaves, through tiny tubes called xylem The plant's roots anchor the plant in the ground and transport water and minerals from the ground to the plant. The stem (or trunk) support the plant above the ground. The leaves collect energy from the Sun and make food for the plant. Flowers make seeds to produce new plants. The stages of a plant's life cycle include germination, flower production, pollination, fertilisation, seed formation and seed dispersal. Insects and the wind can transfer pollen from one plant to another (pollination). Animals, wind, water and explosions can disperse seeds away from the parent plant (seed dispersal).
Animals including humans	Y1 2 3 4 5 6 EYFS Describe people who are familiar to them Learn about how to take care of themselves Y2 Animals have offspring that grow into adults. Animals need water, food, air and shelter to survive. A healthy lifestyle includes exercise, good personal hygiene, good quality sleep and a balanced diet. Y3 Humans have a skeleton and muscles for movement, support and protecting organs. Animals cannot make their own food and need to get nutrition from the food they eat. Carnivores get their nutrition from eating other animals. Herbivores get their nutrition from plants. Omnivores get their nutrition from eating a combination of both plants and other animals. **Year 4**	Y2 Different animals have different stages of growth or life cycles. Their habitat must provide all these things. Risks associated with an unhealthy lifestyle include obesity, tooth decay and mental health problems. Y3 Major bones in the human body include the skull, ribs, spine, humerus, ulna, radius, pelvis, femur, tibia and fibula. Major muscle groups in the human body include the biceps, triceps, abdominals, trapezius, gluteals, hamstrings, quadriceps, deltoids, gastrocnemius, latissimus dorsi and pectorals. **Year 4** The main parts of the digestive system are the mouth, oesophagus, stomach, small intestines, large intestines and rectum. The mouth starts digestion by chewing food and mixing it with saliva. The oesophagus transports the chewed food to the stomach, where it mixes with stomach acid and gets broken down into smaller pieces. In the small intestine, nutrients from the food are absorbed by the body. In the large intestine, water is absorbed by the body. The remaining undigested waste is stored in the rectum before excretion through the anus.

	The digestive system is responsible for digesting food and absorbing nutrients and water. Describe the purpose of the digestive system, its main parts and each of their functions. Identify the four different types of teeth in humans and other animals, and describe their functions. Describe what damages teeth and how to look after them. There are four different types of teeth: incisors, canines, premolars and molars. Y5 Humans go through characteristic stages as they develop towards old age. Y6 The circulatory system includes the heart, blood vessels and blood. Lifestyle choices can have a positive (exercise and eating healthily) or negative (drugs, smoking and alcohol) impact on the body. Recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function.	Incisors are used for cutting. Canines are used for tearing. Premolars and molars are used for grinding and chewing. Carnivores, herbivores and omnivores have characteristic types of teeth. Herbivores have many large molars for grinding plant material. Carnivores have large canines for killing their prey and tearing meat. Regular teeth brushing, limiting sugary foods and visiting the dentist are important for good oral hygiene. Y5 These stages include baby, infant, toddler, child, adolescent, young adult, adult and senior citizen. Puberty is the transition between childhood and adult hood. Describe the changes as humans develop from birth to old age. Y6 The heart pumps blood through the blood vessels and around the body. There are three types of blood vessel: arteries, veins and capillaries. They each have a different-sized hole (lumen) and walls. The blood carries gases (oxygen and carbon dioxide), water and nutrients to where they are needed. The red blood cells carry oxygen and carbon dioxide around the body. The blood also contains white blood cells, which protect the body from infection. The role of the circulatory system is to transport oxygen, water and nutrients around the body. They are transported in blood and delivered to where they are needed. Identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood. Name and describe the purpose of the circulatory system and the functions of the heart, blood vessels and blood. Explain the impact of positive and negative lifestyle choices on the body. Describe the ways in which nutrients and water are transported within animals, including humans. Explain that the circulatory system in animals transports oxygen, water and nutrients around the body.
Living things and their habitats	Y2 4 5 6 EYFS Name and describe animals that live in different habitats.	Y2 Living things are those that are alive. Dead things are those that were once living but are no longer. Some things have never been alive.

	Explore the animals in the surrounding natural environment Describe different habitats Y2 3 categories for things: living, dead or never lived All living things live in a habitat which must provide everything needed for survival. Food chains show how living things depend on one another for food. <u>Year 4:</u> Food chains show what animals eat within a habitat and how energy is passed on over time. All food chains start with a producer, which is typically a green plant. Humans can affect habitats in negative ways, such as littering, pollution and land development, or positive ways, such as garden ponds, bird boxes and wildflower areas. <u>Y5</u> A life cycle is the series of changes in the life of a living thing and includes these basic stages: birth, growth, reproduction, and death. Compare the life cycles of animals, including a mammal, an amphibian an insect and a bird. Reproduction is the process of producing offspring and is essential for the continued survival of a species cat. There are two types of reproduction: sexual and asexual. Sexual reproduction involves two parents (one female and one male] and produces offspring that are different from the parents. Asexual reproduction involves one parent and produces offspring that is identical to the parent. Group and sort plants by how they reproduce. Describe the life process of reproduction in some plants and animals. Population changes in a habitat can have significant consequences for food chains and webs. <u>Y6</u> Scientists classify living organisms into broad groups according to their characteristics.	A habitat is a place where a living thing lives. A microhabitat is a very small habitat (under log, on stony path, under bushes) Local habitats include parks, woodland and gardens. Habitats beyond the locality include beaches, rainforests, deserts, oceans and mountains. All food chains start with a plant, followed by animals that either eat the plant or other animals <u>Year 4:</u> Humans can affect habitats in negative ways, such as littering, pollution and land development, or positive ways, such as garden ponds, bird boxes and wildflower areas. Animals can be divided into six main groups: mammals, reptiles, amphibians, birds, fish and invertebrates. These groups can be further subdivided. Classification keys are scientific tools that aid the identification of living things. The producer is eaten by a primary consumer (prey), which is eaten by a secondary consumer (prey), which is eaten by a tertiary consumer. All food chains end with a top or apex predator. Changes within a food chain, such as an abundance or lack of one food type, have an impact on the entire food chain. <u>Y5</u> Mammals' life cycles include the stages: embryo, baby, adolescent and adult. Amphibians' life cycles include the stages: egg, lava (tadpole), adolescent and adult. Some insects' (butterflies, beetles and bees) life cycles include the stages: egg, larva, pupa and adult. Birds' life cycles include the stages: egg, baby, adolescent and adult. Flowering plants reproduce sexually. The flower is essential for sexual reproduction. Other plants reproduce asexually. Bulbs, corms and rhizomes or some plant parts used in asexual reproduction in plants. Describe, using their knowledge of food chains and webs. What could happen if a habitat had a living thing removed or introduced. <u>Y6</u> Vertebrates are an example of a classification group. There are a number of ranks, or levels, within the biological classification system. The first rank is called a kingdom, the second a phylum, then class,

	Living things are classified into groups, according to common observable characteristics and based on similarities and differences. Scientists compare fossilised remains from the past to living species that exist today to hypothesise how living things have evolved over time. Animals that sexually reproduce generate new offspring of the same kind by combining the genetic material of two individuals. Animals and plants can be bred to produce offspring with specific and desired characteristics. This is called selective breeding. An adaptation is a physical or behavioural trait that allows a living thing to survive and fill an ecological niche. Classification keys help us identify living things based on their physical characteristics. Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. Recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago. Recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parent Scientists classify living organisms into broad groups according to their characteristics. Living things are classified into groups, according to common observable characteristics and based on similarities and differences.	order, family, genus and species. Vertebrates, or chordates, can be subdivided into five groups: amphibians, birds, fish, mammals and reptiles. Humans and apes share a common ancestry and evidence for this comes from fossil discoveries and genetic comparison. Each offspring inherits two of every gene, one from the female parent and one from the male parent. Examples include cows that produce large quantities of milk or crops that are disease-resistant. Adaptations evolve by natural selection. Favourable traits help an organism survive and pass on their genes to subsequent generations. Vertebrates, such as mammals, birds and reptiles, have a cornea and lens that refracts light that enters the eye and focuses it on the nerve tissue at the back of the eye, which is called the retina. Once light reaches the retina, it is transmitted to the brain via the optic nerve. Classify living things, including microorganisms, animals and plants, into groups according to common observable characteristics and based on similarities and differences. Give reasons for classifying plants and animals based on specific characteristics. Explain that living things have changed over time, using specific examples and evidence. Identify that living things produce offspring of the same kind, although the offspring are not identical to either parent. Describe how animals and plants can be bred to produce offspring with specific and desired characteristics (selective breeding). Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. Identify how animals and plants are adapted to suit their environment, such as giraffes having long necks for feeding, and that adaptations may lead to evolution. Vertebrates are an example of a classification group. There are a number of ranks, or levels, within the biological classification system. The first rank is called a kingdom, the second a phylum, then class, order, family, genus and species. Vertebrates, or chordates, can be subdivided into five groups: amphibians, birds, fish, mammals and reptiles.

Evolution and Inheritance	Y6 Scientists compare fossilised remains from the past to living species that exist today to hypothesise how living things have evolved over time. Animals that sexually reproduce generate new offspring of the same kind by combining the genetic material of two individuals. Animals and plants can be bred to produce offspring with specific and desired characteristics. This is called selective breeding. An adaptation is a physical or behavioural trait that allows a living thing to survive and fill an ecological niche.	Y6 Humans and apes share a common ancestry and evidence for this comes from fossil discoveries and genetic comparison. Each offspring inherits two of every gene, one from the female parent and one from the male parent. Examples include cows that produce large quantities of milk or crops that are disease-resistant. Adaptations evolve by natural selection. Favourable traits help an organism survive and pass on their genes to subsequent generations.
Everyday materials	**EYFS** **Explore a range of materials, including natural materials** **Make objects from different materials, including natural materials** **Observe, measure and record how materials change when heated and cooled** **Compare how materials change over time and in different conditions** **Y1**	
Use of everyday materials	**Y2** **Physical properties of material make it suitable for specific purposes.** **Some objects float and others sink.** **Some objects and materials can be changed.**	**Y2** **Materials such as glass for windows and brick for building walls.** **Many materials are used for more than one purpose, such as metal for cutlery and cars.** **Objects that float are typically light or hollow.** **Objects that sink are typically heavy or dense.** **Objects and materials can be changed by squashing, bending, twisting, stretching, heating, cooling, mixing and being left to decay.**
States of matter	**EYFS** **Observe, measure and record how materials change when heated and cooled** **Compare how materials change over time and in different conditions** **Year 4:** The water cycle has four stages: evaporation, condensation, precipitation and collection.	Year 4: Water in lakes, rivers and streams is warmed by the Sun, causing the water to evaporate and rise into the air as water vapour. As the water vapour rises, it cools and condenses to form water droplets in clouds. The clouds become full of water until the water falls back to the ground as precipitation (rain, hail, snow and ice). The fallen water collects back in lakes, rivers and streams. Evaporation and condensation are caused by temperature changes. Solids stay in one place and can be held. Some solids can be squashed, bent, twisted and stretched. Examples of solids include wood, metal, plastic and

	Materials can be grouped according to whether they are solids, liquids or gases. Heating or cooling materials can bring about a change of state. This change of state can be reversible or irreversible.	clay. Liquids move around (flow) easily and are difficult to hold. Liquids take the shape of the container in which they are held. Examples of liquids include water, juice and milk. Gases spread out to fill the available space and cannot be held. Air is a mixture of gases. The temperature at which materials change state varies depending on the material. Water changes state from solid (ice) ⇌ liquid (water) at 0°C and from liquid (water) ⇌ gas (water vapour) at 100°C. The process of changing from a solid to liquid is called melting. The reverse process of changing from a liquid to a solid is called freezing. The process of changing from a liquid to a gas is called evaporation. The reverse process of changing from a gas to a liquid is called condensation.
Properties and changes of materials	**Y5** **Materials can be grouped according to their basic physical properties.** **Properties include hardness, solubility, transparency, conductivity (electrical and thermal) and magnetism.** **Some materials (solutes) will dissolve in liquid (solvents) to form a solution. The solute can be recovered by evaporating off the solvent by heating.** **Some mixtures can be separated by filtering, sieving and evaporating.** **Identify, demonstrate and compare reversible and irreversible changes.**	**Y5** **Compare and group everyday materials by their properties, including hardness, solubility, transparency, conductivity (electrical and thermal) and magnetism.** **Explain, following observation, that some substances (solutes) will dissolve in liquid (solvents) to form a solution and the solute can be recovered by evaporating off the solvent.** **Sieving can be used to separate large solids from liquids and some solids from other solids.** **Filtering can be used to separate small solids from liquids. Evaporating can be used to separate dissolved solids from liquids.** **Separate mixtures by filtering, sieving and evaporating.** **Reversible changes include heating, cooling, melting, dissolving and evaporating.** **Irreversible changes include burning, rusting, decaying and chemical reactions.**
Earth and Space	**EYFS** **Learn about the Solar System and stars** **Learn about space travel** **Y5** **The Solar System is made up of the Sun and everything that orbits around it.** **Describe or model the movement of the planets in our Solar System, including Earth, relative to the Sun.** **The Sun, Earth, Moon and the planets in our solar system are roughly spherical.** **Describe or model the movement of the Moon relative to Earth.**	**Y5** **There are eight planets in our Solar System: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. Earth orbits around the Sun and a year (365 days) is the length of time it takes for Earth to complete a full orbit.** **The Moon orbits Earth, completing a full orbit every month (28 days).** **All planets are spherical because their mass is so large that they have their own force of gravity.** **As Earth orbits the Sun, it also spins on its axis. It takes Earth a day (24 hours) to complete a full spin.**

	This force of gravity pulls all of a planet's material towards its centre, which compresses it into the most compact shape – a sphere. **Describe the Sun, Earth and Moon as approximately spherical bodies and use this knowledge to understand the phases of the Moon and eclipses.** **Use the idea of Earth's rotation to explain day and night, and the Sun's apparent movement across the sky.**	**During the day, the Sun appears to move through the sky. However, this is due to the Earth rotating and not the Sun moving. Earth rotates to the east or, if viewed from above the North Pole, it rotates anti-clockwise, which means the Sun rises in the east and sets in the west. As Earth rotates, different parts of it face the Sun, which brings what we call daytime. The part facing away is in shadow, which is night time.**
Seasonal changes	**EYFS** **Explore shadows** **Play and explore outside in all seasons and in different weather** **Observe living things throughout the year** **Explore rainbows** **Y1**	
Rocks	Y3 Soils are made from tiny pieces of eroded rock, air and organic matter. There are a variety of naturally occurring soils, including clay, sand and silt. Different areas have different soil types. Fossils form over millions of years and are the remains of a once-living organism, preserved as rock. Soils are made from tiny pieces of eroded rock, air and organic matter. There are a variety of naturally occurring soils, including clay, sand and silt. Different areas have different soil types.	Y3 Scientists can use fossils to find out what life on Earth was like in prehistoric times. Fossils form when a living thing dies in a watery environment. The body gets covered by mud and sand and the soft tissues rot away. Over time, the ground hardens to form sedimentary rock and the skeletal or shell remains turn to rock. There are three different rock types: sedimentary, igneous and metamorphic. Sedimentary rocks form from mud, sand and particles that have been squashed together over a long time to form rock. Examples include sandstone and limestone. Igneous rocks are made from cooled magma or lava. They usually contain visible crystals. Examples include pumice and granite. Metamorphic rocks are formed when existing rocks are heated by the magma under the Earth's crust or squashed by the movement of the Earth's tectonic plates. They are usually very hard. Examples include slate and marble. Bath limestone
Light	Y3 6 Y3 A shadow is formed when light from a light source, such as the Sun, is blocked by an opaque object. Transparent objects allow light to pass through them and do not create shadows. Dark is the absence of light and we need light to be able to see. Light can be reflected from different surfaces. Some surfaces are poor reflectors, such as some fabrics,	Y3 Light from the Sun is damaging for vision and the skin. Protection from the Sun includes sun cream, sun hats, sunglasses and staying indoors or in the shade. Shadows change shape and size when the light source moves. For example, when the light source is high above the object, the shadow is short and when the light source is low down, the object's shadow is long.

	while other surfaces are good reflectors, such as mirrors. Y6 Light sources give out light. They can be natural or artificial. When light hits an object, it is absorbed, scattered, reflected or a combination of all three. Light from a source or reflected light enter the eye.	Y6 Apart from some distortion or fuzziness at the edges, shadows are the same shape as the object. The distortion or fuzziness depends on the position or type of light source.
Forces and magnets	Y3 5 EYFS Explore how to change how things work Explore how the wind can move objects Explore how objects move in water Y3 An object will not move unless a pushing or pulling force is applied. Some forces require direct contact, whereas other forces can act at a distance, such as magnetic force. Friction is a force between two surfaces as they move over each other. Friction slows down a moving object. Smooth surfaces usually generate less friction than rough surfaces. Some materials have magnetic properties. Magnetic materials are attracted to magnets. All magnetic materials are metals but not all metals are magnetic. Iron is a magnetic metal. Y5 Gravity is a force of attraction. Friction, air resistance and water resistance are forces that oppose motion and slow down moving objects.	Y3 Magnets have two poles (north and south). Opposite poles (north and south) attract each other, while like poles (north and north, or south and south) repel each other. Y5 Anything with a mass can exert a gravitational pull on another object. The Earth's large mass exerts a gravitational pull on all objects on Earth, making dropped objects fall to the ground. Explain that objects fall to Earth due to the force of gravity. These forces can be useful, such as bike brakes and parachutes, but sometimes we need to minimise their effects, such as streamlining boats and planes to move through water or air more easily, and using lubricants and ball bearings between two surfaces to reduce friction. Compare and describe, using a range of toys, models and natural objects, the effects of water resistance, air resistance and friction.
Sound	**Year 4:** When an instrument is played, the air around or inside it vibrates. These vibrations travel as a sound wave. Sound waves travel through a medium, such as air or water, to the ear. Pitch is how high or low a sound is. Volume is how loud or quiet a sound is. Sounds are louder closer to the sound source and fainter as the distance from the sound source increases.	**Year 4** Parts of an instrument that are shorter, tighter or thinner produce high-pitched sounds. Parts of an instrument that are longer, looser or fatter produce low-pitched sounds. The harder an instrument is hit, plucked or blown, the stronger the vibrations and the louder the sound.
Electricity	Y4 6	

	EYFS Identify electrical devices Use battery-powered devices <u>Year 4:</u> Electricity is a type of energy. Electrical components include cells, wires, lamps, motors, switches and buzzers. Switches open and close a circuit and provide control. A series circuit is a simple loop with only one path for the electricity to flow. A series circuit must be a complete loop to work and have a source of power from a battery or cell. Electrical conductors allow electricity to flow through them, whereas insulators do not. Y6 Voltage is measured in volts (V) and is a measure of the difference in electrical energy between two parts of a circuit. A circuit needs a power source, such as a battery or cell, with wires connected to both the positive and negative terminals. There are recognised symbols for different components of circuits. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. Use recognised symbols when representing a simple circuit in a diagram.	<u>Year 4:</u> Electricity is used to power many everyday items, such as kettles, computers and televisions. Electricity can also come from batteries. Batteries eventually run out of power and need to be recycled or recharged. Batteries power devices that can be carried around, such as mobile phones and torches. Common electrical conductors are metals. Common insulators include wood, glass, plastic and rubber. <u>Y6</u> The bigger the voltage, the more electrons are pushed through the circuit. The more voltage flowing through a lamp, buzzer or motor, the brighter the lamp, the louder the buzzer and the faster the motor. Other components include lamps, buzzers or motors, which an electric current passes through and affects a response, such as lighting a lamp or turning a motor. When a switch is open, it creates a gap and the current cannot travel around the circuit. When a switch is closed, it completes the circuit and allows a current to flow all the way around it. Explain that, due to how light travels, we can see things because they give out or reflect light into the eye. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes. Explain how the brightness of a lamp or volume of a buzzer is affected by the number and voltage of cells used in a circuit. Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. Create circuits using a range of components and record diagrammatically using the recognised symbols for electrical components.