Substantive Scientific Milestones:

Parish Church of England Primary School

These are the carefully selected **substantive knowledge** forming our bespoke Parish Scientific Milestones within each year group. Delivered alongside progressive strands of Scientific Enquiry, the statements have been chosen based on our community needs and allow all children to progress to their next stage of learning within each individual learning cycle.

EYFS	
Nursery (Across the year).	
1	People change as they get older. Everybody looks different.
2	There are many different types of weather that change all of the time.
3	There are many different types of flowers. They need water and sunlight to grow.
4	Natural things are all around us and relate to nature.
5	Some things are able to float while other things sink.
Reception (Across the year).	
1	There are different parts to our body (both internal and external).
2	Some food keeps us healthy, and we can do different things to look after ourselves such as exercise.
3	There are many different types of weather that change across the year. Rain affects the world around us and helps to keep things living.
4	There are many different types of flowers (which can look very different). They need water and sunlight to grow. There are different parts to a flower including the leaves, stem and petals.
5	A lifecycle involves the changes that a living thing will go through over the course of its life.
6	A habitat is an animal's home.
7	Some materials can be changed (such as water and ice). We can make things hotter and colder.

Year 1	
Year 1 – Learning Cycle 1 (Everyday Materials)	
1	There are many different materials including wood, paper, plastic, rock, metal, brick, fabrics, elastic and foil.
2	Common properties for materials include them being soft, hard, bendy, having the ability to float and being see through.
3	The properties of a material mean that different materials are used to make many different objects.
Year 1 – Learning Cycle 2 (The Human Body: 5 Senses)	
1	The human body is made up of different parts and all of them do a different job. We can take care of our bodies by maintaining a balanced diet and exercising regularly
2	We have five different senses in sight, hearing, touch, taste and smell. They help us to understand the world around us and can warn us of danger.
3	Our eyes help us to see things while sound travels through our ears to send messages to our brain.
Year 1 – Learning Cycle 3 (Plants)	
1	Even though plants can look very different, they all have the same basic structure.
2	The basic parts of plants are seeds, roots, stems, branches and leaves.
3	All plants need water, a suitable temperature and light to grow/stay healthy.
4	Common wild and garden plants, include roses, buttercups, dandelions and daffodils
5	Common trees include the oak, ash, sycamore, and hawthorn. There are also two types of trees including the deciduous and evergreen trees.
Year 1 – Learning Cycle 4 (Seasons and Weather)	
1	There are four seasons Winter, Spring, Summer and Autumn. The weather is different in each season depending on where you live – can you think what the weather is like in each of the four seasons?
2	In the UK, colder weather comes in autumn and winter. Warmer weather comes in spring and summer. The day length also changes depending on the season. Our days of sunlight are longest in the summer and shortest in the winter.
3	The temperature means how hot or cold it is. We use a thermometer to measure temperature. In many places the temperature in summer is higher than in winter.
4	Rain falls from clouds and fills up rivers and lakes. Without enough rain, the ground becomes dry and hard and plants can die. When there is a lot of rain for a long time there can be a flood.
Year 1 – Learning Cycle 5 (The Animal World)	
1	There are many different types of animals. All animals have special features that help them to survive such as birds with beaks and fish with gills. Some animals are kept as pets while others must remain wild.
2	Amphibians are cold blooded animals that live in water and also on land. They lay eggs underwater such as frogs, toads and newts.
3	Mammals are warm blooded animals that give birth to live young. Examples are a mouse, lion, dog, deer and a human.
4	Reptiles are cold-blooded animals. They have skin covered with small hard plates called scales and also lay eggs.
5	Animals that eat other animals are called carnivores. Animals that eat plants are called herbivores. Animals that eat both plants and other animals are called omnivores.

Year 2	
Year 2 – Learning Cycles 1 and 2 (Living Things and Their Habitats)	
1	A living thing (an organism) is alive, while a dead thing has been alive, and a non-living thing has never been alive.
2	A habitat is a place that an animal or plant lives. It provides the animal with food, water and shelter.
3	Some examples of habitats include a forest (home to oak trees, squirrels, foxes, badgers, snails, mice), meadow and plains (home to wildflowers, grasses, prairie dogs), underground (home to fungi, moles, worms), deserts (home to cacti, lizards, scorpions) and water (home to fish, oysters, starfish). Can you think of any more examples?
4	A microhabitat is a very small, specific habitat for animals and plants (such as a pond or a rotting log). It differs to the wider environment around it.
5	Plants make their own food, but animals get food from eating plants or other living things. A food chain is a way of showing tahe relationships between living things, often starting with organisms that make their own food such as plants.
Year 2 – Learning Cycle 3 (Materials and their Uses)	
1	There are many different materials, including, wood, paper, plastic, rock, metal, brick, fabrics, elastic and ceramics.
2	We can describe different materials by their properties. They may be rigid, flexible, transparent, translucent, opaque, reflective or absorbent.
3	The shapes of solid objects made from some materials can be changed by squashing, bending, twisting or stretching.
4	Materials are chosen for specific tasks based on their properties. For example, wool is used for clothing, glass for windows, wood for tables and metal for bridges.
Year 2 – Learning Cycle 4 (Animals and Their Needs)	
1	All animals (just like plants) need food, water and space to live and grow.
2	Animals, including humans, have offspring which grow into adults and they are very much (but not exactly) like their parents.
3	Humans grow from a baby to a toddler to a child through to a teenager and finally an adult.
4	Pets have special needs and must be cared for by their owners.
5	Humans must take care of their body through exercise, cleanliness, healthy foods and also rest.
Year 2 – Learning Cycle 5 (How Plants Grow)	
1	Remember from Y1 that plants need warmth, light and water to grow and stay healthy.
2	Plants grow from seeds and bulbs. Some plants grow first from a seed, and then develop a bulb that helps them to grow back year after year.
3	Seeds and bulbs need water to grow but most do not need light, as seeds and bulbs have a store of food inside them.
4	The first stage in the life cycle of most plants is a seed. Seeds come in all shapes and sizes. Every plant has a different seed. Every single seed has the beginnings of a new plant inside it, along with a little store of food to help it grow.
5	Plants are living things and living things are special collections of matter that use energy and grow. Plants can move and grow, sensing changes in their environment.
6	An example is a bean plant which starts as a seedling. It then turns into a flowering plant, becomes beans pods and grows into a bean – this is a continuous cycle.

Year 3	
Year 3 – Learning Cycle 1 (Forces and Magnets)	
1	A force is a push or a pull and can make things change shape.
2	If the forces acting on an object are equal, they cancel each other out and no movement or change is seen. There are also forces that act between moving objects such as air resistance, water resistance and friction.
3	There are two magnetic poles: north-seeking and south-seeking poles. A magnetic field is the area around a magnet where you would feel a magnetic force, and this is at the strongest pole. Remember that unlike poles attract and like poles repel.
4	The Earth behaves as if it were a huge magnet: north and south magnetic poles (near, but not the same as geographic North Pole and South Pole).
5	An electromagnet is a special type of magnet which can be switched on or off.
Year 3 – Learning Cycle 2 (Animals and Humans)	
1	Nutrients are useful substances that help animals and plants to grow. To stay healthy, animals and humans need the right amount of nutrition from the food we eat and we get this from a balanced diet.
2	Carbohydrates are foods that provide us with long-lasting energy. They are found in sugary and starchy foods. Proteins are needed so that the body can grow, repair itself and build muscle. Vitamins and minerals are substances that are found in food which keep us healthy. They are commonly found in various fruits and vegetables. Fibre passes through the body undigested. It is needed to keep our digestive system healthy and to prevent disease.
3	The skeleton is a system of bones which supports and protects the body and allows it to move They are very hard and strong. Animals can have different types of skeletons: exoskeleton (a skeleton on the outside of the body e.g. a beetle), endoskeleton (a skeleton on the inside of the body e.g. a human), hydrostatic skeleton (a fluid-filled skeleton e.g. a jelly fish)).
4	Muscles are attached to bones and allow us to move. Joints are the places where two bones meet and work in pairs.
5	Humans need to exercise in order to be healthy. Exercise makes your muscles (including your heart) and your bones stronger.
Year 3 – Learning Cycle 3 (Lights and Shadows)	
1	Light is a type of energy that makes it possible for us to see. An object which gives out light is called a 'light source', including the Sun, light bulbs and fire.
2	We need light to see things and that if there is absence of light, we say that it is dark.
3	Light is an electromagnetic wave and that visible light is made up of multiple wavelengths.
4	Light is reflected from surfaces, including mirrors, which reflect light so that we can see a reflection.
5	A transparent material allows light to travel through it, an opaque material does not allow light to travel through it and a translucent material allows some light to pass through it.
6	The straight line of rays cannot bend around objects, therefore forming a shadow.
Year 3 – Learning Cycle 4 (Structure and Function of Plants)	
1	Plants need air, light, water, nutrients from the soil and room to grow. This can vary from plant to plant.
2	There are two different types of plants: vascular and non-vascular. Vascular plants have tube-like structures that allow water and dissolved nutrients to move through the plant. Non-vascular plants, such as algae, do not have these systems.
3	Unlike animals, plants make their own food through the process of photosynthesis (photo = light; synthesis = putting together).
4	There are four different types of seed dispersal: wind (light seeds that spin,

	drift or glide), water (seeds that float), explosion (seeds that are flicked out from pods) and animals (who will carry hooked or hairy seeds in their fur or eat fruits and carry the seeds away).
Year 3 – Learning Cycle 5 (Rocks)	
1	There are many varieties of rock such as granite, sandstone, limestone, chalk, slate, marble, basalt and pumice. They all have different qualities and features.
2	Sedimentary rocks are formed from the broken remains of other rocks that become joined together.
3	Igneous rocks are formed from molten rock that has cooled and solidified.
4	Metamorphic rocks are formed from other rocks that are changed because of heat or pressure. They are not made from molten rock – rocks that do melt form igneous rocks instead.
5	A fossil is the preserved remains or traces of a dead organism. The process by which a fossil is formed is called fossilisation.
6	Soil is a mixture of tiny particles of rock, dead plants and animals, air and water. Different soils have different properties depending on their composition.

Year 4	
Year 4 – Learning Cycle 1 (Classification of Living Things)	
1	Scientists classify animals according to the characteristics they share. For example, they could be cold-blooded or warm-blooded. This could be shown on a classification key.
2	Animals can also be vertebrates (have backbones and internal skeletons) or invertebrates (do not have backbone or internal skeletons)
3	Vertebrates can be classified based upon their characteristics as fish, amphibians, birds, reptiles or mammals.
4	Plants can be grouped into flowering plants; for example grasses and non-flowering plants such as ferns and mosses
5	A food chain can be used to show the relationship between different living things. Predators eat other animals and prey are eaten by other animals. A food chain consists of producers, consumers and decomposers.
Year 4 – Learning Cycle 2 (States of Matter)	
1	Matter is anything that takes up space (has volume) and has mass. Matter makes up our planet and the whole universe.
2	There are three states of matter: solid, liquid and gas. Solids have a definite shape and volume. Liquids have a definite volume and take the shape of their container. Gases take the shape of their container and gases escape from an unsealed container.
3	Some materials change state when they are heated or cooled. Heating, cooling, evaporating and condensation are ways in which a material changes state.
4	Melting is the process of changing a solid into a liquid. The melting point of water is 0°C. Condensation is the process of changing a gas into a liquid. Freezing is the process of changing a liquid into a solid. Evaporation is the process of changing a liquid into a gas.
5	The water on Earth is constantly moving. It is recycled over and over again. This recycling process is called the water cycle.
Year 4 – Learning Cycle 3 (Sound)	
1	Sound is caused by an object vibrating rapidly and sound travels as waves. Sound also travels through a medium, for example through solids, liquids, and gases.
2	Sound is caused by an object vibrating rapidly and that we hear because sound is detected by our ears
3	The pitch of a sound is how high or low it is. High pitched sounds are caused by fast vibrations, while low pitch sounds by slower vibrations. The frequency measures how many times a second something vibrates
4	The amplitude of a sound wave measures how loud the sound is. sounds become fainter the further away from the sound source you are.
Year 4 – Learning Cycle 4 (The Human Body: Systems).	
1	There are four main types of teeth in humans: incisors – used for cutting, canines – rip and tear food & molars and premolars – for grinding and chewing food. Food enters the body through the mouth.
2	The main parts and functions of the human digestive system include the mouth and teeth, the oesophagus, the stomach, the small intestine and the large intestine and the rectum and anus as part of the excretory system
3	Food enters the body through the mouth. The teeth start to break the food down. Salivary glands – glands in the mouth, produce a liquid called saliva which is added to the food and the tongue rolls the food into a ball. After swallowing, the food passes down the oesophagus to the stomach. In the stomach the food is broken down further by being churned around and some chemicals are added. Food passes into the small intestine. Here nutrients are removed from the food to be used elsewhere in the body. The rest passes into the large intestine where water is removed to be used elsewhere in the body. What is left is then stored in the rectum until it leaves

	the body through the anus when you go to the toilet.
Year 4 – Learning Cycle 5 (Electricity)	
1	Electricity is a form of energy used for lighting, heating, making sound and making machines work. Electricity (electric current) is the flow of electric charge. Mains electricity is the electricity that is supplied to households from power stations but can be dangerous.
2	An electrical circuit consists of a cell or battery connected to a component using wires. Examples of electrical components are switches, buzzers, motors and bulbs.
3	For an electrical circuit to work, there need to be a complete circuit. This means that a component must be in a complete loop with a cell or battery. A cell is a single unit and a battery is a collection of cells.
4	A switch can be added to a circuit to turn a component on or off. It allows the electricity to flow or it stops it.
5	A conductor is a material that allows electricity to pass through. Metals are good electrical conductors. An insulator is a material that does not allow electricity to pass through it. Non-metals such as plastic are electrical insulators.

Year 5	
Year 5 – Learning Cycles 1 and 2 (Properties and Changes of Materials).	
1	Everyday materials have a range of properties such as hardness, electrical conductivity, thermal conductivity and whether they are transparent, magnetic or soluble. Some materials are natural and some are manufactured.
2	Some solids that dissolve are said to be soluble. Those that are not, are said to be insoluble. A solution is formed when a substance (the solute) is dissolved in another substance (the solvent), such as when sugar or salt is dissolved in water.
3	Several factors that affect the rate at which a solid dissolve, such as temperature and particle size. In a concentrated solution, the solute has reached its maximum point of dissolving into the solvent. If a solution has reached its concentration point, any more solute added will not dissolve and that the solution is saturated.
4	Solids that do not dissolve in water can be separated from liquids by sieving or filtering. In a solution, the solids cannot be separated by filtering. The solute can be recovered by evaporation. During evaporation, the liquid evaporates from the solution, leaving the solid behind
5	Some changes result in the formation of new materials, and that these changes are not usually reversible. These are called chemical changes and are irreversible.
Year 5 – Learning Cycle 3 (Earth and Space).	
1	The Sun is a star and it is a source of energy, light and heat.
2	There are eight planets in the solar system, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune (Note that, in 2006, Pluto was classified as a dwarf planet). The Earth and the other planets revolve around the Sun- the heliocentric model which has the Sun at the centre of the solar system
3	The Earth takes 365 ¼ days to move around the Sun. We call this a year. The original model of the solar system was the geocentric model which had the Earth at the centre of the solar system.
4	The moon orbits the Earth. It takes 27.7 days for one orbit and the phases of the moon are caused by its orbit around the Earth. As the moon orbits the Earth, we can see a different amount of the moon is lit by the sun from our perspective on Earth.
5	The Earth spins on its own axis. One revolution takes one day (24 hours) We get *day and night* because sometimes the part of the Earth we are on is facing towards the Sun (day) and sometimes it is facing away from the Sun (night). The sun rises in the East and sets in the West because at sunrise the Earth is rotating towards the Sun and at sunset away from the Sun
Year 5 – Learning Cycle 4 (Life Cycles and Reproduction).	
1	All living things follow a life cycle specific to their species. Some are as short as a few hours or days while others last for hundreds of years.
2	As it is a life cycle, there is no start or end point, but rather a continuous flow that includes fertilisation, birth, growth and reproduction.
3	Mammals are born alive and they grow/develop until they become adults Meanwhile birds lay eggs - the eggs hatch and the chicks grow and develop into adults
4	Fertilisation can take place externally (for example frogs spawning) or internally (for example in birds and mammals).
5	Amphibians and insects have more complicated life cycles. These animals undergo a metamorphosis (a significant change in their physical structure or habits) and some insects undergo complete metamorphosis such as a butterfly. Amphibians also undergo a metamorphosis. They lay their eggs in water. Larvae hatch and live underwater. They grow and develop into terrestrial adults that live and breathe on land.
6	The life cycle of a human goes from an embryo to a foetus, a new born, an

	infant, childhood, through to adolescence, adulthood and finally old age.
Year 5 – Learning Cycle 5 (Forces and Movement).	
1	A force is a push or a pull which act on our bodies and the things around us. Forces can change the shape of objects or make things move and stop moving Forces are measured in Newtons (N) with a force meter or Newton-meter.
2	Gravity is the pulling force acting between the Earth and a falling object, for example when you drop something. Gravity pulls objects to the ground. Gravity also holds our universe together, moving the planets in our solar system around the Sun.
3	Friction is a 'sticking' force - the resistance that a surface or object encounters when moving over another surface or object. Friction both stops and makes things move: it causes things to stick and rub against each other, and also causes slipping and sliding.
4	Air resistance affects how fast or slowly objects move through the air; some objects are more streamlined than others, which means the air pulls on them less and they travel faster. A parachute uses air resistance to slow down descent to the Earth.
5	Water resistance is the force on objects floating on or moving in water. Air resistance and water resistance are types of friction.
6	A mechanism is a device or a simple machine that allows a small force to be increased to a larger force. This could be a lever (which give us extra pushing or pulling force and helps us lift great weights), gears (different-sized cogs which work together and give a machine extra force or speed) or pulleys (wheels and ropes used together to lift heavy objects).

Year 6	
Year 6 – Learning Cycle 1 (Light and Seeing Things)	
1	Light is a type of energy that makes it possible for us to see. Light travels very fast in straight lines and this causes shadows to have the same shape as the objects that cast them.
2	Different materials allow light to travel through it in different ways. A transparent material allows light to travel through it, while an opaque material does not allow light through it. A translucent material allows some light to pass through it
3	We see objects because light travels from light sources to our eyes or from light sources to an object where it is reflected to our eyes. A mirror may reflect the light.
4	Light is made up of all of the colours of the rainbow (red, orange, yellow, green, blue, indigo and violet) with Isaac Newton creating the phrase 'Colour Spectrum' to describe the 7 colours of light.
Year 6 – Learning Cycle 2 (Living Things: Further Classification).	
1	Scientists have divided living things into five large groups called kingdoms; they are either a plant, animal, fungus, protista or prokaryote/monera. Each kingdom is then divided into smaller groupings known as: kingdom > phylum > class > order > family > genus > species > variety.
2	Taxonomy is the study of classification, and a taxonomist is a biologist who specialises in classification.
3	All living things are made up of cells, although some organisms consist of only a single cell. Most organisms are made up of many cells and we call these multicellular organisms.
4	That microorganisms must have a supply of water to grow, must have a supply of oxygen to survive and grow best at body temperature
Year 6 – Learning Cycle 3 (The Human Body: Systems).	
	Blood vessels carry blood around the body. These are either arteries, veins or capillaries. Arteries carry blood away from the heart while veins carry blood to the heart
2	The heart is a muscular organ. Its function is to pump blood. It has four chambers, the atria (singular atrium) and the ventricles. Valves are found between the atria and ventricles they open and close to allow the blood to flow through the heart
3	The human circulatory system is a double circulatory system. It has two separate circuits and blood passes through the heart twice: the pulmonary circuit is between the heart and lungs and the systemic circuit is between the heart and the other organs
4	Some exercises are called cardiovascular and are designed to improve the fitness of the overall circulatory system by strengthening the organs and pulse rate.
5	Diet, exercise, drugs and other lifestyle choices have an impact on how our bodies function. This can affect how well our heart and lungs work and how fit and well we feel. Some choices such as smoking, drinking alcohol and obesity can be harmful to our health
Year 6 – Learning Cycle 4 (Evolution and Inheritance).	
1	Living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. These characteristics and difference within a species can be inherited or caused by mutations.
2	Living things provide evidence for natural selection and evolution. As animals and plants adapt to their environment and over time, adaptation may lead to evolution.
3	Evolution occurs when there is competition to survive (natural selection), while mutations are random changes (which are not inherited from the parents).
4	Extinct animals can also provide evidence for evolution. Fossils provide

	information about living things that inhabited the Earth millions of years ago.
5	Scientists have researched evolution for many years. Charles Darwin, Mary Anning and Alfred Wallace are scientists who studied evolution.
Year 6 – Learning Cycle 5 (Electricity).	
1	An electrical circuit consists of a cell or battery connected to a component using wires. Examples of electrical components are switches, buzzers, motors and bulbs
2	For an electrical circuit to work there need to be a complete circuit. This means that a component must be in a complete loop with a cell or battery.
3	The cell or battery in a circuit provides energy to the component. Voltage is the amount of energy transferred from the cell to a device in the circuit. Voltage is measured in volts using a voltmeter in a circuit
4	The voltage of the cells affects how the components work in a circuit. The voltage affects the brightness of a lamp or the volume of a buzzer in a circuit for example.