Frimley Church of England School

Approach to Science

Purpose

Science is a subject where we learn about the natural world around us through observation and experimentation.

Biology is the study of living things.
Chemistry is the study of what materials are made of, the properties they have and how they can change.
Physics is the study of the world and universe around us, how matter behaves and the energy that is used.

Intent

At Frimley, we aim to provide a high-quality and engaging Science curriculum which enables children to recognise and understand the importance of Science in every aspect of daily life. We want to provide inspiring opportunities to extend children's learning further, giving them the confidence to carry out their own scientific enquiries. Our Science curriculum fosters children's natural curiosity about the world around them, deepens their understanding and inspires their future scientific aspirations. Through practical, hands-on experiences, our children build on their understanding of substantive knowledge (knowledge of scientific concepts and theories) and disciplinary knowledge (types of scientific enquiry). We aim to ensure that all children have full access to the curriculum through careful scaffolding and can apply their mathematical knowledge to their understanding of science by collecting, analysing and presenting data. We encourage children to become enquiry-based learners, enabling them to develop their own questioning and expose them to a wide range of scientific vocabulary. This allows them to become more confident when communicating their knowledge and explaining their findings. We want our children to become confident and inquisitive Scientists, working collaboratively with their peers and setting high aspirations for themselves. We intend to build a Science curriculum which nurtures a love for science, exposes children to a range of STEM ambitions and prepares them for life beyond primary school.

Implementation

At Frimley, our Science lessons are taught in accordance with the National Curriculum.

- Lessons are taught through a range of different learning experiences, including engaging practical and investigative enquiry linked to a 'Big Idea' (key concept).
- Science lessons are taught weekly.
- In each year group, lessons are appropriately adapted to ensure all children are able to access the curriculum and make expected and beyond expected progress in Science.
- In every Science lesson, the Working Scientifically Toolkit and Types of Enquiry are referred to alongside investigations.
- Teachers refer to the Science overview, so they are revisiting previous learning, thus ensuring retrieval opportunities to secure prior knowledge, make links with new concepts and ensure progression of skills.
- Teachers explicitly explain the area of Science being explored – biology, chemistry and physics.
- Teachers promote and foster a love of Science through opportunities for children to determine the direction their learning takes through developing their own questioning and having opportunities to carry out their own enquiries.
- Cross curricular links are planned for with other subjects like maths and computing.
- When appropriate, opportunities to use the latest technological applications and key equipment in our Science lessons enhance children's learning experiences.
- Through purposeful marking, children have the opportunity to consolidate and extend their learning in order to promote a deeper understanding.
- Children are given clear success criteria in order to achieve the learning intention with differing elements of independence.
- Clear links to a variety of careers in STEM professions are made in lessons to expose children to future ambitious.
- Teachers effectively use assessment for learning in Science lessons to ensure misconceptions are addressed.

- Teachers use our assessment tool and knowledge organisers to ensure they are confident in assessing children's learning.
- Science is monitored across the school by the Science leader.

Impact

- Children will enjoy Science, approaching the subject with a positive and enquiring attitude.
- All children will be able to access the learning in lessons and opportunities for children to deepen their understand will be provided.
- Children will be confident in questioning and discussing 'big scientific ideas' using scientific vocabulary.
- Children will develop the skills needed to follow their own enquiry and explore their ideas.
- Children will be able to have opportunities to apply their mathematical knowledge in Science lessons and link their knowledge to other areas of the curriculum and wider life.
- Children will leave Frimley with strong substantive knowledge of biology, chemistry and physics and be confident using working scientific skills and in their ability to use the appropriate resources.
- All children will be aware of a range of STEM careers.
  Staff will gain in confidence in providing engaging, inspiring and informative lessons alongside assessing their pupils' progress.

National curriculum expectations:

- Children will be confident in questioning and discussing 'big scientific ideas' using scientific vocabulary.
- Children will have a positive and enquiring attitude to learning science.
- They will develop the skills needed to follow their own enquiry and explore their ideas.
- Children will leave Frimley with strong substantive knowledge of biology, chemistry and physics and be confident using working scientific skills and in their ability to use the appropriate resources.
- Staff will gain in confidence in providing engaging, inspiring and informative lessons alongside assessing their pupils' progress.

Pupils should be taught:

- To develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- To develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- The scientific knowledge required to understand the uses and implications of science, today and for the future.

Science Long term plan

	Year 3	Year 4	Year 5	Year 6
Autumn 1	Animals including humans	Electricity	Forces – air resistance	Light
Autumn 2	Animals including humans	Animals including humans	Living things and habitats	Evolution and inheritance
Spring 1	Rocks and soil	Sound	Earth and space Animals including humans	Living things and habitats
Spring 2	Light		Forces- levers and pulleys	Electricity
Summer 1	Forces and magnets	States of matter	Properties and changes of materials	Animals including humans
Summer 2	Plants	Living things and habitats		

What Frimley offers to its pupils: (Science medium term plans) **Biology**, **Chemistry**, **Physics**

		Year 3	Year 4	Year 5	Year 6
Autumn term	**Knowledge**	**Animals including humans** The type and amount of nutrition that animals and humans need. How skeletons and muscles provide support, protection and movement.	**Electricity** Identify some electric appliances. Construct a simple series electrical circuit, naming: cells, wires, bulbs, switches and buzzers. Guidance notes: draw the circuit as a pictorial representation. Identify if a lamp will light in a simple series circuit: the need for a complete loop with a battery. Switches open and close a circuit, recognise if a lamp light in a simple series circuit. Conductors and insulators: metals are good conductors. Guidance notes: use their circuits to create simple devices.	**Force- air resistance** **The force of gravity** acting between the Earth and a falling object. Guidance notes: Galileo/ Newton The effects of **air resistance, water resistance** and friction, between moving surfaces.	**Light** **Light appears to travel in straight lines.** Light travels in straight lines and objects are seen because they give out or reflect light into the eye. Light travels from light sources to our eyes or from light sources to objects and then to our eyes.
	Crucial Learning	• *Nutrients are the important substances you get from food that help your body survive and grow.* • *The main nutrients are: carbohydrates, protein, fats, minerals, vitamins and water.* • *A skeleton provides support to an animal's body and protects important organs.* • *Animals with exoskeletons have their skeletons on the outside of their body.* • *Animals with endoskeletons have their skeletons on in inside of their body.*	• *Electricity is a form of energy.* • *A simple circuit is a complete loop that has a cell, wires and an appliance.* • *A switch opens and closes a circuit and controls the flow of electrical current around a circuit.* • *A conductor is a material that will allow electrical current to flow through it.* • *An insulator is a material that will not allow the current to pass through it.*	• *Gravity is the force that pulls objects to the centre of the Earth.* • *Water resistance is the friction that is created between water and an object that is moving through it.*	• *Light travels in a straight line.* • *We see objects when light goes into eyes, which could come directly from the light source or from it being reflected from the object into our eyes.* • *Reflect means to send back from the surface and not pass through it.* • *Shadows are formed when light from a source is blocked by an opaque object.*
	Knowledge		**Animals including humans** The simple functions of the digestive system in humans. Types of teeth in humans and their functions. Food chains: producers, predators and prey.	**Living things and habitats** The differences between the life cycles of a mammal, an amphibian, an insect and a bird. **Life process of reproduction in some plants and animals (sexual and asexual).**	**Evolution and Inheritance** living things change over time and fossils provide information about Earth millions of years ago **living things produce offspring of the same kind: normally offspring vary and are not identical to their parents**

				Guidance notes: **find out about the work of naturalists and animal behaviourists** e.g. David Attenborough or Jane Goodall	**animals and plants are adapted to suit their environment** Guidance notes: Mary Anning /Charles Darwin
	Crucial Learning		• *Humans have four types of teeth: incisors, canines, premolars and molars.* • *The digestive system has 5 main organs: mouth, oesophagus, stomach, small intestine and large intestine.* • *A producer is an organism that can make its own food, like a plant.* • *A consumer is an organism that eats another organism.* • *A predator hunts other animals.* • *Prey is eaten by another animal.*	• *Sexual reproduction is when a male and a female reproduce to create an offspring who is similar to the parent.* • *Offspring is the young of a person, animal or plant.* • *Asexual reproduction requires one parent, and the offspring are identical to the parent.* • *Germination is the process by which seeds begin to grow into plants.* • *Fertilisation is when the male and female parts meet to form an embryo or seed.*	• *Adaptation is how living things are specialised to suit their environment.* • *Species- a group of living things with similar characteristics.* • *Evolution is the process of change that takes place over many generations.* • *Fossils give us evidence of what lived on the Earth millions of year ago.* • *Inheritance is when living things reproduce and pass on characteristics to their offspring.*
	Theology and vision links	*Science reveals the wonder and beauty of God's creation. Theology gives us the answers to Science that we cannot explain or prove. Through Science lessons, we can learn about the world God created and understand our place in it. We learn how to love and respect God's wonderful creation.* *Through our vision, 'Love Thy Neighbour', we are teaching the children to marvel at the world (God's creation) and understand their place in the world. We teach children how to treat the world and the people in it with respect and love. We also encourage children to be inquisitive about the world we live in and respect their peers' views in Science.*			
Spring term	**Knowledge**	**Rocks** To compare and group different kinds of rocks from their appearance and physical characteristics. Describe how fossils are formed within rocks. Soils are made from rocks and organic matter. Guidance notes: include those in the local environment.	**Sound** How sounds are made and vibrations from sounds travel through a mediums to the ear. Find patterns between the pitch of a sound and features of the object that produced it. Find patterns between the pitch of a sound and features of the object that produced it. Sounds get fainter as the distance from the sound source increases. Find patterns between the volume of a sound and the strength of the vibrations that produced it.	**Earth and Space** The movement of the Earth, and other planets, relative to the Sun to explain day and night. The movement of the Moon relative to the Earth. The Sun, Earth and Moon are approximately spherical bodies. Use the Earth's rotation to explain day and night and **the apparent movement of the sun.** Guidance notes: ideas about how the solar system have developed, geocentric model of the solar system then heliocentric model: scientists such as Ptolemy, Alhazen or Copernicus.	**Living things and habitats** How living things **(micro-organisms, plants and animals**) are classified into broad groups Guidance notes: **subdivisions** **Give reasons for classifying plants and animals.** Guidance notes: **vertebrates and invertebrates**

	Crucial Learning	• *Igneous rocks are formed when magma or lava from volcanoes cools.* • *Sedimentary rocks are formed when tiny pieces of rocks and animal skeletons are pressed together in rivers and oceans.* • *Metamorphic rocks are formed when other rocks are heated and squeezed (pressured).* • *Fossils are the remains of prehistoric life and were formed millions of years ago.* • *Soil is the top layer of the Earth's crust.* • *Soil is made of tiny pieces of rock, dead plants and animals.*	• *A sound produces vibrations which travel from the source to our ears.* • *Pitch is how high or low a sound is.* • *The volume is the loudness of the sound and it depends on the strength (size) of vibrations.* • *Sounds become fainter as you move away from the source.*	• *The Solar System is a collection of planets that orbit the Sun.* • *The Earth spins on its axis as it travels around the Sun, and it rotates once every 24 hours.* • *The Moon is a natural satellite in space which orbits the Earth – held by gravity.*	• *Micro-organisms are living organisms too small to see with the eye.* • *Vertebrates are animals that have a backbone.* • *Invertebrates are animals that do not have a backbone.* • *Bacteria are microscopic organisms that often play a role in the decay of living things, the process of fermentation, and sometimes in causing disease.* • *A virus is a micro-organism that causes an illness.*
	Knowledge	**Light** Recognise that we need light to see and that dark is the absence of light. Light is reflected from surfaces. Light from the sun can be dangerous and how to protect our eyes. How and why the size of shadows change. Shadows are formed when the light from a light source is blocked by a solid object. Guidance notes: explore what happens when light reflects off mirrors or other reflective surfaces		**Animals including humans** How humans change as they age Guidance notes : puberty	**Electricity** **Associate the brightness** of a lamp or **the volume** of a buzzer with the **number and voltage of cells** used in a **series circuit**. **How components function**, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. **Use recognised symbols** when drawing a simple series circuit.
	Crucial Learning	• *When light is reflected by a surface, it changes direction and bounces off the surface.* • *A shadow is formed when light is blocked by an opaque object.* • *An object is opaque when you cannot see through it.* • *An object is transparent when you can see through it.* • *An object is translucent when it allows some light through it.* • *Reflect means to send back from the surface and not pass through it.*		• *Puberty is the stage in someone's life when their body starts to become physically mature.* • *Changes during puberty can include growth in height, sweating more, hair growth and growth in parts of the body.* • *Reproduction is when an animal or plant produces one or more individuals similar to itself.*	• *Electricity is a form of energy which can be generated by gas, coal, oil, wind or the sun (solar).* • *Voltage is a measure of how strong the current is in a circuit.* • *The current is the flow of electricity through the circuit.*

	Knowledge			**Force- levers and pulleys** **levers, pulleys and gears** allow a smaller force to have a greater effect	
	Crucial Learning			• *Levers, pulleys and gears are examples of mechanisms .Air resistance is a type of friction between air and another material.*	
	Theology and vision links	*Science reveals the wonder and beauty of God's creation. Theology gives us the answers to Science that we cannot explain or prove. Through Science lessons, we can learn about the world God created and understand our place in it. We learn how to love and respect God's wonderful creation.* *Through our vision, 'Love Thy Neighbour', we are teaching the children to marvel at the world (God's creation) and understand their place in the world. We teach children how to treat the world and the people in it with respect and love. We also encourage children to be inquisitive about the world we live in and respect their peers' views in Science.*			
Summer term	**Knowledge**	**Forces and magnets** Compare how things move on different surfaces. Some forces need contact between two objects but magnetic forces act at a distance. Magnets attract or repel each other and attract some materials. Magnets have two poles. Compare, group together and identify magnetic materials. Predict whether two magnets will attract or repel each other with reference to their poles. Guidance notes: explore different magnets (e.g. bar, ring, button and horseshoe)	**States of matter** Compare and group materials: solids, liquids or gases. Observe how materials change state when they are heated or cooled, and the temperature at which this happens (°C). Evaporation and condensation in the water cycle and changes of evaporation with temperature	**Properties and Changes of materials** Group and compare materials on the basis of their properties: hardness, **solubility**, transparency, conductivity and response to magnets. **Some materials dissolve in liquid to form a solution, and describe how to recover a substance from a solution.** Use knowledge of solids, liquids and gases to decide **how mixtures might be separated.** Use evidence from comparative and fair tests to explain the uses of everyday materials: metals, wood and plastic. Dissolving, mixing and changes of state are **reversible changes.** **Some changes result in the formation of new materials: not usually reversible** eg. burning and the action of acid on bicarbonate of soda. Guidance notes: find out how **chemists create new materials**, e.g. Spencer Silver (glue for sticky notes) or Ruth Benerito (wrinkle-free cotton)	**Animals including humans** The human circulatory system: functions of the heart, blood vessels and blood. The **impact of diet**, exercise, drugs and lifestyle on our bodies. **How nutrients and water are transported in animals.**
	Crucial Learning	• *A force is a push or a pull.* • *Friction is a force between two surfaces which are sliding across each other.* • *Repel is when the objects push each other away.*	• *A particle is a tiny bit of matter that makes up everything in the universe.* • *The particles in a solid are tightly packed and can only vibrate.*	• *Dissolve is when a substance is mixed with a liquid and the substance disappears.* • *Insoluble means impossible to dissolve and soluble means able to be dissolved.*	• *The circulatory system is made of the heart, lungs, blood and the blood vessels.* • *The circulatory system is the system responsible for circulating blood through the*

		• *Attract is when the objects pull together.* • *Magnets have two poles – a north pole and a south pole.*	• *The particles in a liquid can move and flow over each other.* • *The particles in a gas are spread out and can move in all directions.* • *Evaporation is a change of state from liquid to gas.* • *Condensation is the change back from a gas to a liquid caused by cooling.* • *The stages of the water cycle are evaporation, condensation, precipitation and collection.*	• *Permeable is when a substance allows liquids or gases to pass through it.* • *A solution is a mixture that contains two or more substances combined evenly.*	*body, supplying nutrients and oxygen and removing waste products.* • *Red blood cells carry oxygen and white blood cells protect against disease.* • *Blood platelets help the blood to clot to prevent excessive bleeding.* • *Plasma is the liquid that carries the blood cells and the nutrients along the blood vessels.*
Knowledge	**Plants** The functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. The requirements of plants for life and growth and differences from plant to plant. Investigate water transportation within plants. The life cycle of flowering plants: pollination, seed formation and seed dispersal.	**Living things and habitats** The grouping of living things. Use of classification keys to group, identify and name a variety of living things. Changing environments and the dangers to living things. Guidance notes: identify how the local habitat changes throughout the year.			
Crucial Learning	• *Many plants have roots, stems/trunks, leaves and flowers.* • *Plants need different amounts of water, light, a suitable temperature, air and nutrients from the soil to grow.* • *Pollination is the transfer of pollen from the male part of a plant to a female part of a plant to produce seeds.* *Seed dispersal is the way seeds get away from the parent plant to a new place.*	• *An organism is an individual living thing, such as a plant, an animal or a germ.* • *Living things are any organism that possesses or shows the characteristics of life of being alive.* • *The seven life processes are: movement, respiration, sensitivity, growth, reproduction, excretion and nutrition.* • *A habitat is the natural home or environment of an animal, plant, or other organism.*		
Theology and vision links	*Science reveals the wonder and beauty of God's creation. Theology gives us the answers to Science that we cannot explain or prove. Through Science lessons, we can learn about the world God created and understand our place in it. We learn how to love and respect God's wonderful creation.* *Through our vision, 'Love Thy Neighbour', we are teaching the children to marvel at the world (God's creation) and understand their place in the world. We teach children how to treat the world and the people in it with respect and love. We also encourage children to be inquisitive about the world we live in and respect their peers' views in Science.*				

	Skills applied in all areas	**To begin to** ask relevant questions and use different types of scientific enquiries to answer them set up simple practical enquiries, comparative and fair tests make systematic and careful observations, taking accurate measurements using standard units, using a range of equipment gather, record, classify and present data in a variety of ways to help in answering questions record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions identify differences, similarities or changes related to simple scientific ideas and processes use straightforward scientific evidence to answer questions or to support their findings.	**To be confident to** ask relevant questions and use different types of scientific enquiries to answer them **start to make their own decisions about the most appropriate type of scientific enquiry** set up simple practical enquiries, comparative and fair tests **recognise when a simple fair test is necessary and help to decide how to set it up** make systematic and careful observations, taking accurate measurements using standard units, using a range of equipment **look for naturally occurring patterns and relationships and decide what data to collect** gather, record, classify and present data in a variety of ways to help in answering questions **make decisions about what observations to make, how long for and the equipment that might be used.** record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables **help to make decisions about how to record and analyse data** report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions **use notes, simple tables and standard units,** use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions **draw simple conclusions and answer questions.** identify differences, similarities or changes related to simple scientific ideas and processes	**To begin to** **plan** different types of scientific enquiries to answer questions, **including recognising and controlling variables where necessary** take measurements, using a range of scientific equipment, with **increasing accuracy and precision, taking repeat readings when appropriate** record data and results of increasing complexity **using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs** report and present findings from enquiries, including conclusions**, causal relationships and explanations of and degree of trust in results,** in oral and written forms **use test results to make predictions to set up further comparative and fair tests** **identify scientific evidence that has been used to support or refute ideas or arguments**.	**To be confident to** plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary **select and plan the most appropriate type of scientific enquiry to use** **set up fair tests and explain which variables need to be controlled and why** take measurements, using a range of scientific equipment, **choose the most appropriate equipment to make measurements** record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs **use and develop keys and other information records to identify, classify and describe living things and materials** report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms **identify evidence that refutes or supports their ideas** **use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas** use test results to make predictions to set up further comparative and fair tests identify scientific evidence that has been used to support or refute ideas or arguments. **recognise which secondary sources will be most useful and begin to separate opinion from fact.**

			identify new questions arising from the data, make predictions and find ways of improving what they have already done. use straightforward scientific evidence to answer questions or to support their findings. **recognise when and how secondary sources might help them to answer questions** •		
	Types of Scientific Enquiry The five ways we apply our Working Scientifically Skills.	    	**Pattern seeking** involves identifying patterns and looking for relationships in enquiries. **Research using secondary sources** involves using secondary sources of information to answer scientific questions. **Observing over time** involves observing changes that occur over a period of time ranging from minutes to months. **Comparative and fair testing** involves changing one variable to see its effect on another, whilst keeping all the others the same. **Identifying, classifying and grouping** involves making observations to name, sort and organise items.	