Frimley Church of England School

Science - Skills and Knowledge Progression

Intent

We aim to develop a challenging and engaging Science curriculum which meets the curriculum requirements for building both substantive knowledge (knowledge of scientific concepts and theories) and disciplinary knowledge (types of scientific enquiry) to inspire children's future scientific aspirations.

At Frimley, lessons are taught through a range of different learning experiences including engaging practical and investigative enquiry linked to a 'Big Idea' (key concept). We provide opportunities for children to develop their own questioning and confidence in scientific skills whilst also encouraging a love for Science and healthy curiosity about the world. Opportunities to use the latest technological applications and key equipment enhance these learning experiences.

Marking is purposeful in order for children to consolidate their understanding and move their learning on.

Lessons expose children to a wide range of scientific vocabulary which is regularly revisited across the school ensuring children have the confidence to communicate their knowledge and discuss or explain their findings.

We aim to ensure that all children have full access to the curriculum through careful scaffolding and to provide opportunities to extend their learning further, giving them confidence to carry out their own scientific enquiries.

Implementation

- All staff to use the Working Scientifically Toolkit and refer to the Processes of Enquiry.
- Staff are to refer to the new overview to ensure they are revisiting previous learning before teaching a new subject, thus ensuring retrieval opportunities to secure their prior knowledge and make links with new concepts. Staff will explicitly explain the area of science being explored – biology, chemistry and physics.
- Enable staff to plan opportunities for greater enrichment of learning to embed subject knowledge, understanding of working scientifically skills and the scientific process.
- Provide increased opportunities for children to determine the direction their learning takes through developing their own questioning and having opportunities to carry out their own enquiries.
- Ensure that all children are able to access the curriculum and make expected and beyond expected progress in Science.
- Where appropriate, staff will be encouraged to use a range of technologies and mathematical concepts to support children's learning opportunities.
- Ensure that marking is purposeful, consolidates pupil's learning and promotes a deeper understanding.
- Staff to use the assessment tool and knowledge organisers to enable teachers to be confident in assessing children's learning.
- Science leaders will continue to monitor progress in Science across the school and develop teacher's confidence.
- To begin to incorporate opportunities for children to learn more about the variety of careers in the STEM professions.
- Carry out a staff survey and provide pupil voice to monitor confidence and engagement across the school.

Impact

- Children will have developed a love of science and an increased curiosity about our world
- They will have experienced a variety of investigations through class activities and special focus activities or visits from outside agencies
- Their subject knowledge will show good progress through the year groups
- They will have gained the scientific skills to enable them to tackle problem-solving with confidence and assessment will show good progress in Working Scientifically skills
- They will be able to use key investigational skills across many subject areas of the curriculum
- They will be able to connect their learning with what is currently happening in the world and want to learn more

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.

What Frimley offers to its pupils:

	Year 3	Year 4	Year 5	Year 6
Knowledge **Biology** **Chemistry**	**Animals inc humans** the type and amount of nutrition that animals and humans need	**Animals inc humans** the simple functions of the digestive system in humans types of teeth in humans and their functions	**Animals inc humans** how humans change as they age Guidance notes : puberty **Living things and their habitats**	**Animals inc humans** the human circulatory system: functions of the heart, blood vessels and blood

Physics	how skeletons and muscles provide support, protection and movement **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 **Rocks** 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	food chains: producers, predators and prey **Living things and their 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 **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 **Sound**	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)** Guidance notes**: find out about the work of naturalists and animal behaviourists** e.g. David Attenborough or Jane Goodall **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	**impact of diet**, exercise, drugs and lifestyle on our bodies **how nutrients and water are transported in animals** **Living things and their 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** **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** **animals and plants are adapted to suit their environment** Guidance notes: Mary Anning /Charles Darwin

	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 **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	how sounds are made and vibration Guidance notes: in a range of different musical instruments from around the world 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 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 **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	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) **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. **Forces**	**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 **explain why shadows have the same shape as the objects that cast them** **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

	compare, group together and identify magnetic materials predict whether two magnets will attract or repel each other with reference to their poles <u>Guidance notes</u>: explore different magnets (e.g. bar, ring, button and horseshoe)	switches open and close a circuit, recognise if a lamp light in a simple series circuit conductors and insulators: metals are good conductors <u>Guidance notes</u>: use their circuits to create simple devices	**the force of gravity** acting between the Earth and a falling object <u>Guidance notes:</u> Galileo/ Newton the effects of **air resistance, water resistance** and friction, between moving surfaces **levers, pulleys and gears** allow a smaller force to have a greater effect	
Skills	**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	**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**	**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**	**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,

	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.	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	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**.	**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.

		improvements and raise further questions **draw simple conclusions and answer questions.** identify differences, similarities or changes related to simple scientific ideas and processes **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**		**recognise which secondary sources will be most useful and begin to separate opinion from fact.**