Arnold View Primary School

Science Skills and Knowledge Progression Framework

Intent

At Arnold View Primary School, it is our firm belief that to enhance and enrich all children's learning and provide them with a full and rounded education, we must teach an understanding of natural phenomena. Science aims to stimulate a child's curiosity in finding out why things happen in the way they do. It teaches methods of enquiry and investigation to stimulate creative thought. Children learn to ask scientific questions and begin to appreciate the way science will affect their future on a personal, national, and global level. Our intent is that pupils:

- Develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics.
- 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.
- Are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future.
- Can articulate their own thinking, choices and learning journey.
- Are excited to learn how science has shaped history, different cultures and the wider world.
- Develop skills and understanding that can be transferred not only through each year group but into all aspects of life.

We believe in the importance of sequencing a curriculum which is progressive and designed effectively to reduce gaps in knowledge and to enable children to learn more and remember more. We also believe strongly in supporting cognitive load, enabling children to accumulate information in manageable chunks so that they understand one idea before moving onto the next. To support and develop this, we have ordered and grouped together the science topics within the areas of Biology, chemistry and physics. This enables a logical progression within each area and ensures that any prior knowledge required has been taught and enables children to make clear links across the disciplines.

Our skills and knowledge progression frameworks are separated into two strands: disciplinary knowledge and substantive knowledge. Disciplinary knowledge involves the skills needed in this subject area to gain knowledge to be an accomplished scientist. Substantive knowledge is the specific, factual content – or 'Sticky Knowledge' – that we expect our children to acquire during their time at Arnold View.

Science and SEND

For pupils with SEND, adaptations may be made in science which are based on the child's individual needs. However, we acknowledge that pupils with SEND do not generally benefit from differentiated teaching, tasks or expectations. Targeted teaching, however, can be effective in ensuring pupils achieve specific goals. We also ensure that SEND pupils are appropriately challenged in science by:

- Teaching staff using teaching methods which match the needs of children and not planning for overly elaborate tasks which make it more difficult for pupils with SEND to learn curriculum content. It is important to not assume that practical work allows better learning of content as this can sometimes cause distraction and cognitive overload.
- Having an ethos that any adaptations should be based on individual needs and should aim to retain ambition for pupils with SEND.
- Understanding that for pupils with SEND needs which are more complex, it may be appropriate to have different curriculum expectations.
- Chunking content into smaller steps and organising this sequentially.

Skills and Knowledge Progression Framework

Disciplinary Knowledge – What skills do I need to do to be a successful Scientist?

		EYFS	KS1		LKS2		UKS2		KS3
		EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Exploring	**Questioning**	Explore 'what if' questions through play.	Ask 'why' questions.	Ask 'why' and 'what if' questions.	Use knowledge and understanding to ask 'why' and 'What if' questions.	Use knowledge and understanding to ask questions.	Use knowledge and understanding to ask questions about my observations.	Use knowledge and understanding to challenge scientific ideas and concepts.	**Scientific attitudes** Know and use the terms: accuracy, precision, repeatability and reproducibility. Know how scientific theories can change over time. **Planning** Develop lines of enquiry. Make predictions using scientific understanding. Identify independent, dependent and controlled variables. **Observing and measuring** Choose and use appropriate techniques and a wider range of scientific equipment. Have a knowledge of risk assessment during the practical work. Use a wide range of methods to make and record measurements. Apply sampling techniques. **Analysis** Present data in appropriate method (tables, bar chart, line graphs).
	Explaining	With support, recall simple scientific facts.	Recall some simple scientific facts.	Recall relevant scientific facts with some confidence.	Use science ideas and facts to describe and explain.	Show developing knowledge and understanding of scientific ideas and concepts.	Show clear knowledge and understanding of scientific ideas and concepts	Show secure knowledge and understanding of scientific ideas and concepts.	
		With support, pronounce simple scientific words to help with an activity.	Remember and use relevant scientific words during an activity.	Construct an oral sentence using scientific words.	Use simple scientific words in a written sentence.	Use scientific words during oral and written explanations.	Accurately use a range of scientific words during oral and written explanations	Use a range of complex scientific words in a written report.	
		With support, describe what is happening using words or actions.	Describe what is happening using words	Describe and recall what I have observed.	Describe simple scientific models / diagrams.	Describe and explain scientific models / diagrams.	Use knowledge and understanding to describe and explain scientific models / diagrams.	Begin to use scientific models /diagrams to explain new events (Linking prior knowledge).	
	Diagrams	Match a picture to the correct label.	Use a word bank to match a label to the correct part of an Image.	Label a simple diagram using scientific words.	Label and annotate a diagram with scientific information.	Draw, label and annotate my own diagram with given scientific information.	Draw, label and annotate my own diagram with selected scientific information.	Draw, label, annotate and explain my own diagrams using scientific information.	
	Secondary sources	Recall some simple scientific facts.	Begin to select some facts to use in an answer.	Select relevant scientific facts to use in an answer.	Link relevant scientific facts together in an answer.	Use scientific facts to create an argument.	Select and prioritise scientific facts to create an argument.	Present a clear and logical argument using scientific facts.	
Classification	**Identifying**	With support, name things related to science.	Accurately name a range of things related to science.	Identify and name simple scientific things, ideas and processes.	Identify and name a range of scientific things, ideas and processes.	Identify and describe changes in scientific processes.	Use knowledge and understanding to help identify unknown scientific things, ideas and processes.	Use knowledge, understanding and secondary resources to identify unknown scientific things, ideas and processes.	
	Classifying	Group by familiar features e.g., Shape, size, colour	Group by similarity or difference.	Use multiple groups when sorting.	Create my own criteria for sorting.	Create and explain my own criteria for sorting.	Create my own criteria for sorting, which includes a subgroups	Create my own criteria for sorting, which includes multiply sub-groups.	
		Use given instructions to sort.	Sort using simple yes/no statements.	Follow and complete simple classification keys with obvious differences.	Construct a simple classification key using given information.	Construct a simple classification key.	Construct a complex classification key.	Construct and explain a complex classification key.	
	Comparing	Describe given things.	Identify obvious differences.	Identify similarities and differences.	Link properties to purpose and suitability.	Identify when properties change.	Describe how properties change.	Explain how and why properties change.	
Experimenting and investigating	**Predicting**	Suggest what might be 'best' or 'worst'.	Suggest what might happen.	Use own knowledge to suggest what might happen in an investigation.	Predict cause and effect (casual prediction)	Predict a trend (relationship prediction)	Use knowledge and understanding to justify my prediction.	Use knowledge and understanding to generate a testable hypothesis.	

	Observing	Comment on what I see.	Comment on what I see during an investigation.	Identify changes during an investigation.	Explain changes during an investigation.	Use knowledge and understanding to explain changes during an investigation.	Use knowledge and understanding to identify trends during an investigation.	Identify trends during an investigation and make justified predictions for the rest of an investigation.	Identify patterns in data to draw conclusions. Use scientific understanding to explain data. Use simple statistical techniques, including means of data. **Evaluating** Evaluate data, including potential random and systematic errors. Identify further questions arising from results. **Measurement** Use standard units when measuring.
	Equipment	Use a range of everyday items to investigate.	Use some scientific equipment.	Use a range of scientific equipment.	Select suitable equipment for a given task.	Select and independently use a range of scientific equipment for a given task.	Select the most appropriate equipment for an independently designed task	Justify reasons for selecting specific equipment and identify possible alternatives.	
		Work safely when given instructions.	Notice risk and identify some common dangers.	identify and begin to explain common dangers.	Predict obvious risk and act on safety suggestions.	Plan to minimize risk and work safely.	Plan to minimize risk and describe safe use of equipment.	Predict risks and explain how I can plan and control risks.	
	Designing	With support, suggest ideas to investigate.	I can suggest an idea to investigate and ask questions.	Demonstrate how why might investigation something.	Demonstrate and explain how why might investigate something.	Plan a fair test by selecting variables to change and measure.	Plan a fair test and ensure controlled variables are kept the same.	Plan a reliable and fair test.	
		With support, say how we might investigation.	Begin to identify variables in an investigation.	Identify which variable we are testing.	Identify a range of variables which could be tested.	Identify a range of variables which could be tested and explain appropriate tests.	Identify a range of variables which could be tested and devise appropriate tests.	Explain which variables will be kept the same and devise tests which ensure these variables are controlled.	
		Follow a short demo and spoken instructions.	Follow a short demo, spoken and picture instructions.	Follow short spoken and written instructions in order.	Follow instructions and write a simple method	Design and write a simple ordered method.	Design and write a reliable ordered method.	Design and write a reliable and precise method.	
Data	**Collecting**	Use non-standard units of measure and compare 2 things e.g.: heavier / lighter. .	Use non-standard units of measure and compare multiply things e.g.: lightest, light, heavier, heaviest	Measure using standard units: Length: cm / m Mass: g / kg Capacity: ml / l	Measure and compare using standard units: Length: mm / cm / m Mass: g / kg Capacity: ml / l	Measure and compare using standard units: Length: mm / cm / m Mass: g / kg Capacity: ml / l Time: seconds / minutes	Measure, convert and compare using standard units: Length: mm / cm / m Mass: g / kg Capacity: ml / l Time: seconds / minutes	Calculate an average from repeated measurements.	
	Tables	Use a simple table to record pictures and words.	Use a simple, given table to record.	Use a simple, given table to tally and record totals.	Use a frame to record a table of results.	Construct a simple table to compare cause and effect.	Use a frame to construct a complex table of results to show repeated data.	Construct a complex table of results to show repeated data.	
	Graphs	Use prepared pictograms to record my observations.	Use a frame to add pictograms and block charts.	Construct simple pictograms and block charts.	With support, use axes to construct a bar chart.	Accurately and independently construct a bar chart.	With support, use a frame to construct a graph and scale one axis.	Accurately construct and scale a graph.	
		Add pictures to a given pictogram.	Add blocks to a given chart.	Use a scale on a block chart to add the correct blocks.	Draw bars on a given bar chart.	Plot coordinates in the first quadrant.	Join plotted coordinates with straight lines.	Plot mean values and draw a trend line for linear data.	
Making conclusions	**Patterns and relationships**	Recognise, create and simple patterns e.g.: size.	Recognise, create and describe simple patterns	Describe simple patterns in data and charts.	Describe simple patterns in data, charts, and graphs.	Describe patterns, trends and relationships in data, charts and graphs.	Describe and compare patterns, trends and relationships in data, charts and graphs.	Describe and compare changing patterns, trends and relationships in data, charts and graphs.	
		Use ‘more’ or ‘less’ to compare observations.	Use ‘more’ or less’ to compare observations and numbers.	Identify differences in sets of data.	Identify and explain differences in sets of data.	Identify and explain differences in sets of repeated data.	Identify and explain differences in sets of repeated data and identify anomalies.	Identify and explain, using margin of error, differences in sets of repeated data and identify anomalies	
	Concluding	Comment on changes that I observe during an activity.	Describe the changes that are happening.	After an activity, recall and describe the changes that have happened.	Describe my results linking cause and effect.	Describe trends and begin to use scientific observations to explain.	Use data in my conclusions and use science to explain.	Use primary and secondary data and ideas when concluding.	

		Begin to talk about what we did.	Explain what we did.	Explore different ways to do things.	Identify weaknesses in my methods.	Identify weaknesses in my methods and suggest improvements.	Identify how limitations in my methods might affect my results and suggest improvements.	Identity limitations in my methods and use my results data to justify improvements.	

Substantive Knowledge – Sticky Knowledge

	KS1	LKS2	UKS2	KS3
Plants	• To know and name a variety of common wild and garden plants. • To know and name the petals, stem, leaves and root of a plant. • To know and name the roots, trunk, branches and leaves of a tree. • To know and explain how seeds and bulbs grow into plants. • To know what plants, need in order to grow and stay healthy (water, light & suitable temperature).	• To know the function of different parts of flowing plants and trees. • To know how water is transported within plants. • To know the plant life cycle, especially the importance of flowers.		• Know the equation for photosynthesis and use it to identify factors need for plant growth.
Animals including humans	• To know how to classify a range of animals by amphibian, reptile, mammal, fish and birds. • To know and classify animals by what they eat (carnivore, herbivore and omnivore). • To know how to sort by living and non-living things.	• To know about the importance of a nutritious, balanced diet. • To know how nutrients, water and oxygen are transported within animals and humans. • To know about the skeletal and muscular system of a human. • To identify and name the parts of the human digestive system. • To know the functions of the organs in the human digestive system. • To identify and know the different types of human teeth. • To know the functions of different human teeth. • To use and construct food chains to identify producers, predators and prey.	• To create a timeline to indicate stages of growth in humans. • To identify and name the main parts of the human circulatory system. • To know the function of the heart, blood vessels and blood. • To know the impact of diet, exercise, drugs and lifestyle on health. • To know the ways in which nutrients and water are transported in animals, including humans.	• Identify the different parts of animal and plant cells. • Know the different parts of specialised cells, their function and adaptations. • Know the difference between sexual and asexual reproduction. • Know how females get pregnant and how females get pregnant and the stages of embryo development.
Materials	• To know the name of the materials an object is made from. • To know about the properties of everyday materials and why a material might or might not be used for a specific job. • To know how materials can be changed by squashing, bending, twisting and stretching.		• To compare and group materials based on their properties (e.g., hardness, solubility, transparency, conductivity, [electrical & thermal], and response to magnets. • To know and explain how a material dissolves to form a solution. • To know and show how to recover a substance from a solution. • To know and demonstrate how some materials can be separated (e.g., through filtering, sieving and evaporating). • To know and demonstrate that some changes are reversible, and some are not • To know how some changes result in the formation of a new material and that this is usually irreversible	• Know how the properties of the different components of a mixture lead to different methods of separating them.

Seasonal Changes	• To be able to name the seasons and know about the type of weather associated with each season. • To know the main months associated with each season.			
Living things and their habitats	• To know how to classify a range of animals by amphibian, reptile, mammal, fish and birds. • To Know and classify animals by what they eat (carnivore, herbivore and omnivore).. • To Know how to sort by living and non-living things	• To know the temperature at which materials change state. • To know about and explore how some materials can change state • To know the part played by evaporation and condensation in the water cycle	• To know the life cycle of different living things e.g., mammal, amphibian, insect and bird. • To know the differences between different life cycles. • To know the process of reproduction in plants. • To know the process of reproduction in animals. • To classify living things into broad groups according to observable characteristics and based on similarities and differences. • To know how living things have been classified. • To give reasons for classifying plants and animals in a specific way.	• Construct food chains and food webs to investigate feeding relationships. • Classifying within vertebrate and invertebrate groups. • Classifying with in the five different kingdoms.
Light, Sound and Shadows		• To know that dark is the absence of light. • To know that light is needed in order to see and is reflected from a surface. • To know and demonstrate how a shadow is formed and explain how a shadow changes shape. • To know about the danger of direct sunlight and describe how to keep protected. • To know how sound is made, associating some of them with vibrating. • To know how sound travels from a source to our ears. • To know the correlation between pitch and the object producing a sound. • To know the correlation between the volume of a sound and the strength of the vibrations that produced it. • To know what happens to a sound as it travels away from its source	• To know how light travels. • To know and demonstrate how we see objects. • To know why shadows have the same shape as the object that casts them. • To know how simple optical instruments work e.g., periscope, telescope, binoculars, mirror, magnifying glass etc.	**<u>Light</u>** • Know how refraction of light can occur when light travels through different objects. **<u>Sound</u>** • Read the pattern of sound waves. • Identify different pitches and amplitudes for the sound waves.
Forces and Magnets		• To know about and describe how objects move on different surfaces. • To know how a simple pulley works and use to on to lift an object. • To know how some forces require contact and some do not, giving examples. • To know about and explain how magnets attract and repel. • Predict whether magnets will attract or repel and give a reason.	• To know what gravity is and its impact on our lives. • To identify and know the effect of air and water resistance. • To identify and know the effect of friction. • To explain how levers, pulleys and gears allow a smaller force to have a greater effect.	• Know the difference between balanced and unbalanced forces and how they influence the movement of an object.
States of Matter		• To know the temperature at which materials change state. • To know about and explore how some materials can change state. • To know the part played by evaporation and condensation in the water cycle.		• Know the difference between a chemical and a physical change. • Link knowledge of chemical and physical changes to reactions with acids and alkalis. • Know how the properties of solids, liquids and gases are determined by the particle model.

Electricity		• To identify and name appliances that require electricity to function. • To construct a series circuit • To identify and name the components in a series circuit (including cells, wires, bulbs, switches and buzzers). • To predict and test whether a lamp will light within a circuit. • To know the function of a switch. • To know the difference between a conductor and an insulator; giving examples of each.	• To compare and give reasons for why components work and do not work in a circuit. • To draw circuit diagrams using correct symbols. • To know how the number and voltage of cells in a circuit links to the brightness of a lamp or the volume of a buzzer.	• Construct series and parallel circuits. • Measure current and potential differences within a circuit.
Earth and Space			• To know about and explain the movement of the Earth and other planets relative to the Sun. • To know about and explain the movement of the Moon relative to the Earth. • To know and demonstrate how night and day are created. • To describe the Sun, Earth and Moon (using the term spherical).	• Know how gravitational forces cause the orbits of the planets and their moons. • Know how the tilt of the earth causes the seasons.
Evolution and Inheritance			• To know how the Earth and living things have changed over time. • To know how fossils can be used to find out about the past. • To know about reproduction and offspring (recognising that offspring normally vary and are not identical to their parents). • To know how animals and plants are adapted to suit their environment. • To link adaptation over time to evolution. • To know about evolution and can explain what it is.	• Know the roles that genes and environments have on characteristics