



Ark John Archer Primary Academy *Science*



Science Curriculum: *Rationale*

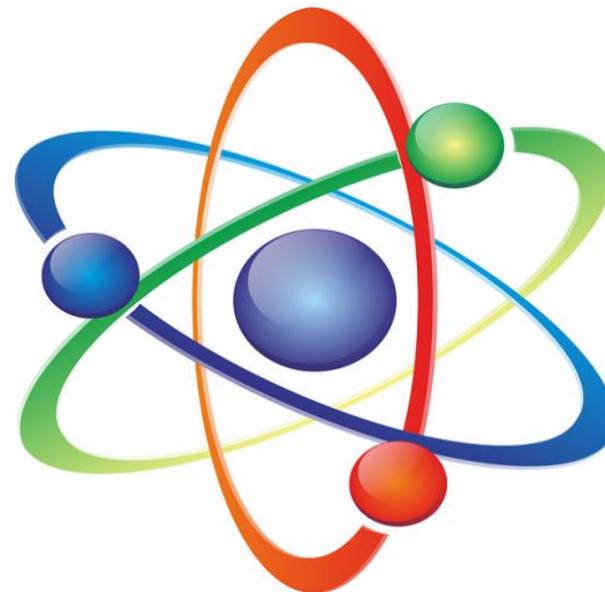
The Ark John Archer Science Curriculum provides all pupils with the foundations for understanding the world, developing foundational building blocks within the specific disciplines of Biology, Chemistry and Physics. The curriculum is rich in key foundational knowledge and concepts, pupils are encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. It enables children to become natural explorers and provide opportunities to develop thinking, knowledge and positive attitudes to Science. In EYFS, children begin to gain key scientific knowledge that they later build on in the primary years. Children learn to use Science to explain what is occurring and make sense of the world around them, predict how things might behave and analyse cause and effect to better understand why and how things happen. Children are encouraged to develop a natural curiosity and follow well-considered lines of enquiry within the subject. They explore rich content and are able to apply this knowledge to practice, developing a range of scientific skills.

The curriculum has been developed to facilitate an accumulation of knowledge and concepts in a specific order, with a careful and consistent progression of skills and knowledge that allows the pupil to make the necessary connections to piece their learning together throughout their learning journey. It is fundamental that all pupils develop a secure understanding of each block of knowledge in order to progress to the next stage. As children progress through the Science Curriculum, explicit links and connections are made to support pupils to continually build upon the knowledge and skills they have accumulated in previous year groups.

The sequence of learning endeavours to continually build upon pupil starting points and the progression of knowledge and skills acquired. Some of the units follow directly on from others, building on pupils' prior knowledge and understanding (an example being the Chemistry strand, which starts with common materials in Ks1 and builds up to changing states of matter in upper Ks2). Other Units, however, are not directly linked to previous learning, such as many of the units within the Physics strand of Science. The units in this discipline are sequenced so that a pupil's breadth of knowledge is built upon year after year. The importance of all pupils developing a secure knowledge of concepts taught is important in both of the models listed above; if a child does not understand some of the basic properties of materials they will be at a significant disadvantage when learning about changes in state to those materials. Likewise, the topic of Sound is taught once, if a child completes this unit without a secure understanding of the concepts taught then this will not be retaught again within their Primary education.

Pupils are taught to describe associated processes and key characteristics in common language, while using technical terminology accurately and precisely. In turn, this provides pupils with the opportunity to build up an extended specialist vocabulary, deepening knowledge and understanding, and developing the ability to make informed choices when reasoning and explaining their thinking.

As children develop a secure understanding and ability to independently connect their learning they will be able to speak enthusiastically about their knowledge and conduct research that builds on what they have learnt in the classroom and is applied into society and beyond. Pupils demonstrate perseverance and adopt a relentless approach in their quest for knowledge and understanding, forming their own lines of enquiry and opinions, continually shaping their character and personality.



Science Curriculum: Our Aims

- Pupils develop scientific knowledge and conceptual understanding through the specific disciplines of *biology, chemistry and physics*.
- Pupils develop understanding of the nature, processes and methods of science through different types of scientific enquiry that enable them to be able to answer scientific questions about the world around them.
- Pupils needs, interests and stages of learning are incorporated to ensure that a challenging and enjoyable experience is implemented.
- Pupils are equipped with scientific knowledge required to understand the uses and implications of science, today and for the future.

Science Curriculum: Our Approach

Knowledge and memory:

- *Knowledge organisers:* prior to a unit of study, pupils are given knowledge organisers, allowing them to immerse themselves in the unit of study. Knowledge organisers present main concepts, key questions, definitions of specific vocabulary, significant people and places and images and diagrams to support understanding, and are regularly referred to within a unit and a main component of an introduction lesson. Children are encouraged to read and discuss information, share parts that sparked interest and ask questions; provoking curiosity. Organisers help children to make links with their learning and share the 'bigger picture' of a topic, enabling children to digest essential knowledge.
- *Evidenced learning:* A range of work is evidenced throughout a unit in every year group. Scientific learning is recorded, allowing children the opportunity to demonstrate their understanding about a concept or learning task, explain their ideas and what they know. Recorded work facilitates the assessments of children's understanding, made against the knowledge and skills criteria.
- *Discovery boxes:* as pupils head off for a half-term or holiday, they each take home a discovery box to engage them in their upcoming unit of study before the learning has even started. These include a range of activities and ideas to feed pupils' curiosity about what they are going to learn, encourage independent research and wider reading, and inspire creativity and joy for learning in the home. All pupils are provided with the materials and resources they need to engage in the crafts and activities, ensuring they are accessible for all children and families.
- *Connections and links:* while we acknowledge that most pupils find difficulty in transferring knowledge and skills from one context to another, explicit connections and references to prior learning are made for pupils throughout a unit to support mastery of the subject across different domains.
- *Wider reading and home learning:* suggested books and websites are shared with parents and pupils at the start of a unit of study to encourage wider reading, independent research and a collaborative approach to learning within the family environment.
- *Vocabulary is knowledge:* as part of a school-wide focus, children are exposed to challenging and innovative vocabulary at the beginning of each lesson to enrich their learning. Teachers take pupils through a deep dive into a few carefully selected words, providing opportunity to orally rehearse, apply in different contexts and construct sentences with accurate use of new terms. This enables children to expand their vocabulary knowledge, embed words and then have the confidence to apply them within their learning.
- *Learning excursions:* opportunities are mapped out for pupils to apply their knowledge acquired and expand their thinking through fieldtrips and linked excursions. These may come at the start of a unit to launch new learning, or throughout a unit to facilitate key scientific knowledge, promote engagement and enrich the scientific topic further.

- *Subject weighting: Across key stages, our curriculum enables pupils to be exposed to 1.5- 2hours of Science learning each week. This enables time for a broad and balanced curriculum; ensuring that children are immersed in the subject and given the opportunity to accumulate key knowledge and skills.*

Skills acquisition:

Scientific skills are incorporated into the planning of each lesson. We ensure that children have a balance between play, rich theory and practical lessons, whereby children think critically, follow lines of enquiry and in turn increase their capacity to problem solve and answer questions. Children are encouraged to explore and think scientifically, recording evidence through planning and carrying out enquiries, making observations, measuring, presenting and analysing information. Children have opportunities to communicate their findings, both written and verbally, draw conclusions and reflect on their learning. Thinking and reasoning is nurtured – pupils are frequently provided opportunities to communicate what they have found out and use evidence to support their ideas, drawing upon the knowledge and skills gained throughout their sequence of learning. Our science curriculum promotes challenge and all pupils are given opportunities to extend and apply knowledge in different contexts.

Learning Environments:

The classroom environment is designed to inspire curiosity, fascination, enquiry and independent investigation. To enable children's knowledge to develop and evolve, the environment grows in complexity throughout the school. Key materials are displayed around the classroom to communicate scientific information throughout the progression of a unit of study:

- *Driver questions:* classroom displays place the driver question as a focal point for the unit of study. Key materials and exemplary models are displayed on learning walls, demonstrating the learning journey and supporting pupils to see how each lesson is a building block towards answering the driver question.
- *Vocabulary:* key vocabulary to support application of both knowledge and skills are displayed on learning walls and throughout the classroom environment. Pupils are encouraged to make reference to this when completing written tasks and reasoning verbally within class discussions.
- *Pupil outcomes and achievements:* pupils are motivated by the opportunity to have an example of their learning displayed within the learning environment. Examples are chosen where pupils have demonstrated application of knowledge, progress in understanding and exceptional achievements in their learning.
- *Key knowledge:* classroom displays capture key knowledge and pupil responses, which showcase and demonstrate understanding to learning questions. Key knowledge is referred to and supports pupils to be able to embed key Scientific concepts and ideas.
- *Home learning:* pupils are continually encouraged to engage further with their learning and study while at home and outside of the school environment. Home learning is celebrated during whole-school assemblies and displayed within classrooms / around the school for all pupils to view and celebrate.

Assessment:

- *Knowledge quizzes:* at the end of each unit, pupils complete an extensive knowledge quiz in order to assess knowledge retention across a unit of study (what has been remembered as opposed to what has been taught). Pupils enjoy the opportunity to demonstrate what they know and share in the success of their learning journey. Teachers are able to use results from the assessments in order to inform planning and address misconceptions and/or misunderstandings.
- *Science Meetings:* Science meetings are conducted at the beginning of each lesson, whereby previous and current units of study are worked on. Children answer questions, discuss and engage in showcasing their increasing knowledge and understanding of scientific concepts. Science meetings allow for quick assessments to be made, rapid feedback and responsive teaching.

- *Driver question:* at the end of a unit, learning is assessed through pupil response to the 'driver question' from the beginning of the unit. This provides pupils with the opportunity to share the knowledge they have retained throughout the unit of study and assess depth of application. There is a termly moderation cycle of children's responses to the questions, which inform teachers of attainment, planning and misconceptions that need to be addressed. Each Science lesson, builds on the fundamental knowledge and skills needed for children to be able to individually access and apply their learning at the end of a unit.
- Teachers make ongoing formal and summative assessments of children's knowledge and understanding within lessons. The skills of working scientifically are taught and assessed within the context of investigations, related to the science content.

Science: Knowledge Progression Map

	Reception	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Plants	<p>Understand that plants grow in different places.</p> <p>Know the different parts of a plant – petal, stem, leaf</p> <p>Describe what is needed for a plant to grow – light, soil, water</p>	<p>Identify and name a variety of common wild and garden plants</p> <p>Identify and describe the basic structure of a variety of common flowering plants</p>	<p>Observe and describe how seed and bulbs grow into mature plants</p> <p>Find out and describe how plants need water, light and a suitable temperature to grow and be healthy</p>	<p>Identify and describe the functions of different parts of flowering plants</p> <p>Explore the requirements of plants for life and growth and how these vary</p> <p>Investigate the way water is transported in plants</p> <p>Explore the part that flowers play in the life cycle of flowering plants including pollinations and seed dispersal</p>			
Animals including humans	<p>Know the names of different fruits and vegetables</p> <p>Know the names of different body parts</p> <p>Know that there are different senses</p> <p>Recall the names of different senses</p> <p>Know the ways to keep healthy – exercise, brushing teeth, eating well</p>	<p>Identify and name a variety of common animals including fish</p> <p>Identify and name a variety of common animals that are carnivores</p> <p>Describe and compare the structure of a variety of common animals</p> <p>Identify, name, draw and label the basic parts of the human body</p> <p>Know which part of the human body is associated with which sense</p>	<p>Notice that animals, including humans, have offspring which grow into adults</p> <p>Research and describe basic needs of animals</p> <p>Describe the importance of exercise and diet</p>	<p>Know that animals, including humans, need the right types of nutrition and cannot make their own food</p> <p>Identify the main parts of the human and other skeletons and their functions</p> <p>Know that humans and some animals have skeletons and muscles for support, protection and movement</p>	<p>Research the function of the parts of the digestive system</p> <p>Create a model of the digestive system using household objects</p> <p>Explore eating different types of food to identify which teeth are being used for cutting, tearing and grinding</p> <p>Classify animals according to teeth</p> <p>Use food chains to identify producers, predators and prey</p>	<p>Describe the changes as humans develop to old age</p> <p>Draw a timeline to indicate stages in the growth and development of humans</p> <p>Research the gestation periods of other animals and compare them with the gestation periods of humans</p>	<p>Identify and name the main parts of the human circulatory system and describe the functions of the heart, blood vessels and blood</p> <p>Recognise the impact of diet, exercise, drugs and lifestyle on the way that bodies will function</p> <p>Describe the way nutrients and water are transported within animals, including within humans</p>
Materials	<p>Use simple terms to describe materials (e.g. smooth / rough)</p> <p>Identify similarities and differences between some materials</p> <p>Identify best use of some materials</p>	<p>Distinguish between an object and the material from which it is made</p> <p>Identify and name a variety of everyday materials</p> <p>Describe the simple physical properties of a variety of everyday materials</p> <p>Compare and group together a variety of everyday materials on the basis of their simple physical properties</p>	<p>Identify and compare the suitability of a variety of everyday materials for particular uses</p> <p>Find out how the shapes of objects made from some materials can be changed</p>				

Season changes		<p>Observe changes across the four seasons and write about those changes</p> <p>Observe and describe weather associated with the seasons and how day length varies</p>					
Living things and their habitats	<p>Understand that animals live in different habitats</p> <p>Recall animals that live in a habitat</p> <p>Identify simple similarities and differences between living things</p> <p>Know that the environment and living things are influenced by human activity</p>		<p>Explore the differences between things that are living, dead and never been alive</p> <p>Identify living things in habitats to which they are suited and why</p> <p>Identify and name a variety of plants and animals in their habitats including microhabitats</p>		<p>Observe plants and animals in different habitats through the year</p> <p>Compare living things observed</p> <p>Use classification keys to name unknown living things</p> <p>Classify living things from different habitats based on features</p> <p>Use secondary sources to find out how environments may change and how human impact on the environment</p>	<p>Describe the differences in the life cycles of a mammal, amphibian, an insect and a bird</p> <p>Describe the life processes of reproduction in some plants and animals</p> <p>Study and raise questions about the local environment and how it changes throughout the year</p>	<p>Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences</p> <p>Explain reasons for classifying plants and animals based on their specific characteristics</p>
Rocks				<p>Compare and group together different kinds of rocks on the basis of their appearance and properties</p>			
Light	<p>Understand ideas connected to light and dark – e.g. reflection, nocturnal animals.</p>			<p>Recognise that we need light in order to see things and the dark is the absence of light</p> <p>Observe that light is reflected from surfaces</p> <p>Recognise that light from the sun can be dangerous and ways to protect the eyes</p> <p>Recognise how shadows are formed and find patterns in the way that the size of a shadow can change</p>			<p>Recognise that light appears to travel in straight lines</p> <p>Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye</p> <p>Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then our eyes</p> <p>Use the ideas that light travels in straight lines to explain why shadows have the same shape as the objects that cast them</p>
Forces and magnets				<p>Compare how things move on different surfaces</p> <p>Notice that some forces need contact between two objects but magnetic forces can act at a distance</p>		<p>Explain that unsupported objects will fall towards the Earth because of the force of gravity acting between the Earth and the falling objects</p>	

				<p>Observe how magnets attract or repel each other and attract some materials</p> <p>Describe magnets as having two poles and predict whether two magnets will attract or repel</p>		<p>Identify the effects of air resistance, water resistance and friction</p> <p>Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect</p>	
States of matter	<p>Talk about changes</p> <p>Observe that some materials change when they are heated or cooled</p>				<p>Compare and group materials together according to whether they are solids, liquids or gases</p> <p>Observe that some materials change state when they are heated and cooled</p> <p>Measure the temperature at which changes happen</p> <p>Identify the part played by evaporation and condensation in the water cycle</p>		
Sound					<p>Identify how sounds are made and associate this with something vibrating</p> <p>Recognise that vibrations from sound travel through a medium to the ear</p> <p>Find patterns between the pitch of a sound and features of the object that produced it</p> <p>Find patterns between the volume of a sound and the strength of the vibrations that produced it</p> <p>Recognise that sounds get fainter as the distance from the sound source increases</p>		

<p>Electricity</p>					<p>Identify common appliances that need electricity to work</p> <p>Construct a simple electrical circuit, identifying and naming its basic parts including cells, wires, bulbs, switches and buzzers</p> <p>Identify whether or not a lamp will light in a simple series circuit</p> <p>Recognise that a switch opens and closes a circuit and recognise some common conductors & insulators</p>		<p>Associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit</p> <p>Compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and on/off position of switches</p> <p>Use recognised symbols when representing a simple circuit in a diagram</p>
<p>Properties and changes of matter</p>						<p>Compare and group everyday materials</p> <p>Know that some materials will dissolve in liquid to form a solution and describe how to recover a substance from a solution</p> <p>Use knowledge of solids, liquids and gases to decide how mixtures might be separated</p> <p>Explain, using evidence from tests, the uses of everyday materials such as metals, woods and plastics</p> <p>Demonstrate that dissolving, mixing and changes of state are reversible changes</p> <p>Explain that some changes results in the formation of new materials and are therefore usually irreversible</p>	
<p>Earth and space</p>	<p>Recognise that the solar system is made up of different planets</p> <p>Name different planets</p> <p>Describe planets</p>					<p>Describe the movement of the Earth and other planets relative to the sun</p> <p>Describe the movement of the Moon relative to the Earth</p> <p>Describe the Earth, Sun and Moon as approximately spherical bodies</p>	

						Use the idea of the Earth's rotation to explain day and night and the movement of sun across the sky	
Evolution and inheritance							<p>Recognise that living things have changed over time and fossils provide information</p> <p>Recognise that living things produce offspring but normally vary and are not identical to their parents Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution</p>

Science: Skills and Enquiry Progression Map

	Reception	KS1	LKS2	UKS2
Scientific enquiry	Make comparative observations about objects, events and animals, and answer questions about these		Ask relevant questions and using different types of scientific enquiries to answer them	Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
	Find out how things work by observation and experimentation	Ask simple questions and recognise that they can be answered in different ways	Set up simple practical enquiries, comparative and fair tests	Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
	Ask questions about the familiar world	Observing closely, using simple equipment	Make systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers	Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
	Generate simple ideas for testing	Perform simple tests	gathering, recording, classifying and presenting data in a variety of ways to help in answering questions	Use test results to make predictions to set up further comparative and fair tests
	Make predictions about what might happen	Identify and classifying	Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables	Report and present findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations
	Measure by direct comparison	Use their observations and ideas to suggest answers to questions	Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	Identify scientific evidence that has been used to support or refute ideas or arguments
	Record ideas verbally, in pictures and key words	Gather and record data to help in answering questions	Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions	
	Notice changes		Identify differences, similarities or changes related to <i>simple scientific ideas</i> and processes using straightforward scientific evidence to answer questions or to support their findings.	
Answer simple questions				

Science: Unit Overview

	Autumn 1	Autumn 2	Spring	Summer 1	Summer 2
Reception	All About Us	The World Around Us	Space	Growth, Plants and Animals	The Seaside
Year 1	Everyday Materials	Seasons: Autumn and Winter	Amazing Animals	Seasons: Spring and Summer	Plants
Year 2	Animals: Need for Survival	Uses of Materials	Habitats	Protecting Our Environment	Plants: Bulbs and Growth
Year 3	Skeletons and Muscles	Rocks and Fossils	Light and Shadows	Plants: Need for Survival	Forces and Magnets
Year 4	Teeth and Digestion	States of Matter	Classification and Environments	Sound	Electricity
Year 5	Earth and Space	Forces	Materials: Properties and Changes	Life Cycles	Growing Old
Year 6	Light and Perception	Classification	Evolution and Inheritance	Electricity	Circulation and Lifestyle