

Curriculum intent

Academy curriculum Intent

Our aim at the Achieve and Learn Trust is to provide an outstanding education to all our students through a curriculum which **promotes high aspiration; enables academic success and excellence; and supports personal growth, preparing and equipping students for success** in all aspects of their adult life.

Our curriculum is designed to enable students **to acquire and retain the core knowledge and skills** that they require in each subject discipline, in order to be **successful in education and transferable to later life and further learning**. It is equally important that, through great teaching, the core knowledge is developed, extended upon, contextualized and applied in order to provide a **richness of curriculum that engages students, consolidates learning, provides a scaffold** for future advanced learning and encourages transferable skills.

Our whole school vision is to “nurture well-rounded citizens of the future who are knowledgeable, happy and resilient so that they make a valuable contribution to the world in which they live and are empowered to make informed and positive life choices.”

Department Intent

“Somewhere, something incredible is waiting to be known” Carl Sagan

Students should study the sciences in ways that help them to develop curiosity about the natural world, that give them an insight into how science works and that enable them to appreciate its relevance to their everyday lives. The scope and nature of the study should be broad, coherent, practical and satisfying. It should encourage students to be inspired, motivated and challenged by the subject and its achievements.

Our aims throughout the Science journey at Altrincham College :

KS3: Students follow broad and deep curriculum that focuses on powerful knowledge and threshold concepts. We believe that mastery of threshold concepts is integral to students accessing powerful knowledge and gaining a deep understanding and appreciation of science.

We aim for each child to develop a natural curiosity and passion for science through scientific enquiry and a wide range of practical and enrichment activities.

KS4: Students experience a wide range of new topics and skills at KS4 whilst following the Edexcel combined or Triple science specifications. Each topic strand is linked intrinsically to prior knowledge and skills from KS3 and builds in terms of complexity, skills and application. Our aim is that all students should leave the academy being able to understand and explain the scientific world around them and more importantly are equipped with the skills to problem solve and critically evaluate the ‘big’ moral questions.

KS5: The study of Science in the Sixth Form provides the opportunity to further develop a knowledge and understanding of the principles which were studied at GCSE. The curriculum is planned as a natural extension of GCSE. It promotes the development of an awareness of the wide impact that Science and Technology have on our society.

Types of knowledge

In Science, our curriculum is designed around four types of knowledge. Our curriculum is built around a mastery interleaved approach as students need to mastery key threshold concepts in science to then allow them to understand future powerful knowledge. We want students to learn about powerful knowledge and understand that all the science curriculum is powerful as it is distinct from common sense.

Substantive Knowledge

These are THE FACTS. It is the core knowledge that ALL students should know and remember.

Eg:

Naming organelles, stating scientific laws, writing word and symbol equations, drawing electron shells, stating facts.

Threshold concepts

All threshold concepts in science are powerful knowledge.

They are gateways that must be crossed in order to access certain areas of knowledge.

These threshold concepts must be mastered in order for pupils to move onto subsequent powerful knowledge.

Powerful Knowledge

Distinct from 'common sense' knowledge acquired from everyday experience and therefore context specific and limited.

It is specialised; developed by subject specialists within defined fields of expertise and enquiry.

Disciplinary Knowledge

The HOW the knowledge becomes a fact.

Part of Science where students understand each discipline as a tradition of enquiry with its own distinctive pursuit of truth.

We want students to understand how theories are developed, tested, reviewed and later accepted if based on extensive evidence.

Threshold concepts in Science

Biology	Chemistry	Physics
<p>Cells and the cell cycle To include the differences between animal, plant and bacterial cells and examples of specialised cells.</p> <p>Respiration All living things need to respire and products and reactants of this</p> <p>Photosynthesis Plants need to photosynthesise to make glucose</p> <p>Proteins To include enzymes in digestion and defence.</p> <p>DNA To include the structure of DNA, inheritance, protein synthesis and the importance of mutation in variation.</p> <p>Particle model and transport To include how particles move across membranes via osmosis, diffusion and active transport.</p> <p>Homeostasis To include how organisms maintain constant internal conditions</p> <p>Ecology To include interactions and interdependence between organisms</p>	<p>Particle model: How particles behave in solids, liquids and gases. How particles behave in chemical and physical changes.</p> <p>Atoms, Elements, Compounds, Mixtures: To include the difference between these and common examples.</p> <p>General Equations: To include the law of conservation of mass and why this means we need to balance equations, also includes how to balance equations. To include the need to learn general equations in order to write equations that represent neutralisation, combustion, oxidation, displacement (KS4)</p> <p>Atomic Structure: To include the location, charge and relative mass of sub-atomic particles in addition to links to the periodic table. Links to include the relationship between electronic structure and location on the periodic table.</p> <p>Periodic Table: To include how to locate elements in groups and periods. To include gaining an understanding of how there are chemical and physical patterns and trends in the periodic table.</p> <p>Energy in chemical: reactions: To include the concepts of exo/endothermic reactions in terms of bond breaking and making and the concepts of activation energy.</p> <p>Opposites attract: A very simple concept, but one that needs revisiting due to its importance in many chemistry concepts, for example bonding and electrolysis.</p> <p>Mass and Moles: To include the concepts of relative mass, conservation of mass and using moles in calculations.</p> <p>Collision Theory An important concept when understanding why different factors can affect the rate of a reaction.</p>	<p>Electricity: Current as the (rate of) flow of charge.</p> <p>Electromagnetism: Current carrying wires are surrounded by magnetic fields.</p> <p>Electromagnetic induction: The relative motion of a wire and a magnet induces an emf/potential difference</p> <p>Energy: Conservation of energy; energy cannot be created or destroyed, only shifted between different stores.</p> <p>Motion: Speed is the rate of change of distance, and acceleration is the rate of change of speed/velocity</p> <p>Forces: Forces, both contact and non-contact, can be represented with arrows and the motion of an object depends on the resultant force acting on the object</p> <p>The model of the atom: A nucleus of protons and neutrons, surrounded by shells of electrons</p> <p>Particle model: of solids, liquids and gases</p> <p>Earth/Moon/Sun system: The Earth rotates on an axis and orbits the Sun</p> <p>Light: Visible light as a spectrum of colours of different wavelengths and frequencies Light travels in straight lines called rays, which can change direction at a boundary between different media</p> <p>Sound: produced and transmitted by vibrations</p>

Curriculum sequencing

	Overview	Topics	Year end-points																	
Year 7	Students build on their KS2 Science knowledge and begin to be introduced to key threshold concepts in Science: Topics covered are:	<table><tr><td>Introduction to Science</td></tr><tr><td>Cells</td></tr><tr><td>Forces</td></tr><tr><td>Energy</td></tr><tr><td>The Particle Model</td></tr><tr><td>Atoms and Elements</td></tr><tr><td>Reproduction</td></tr><tr><td>Compounds and Mixtures</td></tr><tr><td>Acids and Bases</td></tr><tr><td>Electricity</td></tr><tr><td>Magnetism</td></tr><tr><td>Common Reactions</td></tr><tr><td>Environment</td></tr><tr><td>Food and Digestion</td></tr><tr><td>Sound and Light</td></tr><tr><td>Space</td></tr></table>	Introduction to Science	Cells	Forces	Energy	The Particle Model	Atoms and Elements	Reproduction	Compounds and Mixtures	Acids and Bases	Electricity	Magnetism	Common Reactions	Environment	Food and Digestion	Sound and Light	Space	<p>Students have gained a wide range of scientific terminology covered within the initial topics.</p> <p>Students have shown knowledge and skill retention over time evidenced in retrieval activities.</p> <p>Students have performed basic practical work and have become familiar with a range of laboratory apparatus.</p>	
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Year 8	Students build on substantive, disciplinary and procedural scientific knowledge from Year 7 and content is interleaved to develop mastery in the threshold concepts. Topics covered are:	<table><tr><td>Motion</td></tr><tr><td>Energy</td></tr><tr><td>Organ Systems</td></tr><tr><td>Chemistry Fundamentals</td></tr><tr><td>Purity</td></tr><tr><td>Electricity</td></tr><tr><td>Thermal Physics</td></tr><tr><td>Plants and environment</td></tr><tr><td>Unicellular Organisms</td></tr><tr><td>Rates of reaction</td></tr><tr><td>Light</td></tr><tr><td>Habitats and Human Impact</td></tr><tr><td>Gravitational forces</td></tr><tr><td>Earth Science</td></tr><tr><td>Metals</td></tr></table>	Motion	Energy	Organ Systems	Chemistry Fundamentals	Purity	Electricity	Thermal Physics	Plants and environment	Unicellular Organisms	Rates of reaction	Light	Habitats and Human Impact	Gravitational forces	Earth Science	Metals	<p>Students have gained a wide range of scientific terminology covered within the initial topics.</p> <p>Students have shown knowledge and skill retention over time evidenced in retrieval activities.</p> <p>Students continue to perform practical work throughout each topic and should now be able to name and use all common laboratory equipment.</p>		
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Year 9	Students build on substantive, disciplinary and procedural scientific knowledge from Year 7 + 8 and content is interleaved to develop mastery in the threshold concepts. Topics covered are:	<table><tr><td>Chemistry Fundamentals</td></tr><tr><td>Energy in reactions</td></tr><tr><td>Chemical Reactions</td></tr><tr><td>Genetics and variation</td></tr><tr><td>Enzymes</td></tr><tr><td>Newtons Laws of Motion</td></tr><tr><td>Generating electricity</td></tr><tr><td>Atoms and periodic table</td></tr><tr><td>Exchange in organisms</td></tr><tr><td>Electromagnetic waves</td></tr><tr><td>Simple machines</td></tr><tr><td>Ecology</td></tr><tr><td>Nuclear Physics</td></tr><tr><td>Separating techniques</td></tr><tr><td>Photosynthesis</td></tr><tr><td>Respiration</td></tr><tr><td>Cosmology</td></tr></table>	Chemistry Fundamentals	Energy in reactions	Chemical Reactions	Genetics and variation	Enzymes	Newtons Laws of Motion	Generating electricity	Atoms and periodic table	Exchange in organisms	Electromagnetic waves	Simple machines	Ecology	Nuclear Physics	Separating techniques	Photosynthesis	Respiration	Cosmology	<p>Students have gained a wide range of scientific terminology covered within the initial topics.</p> <p>Students have shown knowledge and skill retention over time evidenced in retrieval activities.</p> <p>Students continue to perform practical work throughout each topic and should now be able to be left to conduct a full lesson practical following a method from start to finish with minimal teacher support.</p>
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Key stage end-point	<ul style="list-style-type: none">Students have gained a comprehensive understanding of basic threshold concepts which will enable them to be successful at GCSE.Students have gained a breadth of valuable practical experiences which have given them the skills																			

Year 10	<p>Students build on their knowledge from KS3 following the Edexcel curriculum for each science specialism (physics, chemistry, biology).</p> <p>Twice per half term retrieval assessments are in place to ensure long term knowledge retention. These include the most recent taught content interleaved with previous key concepts. The dates of these assessments are not shared with the pupils. The expectation is that they are consistently reviewing their knowledge.</p>
Year 11	<p>Students also complete 8 core required practical activities per specialism which are spread across the two years. Additional practical activities are embedded throughout the curriculum to support with understanding of content.</p>
Key Stage end-point	<p>End Point: Students are adequately prepared for GCSE examinations and possess the relevant knowledge and practical expertise to take a science at A level if they wish</p>
Year 12	<p>Students build on their knowledge from GCSE following the Edexcel or AQA curriculum for each science specialism (Physics AQA, Chemistry AQA, Biology Edexcel).</p> <p>Fortnightly retrieval assessments are in place to ensure long term knowledge retention. These include the most recent taught content interleaved with previous key concepts. The dates of these assessments are not shared with the pupils. The expectation is that they are consistently reviewing their knowledge.</p>
Year 13	<p>Students also complete required practical activities per specialism which are spread across the two years. Additional practical activities are embedded throughout the curriculum to support with understanding of content.</p>
Key Stage end-point	<p>End Point: Students are adequately prepared for A level examinations and possess the relevant knowledge, practical expertise, and independent learning skills to take a science at University if they wish.</p>

Full long-term plans of curriculum at all Key Stages can also be found on our website.