Science Curriculum Intent

Our ambitious aims

By the end of their time with us at Gloucester Academy, our students will be able to:

- Have a secure understanding of the domain-specific knowledge in Science, including interconnected concepts of Biology, Chemistry & Physics, which will lead them to expertise.
- Use schema to apply knowledge in context and solve the problems that exist and provide the solution to problems that have yet to be identified.
- Have the ability to work scientifically with a curious mind to analyse, communicate, enquire and solve problems both of an investigative nature and broader issues in Science such as global warming or investigating the products of Thermal Decomposition.
- Leave with cultural capital, which will give our students the very best advantage at the top Universities with the ambition to pursue Degrees in Biology, Chemistry & Physics, and the many other Science Degrees. Our curriculum will prepare them for adulthood as our students will leave with skills that are useful beyond study.
- Become young adults who can take in information and make informed decisions to benefit themselves and the people around them.

Helping each student to 'climb their own personal mountain to the very best university or profession'

Big ideas

To achieve our aims, students will be exposed to and develop a deep understanding of powerful scientific concepts.

Concept	Definition	Rationale
Biology **Structure & Function of Living Organisms**	***Cells and Organisation*** ***Skeletal and Muscular Systems*** ***Nutrition and Digestion*** ***Gas Exchange Systems*** ***Reproduction*** ***Health***	As a core subject, our key aim is to spark wonder, joy and awareness of how the world works. The concepts that have been developed by the disciplines of Biology, Chemistry and Physics represent the greatest achievements of Scientists throughout time and are still being evolved today. Within this subject, knowledge: both declarative and procedural are taught from concrete tangible ideas like relationships between organisms in an ecosystem and then moved towards more abstract concepts like cells and organisation. Concepts that are taught in KS3 are progressed upon in KS4. For example, where students are introduced to energy stores and transfers in Year 7, this is kept to identifying energy stores before and after work is done in the system. This is revisited in Year 9 to recap prior knowledge and to teach about the different types of energy transfer. Furthermore, this is applied again at GCSE Science in lessons about energy efficiency. The Science curriculum is knowledge rich and becomes a natural foundation to build curiosity in everyday phenomenom. This powerful knowledge is delivered in a spiral curriculum which sees the 11 big ideas revisited as students move through each key stage. Through the use of the knowledge organiser, key terminology for lessons is developed to make use of in lessons. Review questions each lesson are used to check understanding to plan next steps in teaching. Investigations in Science offer students the chance to experience Practical Science in order to make links with what has been taught. For example, after teaching about Transpiration in Year 10, we teach students how to investigate factors affecting Transpiration using potometers. The use of writing frames ensures that quality writing occurs in lessons so that students can plan, compare, contrast, explain and evaluate key concepts in lessons. Science lessons are taught by subject experts who collaboratively plan lessons to ensure that each lesson is quality assured by multiple lenses. Our common approaches to procedural knowledge in lessons ensures that all students are taught using the very best methods. Our lessons are fully inclusive to all students, as they stretch the most able students whilst supporting those in need with appropriate scaffolding as opposed to missing content.
Biology **Material Cycles & Energy**	**Photosynthesis** **Respiration**	
Biology **Interactions & Interdependencies**	**Relationships in an Ecosystem** **Inheritance, Chromosomes, DNA and Genes**	
Chemistry **Matter**	***The Particulate Nature of Matter*** ***Pure and Impure Substances***	
Chemistry **Chemical Reactions**	***Atoms, Elements and Compounds*** ***Chemical Reactions*** ***Energetics*** ***Periodic Table*** ***Materials***	
Chemistry **Earth**	***Earth and Atmosphere***	
Physics **Energy**	***Calculation of fuel uses and costs in a domestic context*** ***Energy changes and Transfers*** ***Changes in Systems***	
Physics **Motion and Forces**	***Describing Motion*** ***Forces*** ***Pressure in Fluids*** ***Balanced Forces*** ***Forces and Motion***	
Physics **Waves**	***Observed Waves*** ***Sound Waves*** ***Energy and Waves*** ***Light Waves***	
Physics **Electricity & Electromagnetism**	***Current Electricity*** ***Static Electricity*** ***Magnetism***	
Physics **Matter**	***Physical Changes*** ***Particle Model*** ***Energy in Matter*** ***Space Physics***	

Curriculum Journey

In Science, our students will study a curriculum with spaced practice and interweaved ideas.

Year	Summary of study	Narrative & Rationale
7	Energy Particle Theory Interdependence Forces Elements Organisation Magnetism & Charge Compounds The Cell	KS3 Science will extend over three years with a bespoke and balanced Science Curriculum that takes into consideration prior learning at KS2, and what will be required for KS4 Science. The concepts in our curriculum are part of a spiral design to secure a deeper knowledge of Science from understanding to application. They form an essential programme of study that explores scientific principles in depth, taking elements from the National Curriculum, AQA Science Specifications and department consultation. It's easier for students to develop an understanding of a big idea by multiple interactions with the concepts within the idea. By connecting smaller ideas to more abstract ideas, students will be better prepared to apply these concepts when approaching an unfamiliar topic. Each big idea contains smaller topics that build in complexity. For example, to understand Genes, students will start with variation and reproduction before moving onto evolution and inheritance. This enables students to gain confidence as they secure initial knowledge and apply this to more complex abstract ideas. Each subsequent lesson will build on prior learning and we will explicitly make connections between ideas to build schema and meaning from what is being taught. This aspect will make it a challenging curriculum as there will be a high ratio of retrieval and questioning to ensure that knowledge builds on knowledge. For example in Genetics students will build on the simple idea that changes to the DNA cause structural changes to the organisms. This idea then builds in complexity to explain the structure of DNA and how genes are inherited from parents to offspring. This bespoke curriculum will build on a model of mastery where teachers plan for error to ensure that lessons are adapted and appropriate for different teaching groups. In our lessons we consider the success criteria for each lesson so that students know what to produce to be successful Scientists. Therefore in our equations lessons, we teach students to identify key values, work in both the multiplication and change subject form, complete unit conversions and process answers to the correct number of decimal places and significant figures. Students will learn through deliberate practice to master each step before progressing on to the next skill. Core Practicals are considered and chosen to enhance learning and enquiry processes. These skills are: - Analyse - Communicate - Enquire - Solve When students start their KS4 Science curriculum, they do so with a solid foundation of competencies from KS3. Furthermore, they will have vital communication, enquiry, mathematical and problem solving skills that are endlessly useful beyond school.
8	Respiration Current Atomic Structure Transport Particle Theory Graphs in Science Metals & Ions Waves Health & Disease Speed Biodiversity	
9	Human Systems Separating Mixtures Electrical Circuits Periodic Table Resistance Organisation in Plants Mains Electricity Energy Covalent & Ionic Bonding	
10	<u>GCSE Combined Science: Trilogy</u> Cell Biology Organisation Infection and Response Bioenergetics <u>Chemistry 1</u> Atomic Structure & the Periodic Table Bonding, Structure & the Properties of Matter Quantitative Chemistry Energy Changes	The GCSE Combined Science curriculum is ambitious and challenging. Our lessons make it accessible so that students are exposed to expert knowledge, modelling and practice in preparation for their next steps beyond GCSE. **Retrieval practice** is important in lessons to make links between what has been taught before and to secure Scientific concepts from working memory to long term memory. There is a progression of skills across the disciplines. For example, in Biology students will learn about Cell Biology, which then leads on to the topic of

	Physics 1 Energy Electricity Particle Model of Matter Atomic Structure	Organisation, learning about organ systems. This requires retrieval of specialised cells and function. From this, students learn about what happens if these organ systems are damaged by poor lifestyle choices or how genetic diseases are inherited. Students will need the right knowledge to make informed decisions about choices of treatment or fertility decisions. Students will also make the connection to the wider environment, learning how our environment can put us at risk and therefore understand their local and global impact. Across the lessons, students are taught to describe, explain, suggest, compare and evaluate. These skills are modelled and rehearsed to ensure that students are successful at evaluating energy resources or explaining methods of metal extraction. From GCSE Combined Science, students can progress to A Levels in Biology, Chemistry and Physics or use the skills acquired in many other career paths.
11	Biology 2 Homeostasis and Response Inheritance, Variation and Evolution Ecology Chemistry 2 Rate and Extent of Chemical Change Organic Chemistry Chemical Analysis Chemistry of the Atmosphere Using Resources Physics 2 Forces Waves Magnetism and Electromagnetism	