

CURRICULUM INTENT/RATIONALE

SUBJECT: Science

Curriculum Intent

Knowledge Rich – Hinterland knowledge as well as core.

Focus On Mastery by revisiting core knowledge and concepts.

Emphasis on long term memory and recall – quizzes that interleave throughout.

Inclusion- Scaffolding for lower abilities where all levels of students will overcome challenges.

Maximises the impact of Assessment – Knowledge checks at the end of components and composites.

Our shared vision

To encourage students to share a passion and love for science that enables them to describe, explain and observe science phenomena. Students to be enriched with knowledge from the three scientific disciplines; biology, chemistry and physics that underpin the functions of the individual, the world and the universe. By exploring knowledge of the three disciplines students will grasp an awareness and understanding of the world in which they live – from the molecular level, organism level through to the environmental level. We also develop inquisitive thinkers and give them the skills necessary to follow the scientific method of curiosity, inquiry and analysis through a series of practical. By acquiring the knowledge from the three disciplines students will build on their skills of inquiry, analysis and critique. “The more we know on any given subject, the more we’ll be able to think about. And the more we’re able to think about, the greater our ability to think with” (Didau, 2014 <https://learningspy.co.uk/featured/thinking/>)

Science

The aim of the science curriculum is to help pupils develop into curious, independent, life long learners, who are able to question and explain how the world works. We provide a knowledge rich curriculum embodied in a rich practical provision that develops scientific skills that can applied across all curricular. The curriculum builds on the big ideas found within the traditional Key Stage 3 Science National Curriculum, but evolved to focus on the intertwined nature of our topics, building developed and branched schemata. This allows students to easily make links between concepts and phenomena. We have carefully sequenced our composites so that components in each composite are distributed across KS3 and provide the basic scaffold to learning in KS4.

To this extent by the end of KS 3 students have a secure knowledge in the foundation block concepts of knowledge: Biology- Structure and function of living organisms, Material cycles and energy, Interactions and interdependencies, Genetics and evolution; Chemistry - The particulate nature of matter, Chemical reactions, Energetics, The periodic table, materials, Earth and atmosphere; Physics – Energy, Waves, Motion and Forces, Electricity and electromagnetism, Matter. Across both key stages we build the ability to understand scientific attitudes, develop experimental and analytical skills and have strong grasp of measurement, core vocabulary, units, symbols and nomenclature – thus allowing pupils leaving KS3 to be GCSE ready. As pupils progress, and knowledge is deepened, we expect them to exit KS4 holding the breadth and depth of knowledge and skills to be able to transition onto advanced science course.

Science, at its root, is about gleaming knowledge in order to better understand the world around us, as such pupils with need to collect, process and retain large amounts of substantive knowledge, our curriculum both recognises and supports this process. For example, in order to be able to discuss the ethical and medical implications of stem cell research (KS4), first pupils will need a broad range of knowledge, for cellular structure (year 7), differentiation and specialisation to the medical processes and historic advances within the field of stem cell research, only then will they be able to tackle this discussion fully.

As this substantive knowledge will only remain with pupils as long as they are revisiting and utilising it our curriculum has a high focus on planning to the limitations of the working memory (a small number of lesson outcomes, focusing on core knowledge); while recognising the importance of transferring across to the long term memory, where schema can be developed (via low stake quizzing and the cyclical nature of our curriculum plan). This allows us to revisit, and review, the core knowledge periodically across both a half-term, term, year, key stage and throughout a pupil’s science journey. This is achieved by assessing what knowledge is understood within a lesson, via Q&A, tasks set and practical undertaken; directly following a lesson in the form of extended learning task; at the beginning of the next lesson, in the form of a low states quiz; at the end of the composite, in the form of a mini knowledge based test; across the term in formal SAT assessments.

Through time this allows pupils to have a clear sequence and build upon prior knowledge. For example, by following a spiral curriculum, we are able to link topics based on common themes, across our three disciplines. This approach helps make the topics relatable, embeds core knowledge, and build long term memory as topics are revisited regularly to help contract the ‘forgetting curve model’. An example core concept is that of the building blocks of our world.

During year 7 we start by focusing on the introduction of science, so students understand fully the safety and precautions needed to be taken into a scientific laboratory. These skills will be revisited each time a practical is undertaken but it is essential they understand fully the operations of a science laboratory. Up until this year students are unlikely to experience the nature of a scientific lab therefore it is necessary to introduce them to this very early on. The next topic we look at is electricity, this is due to it being a very relatable topic and building on the cultural capital of students who have already been exposed to electricity in their home. Although, they do not understand the nature of the working of electricity they have a very secure basic concept on when we flick a switch something happens. It also allows them to put into practice the skills they have picked up on in the introduction of science can be transferred when building electrical circuits in the lab. This is something they will have encountered in KS2, but without the many different electrical components that can be added into a circuit. We then accommodate a new schema by moving onto the structure and function of living organisms – cells this allows us to make links and assimilate the knowledge they picked up in electricity by giving students an understanding that all things are made up of smaller things (electricity – made up of electrons and living things- made up of cells). We then revisit the electricity composite to teach voltage and resistance so they can apply the knowledge of electricity to better understand how we can change electricity to suit our needs. We then build upon our idea that all things are made up of smaller things by exploring the particle model of matter. This would have also been studied at KS2 but now we place greater emphasis on the intermolecular forces between particles and the kinetic energy associated with each particle model of matter. Our curriculum continues to follow this theme of building on knowledge and linking the three scientific disciplines together. Please see our LTP plan for more detail.

During year 8 we intend to build upon knowledge acquired from our year 7 composites by providing opportunities for us to revisit previous knowledge with retrieval practice and then build upon the scaffolded knowledge in year 7. For example, electricity is then explored in a greater detail by introducing the concept of magnetism. How certain appliances have solenoids which require magnets and electricity to function.

Now students have learnt the structure of a human from a cellular level we build upon this in year 8 by looking at how cells and tissues form organs and system that allow the functioning of specific things such as breathing and digestion. Following on from the teaching of the structure and composition of the earth in year 7 we look at its place in the Universe at year 8 and look at the structure and composition of this.

During year 9 we have the opportunity to further embed and deepen our knowledge by revisiting composites and building again upon our knowledge. This spiralling allows for greater retention of material and knowledge in our long term memory and the sequencing enables us to strengthen our students' schema. Our long term plans explore the rationale for completing certain composites in a sequenced order.

KS4

Our intentions for KS4 are that we strengthen the knowledge gained from KS3, we address misconceptions that arise and we plug any gaps our students encounter. We deliver a curriculum that is at least ambitious against the national curriculum. From our long term plans you can see that Cell Biology in KS4 revisits previous knowledge of cell biology taught in KS3. This is important because students need this knowledge and understanding in order to access the higher curriculum demands in KS4. In KS3 they will have been taught the structure and function of a cell the basic knowledge needed in order to develop a greater understanding of the functions of specialised cells. In KS3 they will learn the nucleus is the control centre of the cell without truly understanding what that means. In KS4 they will understand and go into detail the structures in the Nucleus that control our genetic information. Our intentions at KS3 is to build the base of which all our knowledge will develop to greater heights in KS4.

Assessment will be an integral part of our curriculum. If our curriculum is made following from our intentions and teaching and learning is how we implement our curriculum our assessment will be how we evaluate the impact of our curriculum. Assessments will be in the form of retrieval practice from all the different composites students have learnt every lesson. Exam questions will assess the learning that has taken place during that lesson with feedback that addresses students' misconceptions and time to make improvements. Students will also have data recorded following cumulated assessment of the composites covered so far. Assessments will allow for retrieval practice and a focus on the A01, A02 and A03 objectives assessed in Science according to the AQA Trilogy Combined Science Specification.