



Science Curriculum Statement

King's Academy Binfield

This document sets out the curriculum that we have selected as most appropriate for our students that will support them to achieve our vision and aims; 'dare to be remarkable' and 'opportunity and success on a global stage'.

Intent

A high-quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. It is vital, therefore, that we provide students with the tools and understanding that not only prepares them for the next level of their education, but also for evaluating and making sense of the changing world around them.

EYFS

During their time in nursery and reception students will start to learn the foundations of the science curriculum through the 'Understanding the World' area of the EYFS Curriculum. It is introduced indirectly through activities that encourage students to explore, problem solve, observe, predict, think, make decisions and talk about the world around them. Early Years Science also helps children with skills in other Foundation Stage areas of the National Curriculum, such as Physical Development and Expressive Arts and Design.

KS1 and KS2

Science teaching in KS1 and KS2 aims to give all students a strong understanding of the world around them whilst acquiring specific skills and knowledge to help them to think scientifically, to gain an understanding of scientific processes and also an understanding of the uses and implications of Science, today and for the future.

Scientific enquiry skills are embedded in each topic the children study and these topics are revisited and developed throughout their time at school. Topics, such as Plants, are taught in Key Stage One and studied again in further detail throughout Key Stage Two. This model allows children to build upon their prior knowledge and increases their enthusiasm for the topics whilst embedding this procedural knowledge into the long-term memory. All children are encouraged to develop and use a range of skills including observations, planning and investigations, as well as being encouraged to question the world around them and become independent learners in exploring possible answers for their scientific based questions.

Specialist vocabulary for topics is taught and built up, and effective questioning to communicate ideas is encouraged. Concepts taught should be reinforced by focusing on the key features of scientific enquiry, so that pupils learn to use a variety of approaches to answer relevant scientific questions.

KS3

The principal focus of the KS3 curriculum at King's Academy Binfield is to deepen and develop students' understanding from the KS2 curriculum. At the heart of the curriculum are the 10 big ideas (Forces, Electromagnetism, Energy, Waves, Matter, Reactions, Earth, Organisms, Ecosystems and Genes). Each of these are broken down into 4 smaller ideas, which are set in order of increasing complexity and cognitive load. These are then spread throughout the KS3 curriculum in a "spiral" design so that each of the big ideas are revisited throughout the Keystage, each time building on the knowledge learned previously. Also key to our curriculum design are explicit links between the different content areas. This helps students to recognise the interlinked nature of the Sciences but also helps to turn good performances by students in the classroom into substantial long term learning.

Further to the 10 big ideas covering the core scientific knowledge concepts are the 4 areas of enquiry; Analyse, Communicate, Enquire and Solve. In a similar fashion to the 10 big ideas, these are each broken down into 4 smaller areas of focus. The working scientifically ethos is embedded into the curriculum at KAB, with practical work being a fundamental part of every student's science education and students always being encouraged to work "like a scientist" and apply good practice when it comes to analysis, scientific communication, enquiry and problem solving. Further to this, each half term a single strand of one of the 16 enquiry processes is focussed upon. These are set out in a spiral throughout the curriculum so that students revisit each of the 4 enquiry skills throughout the keystage, and again they are structured in terms of cognitive load with the simpler more concrete concepts coming early in year 7, and the more complex and abstract ones later in year 9.

Students in KS3 are working towards the AQA programme of study at GCSE so the curriculum at KS3 is based upon the AQA syllabus too. Not only does this provide a broad and comprehensive programme of study in the sciences, but it makes for a seamless progression to KS4 and allows for a 5 year curriculum that is coherent and has clear links between topics, key stages and the three sciences.

KS4

Our KS4 curriculum picks up where the KS3 programme of study left off, continuing to build upon the concepts introduced and studied in earlier years, with increasing demand and complexity; as well as introducing new concepts for which the prior learning undertaken at KS3 was a prerequisite.

Whilst at KS3 students were taught units of work in Biology, Chemistry and Physics in chunks, in KS4 the increased volume of content, as well as its increased demand, requires the three subjects to be taught concurrently and by subject specialist teachers.

Three paths through KS4 Science are offered, all provided by AQA. Separate Sciences are offered as an option to all students, with tier decisions being made in year 11. The rest of the cohort will follow the Combined Science "Trilogy" route. Students whose KS3 outcomes show that they will struggle to attain a grade 3 on a foundation Science GCSE paper will work towards an Entry Level Certificate in Science during year 10, and build upon these foundations in order to be entered for a single science GCSE probably Biology.

In each of the three sciences there exists a number of core concepts or principles that underpin other curriculum areas. In Chemistry this includes Atomic Structure and the Periodic Table, Chemical Bonding and Structure and the Quantitative Interpretation of Chemical Reactions. In Biology this includes Cell Function and Structure, Bioenergetics, Metabolism and the cycling of molecules in the natural world. In Physics this includes Energy and Electricity. Because of their

fundamental nature students need to be able to make links between these areas and other course content, and could be examined on them on either paper.

These fundamentals are taught early on in their respective order of teaching, allowing the knowledge to create a solid foundation for the other concepts that they underpin. Moreover, throughout the curriculum these concepts are interwoven and referenced in order to make their links with the rest of the course content explicit to students.

Implementation

In the 2020-2021 curriculum all KS3 students will have 9 lessons per fortnight of Science to help to address some of the lost learning time as a result of COVID-19 pandemic.

The fundamental principles that underpin the delivery of our curriculum are the same across all key stages. We deliver science lessons through a variety of activities with practical science being at the centre of that. Science is a practical subject and provides a set of ideas, theories and rules that allow us to make sense of the material world around us. As such, an education in Science must equip students with the tools to enquire, investigate and evaluate.

Our curriculum does that by weaving the opportunity to “work scientifically” throughout the specification and putting scientific thinking, skills, analysis and vocabulary at the heart of each science lesson. If a theory, concept or idea can be taught by a practical investigation or demonstration, then the lesson or sequence of lessons will be based upon that activity. Where this is not possible because of the particular content being taught then a range of other techniques are used to bring to life the often abstract and complex ideas that students encounter in Science. This includes modelling, roleplay, creation of media as well as observing videos of experiments or videos that are not possible in the school laboratory.

An effective Science lesson has two aspects to it, content and process. Although these are two distinct aspects, the best way to teach each is to teach one through the other. In other words students learn the science content, by applying their working scientific skills and students learn how to work scientifically by linking the investigations that they are doing directly to the course content. This approach is also taken to the required practical activities in Ks4. The activities are embedded within the curriculum and are undertaken whilst students are studying related course content, enabling students to clearly see the links between the theory and the practical work that can be done to investigate it.

Lesson structure follows the same basic plan throughout Ks3 and 4. All lessons begin with a starter or do now activity that is on the board or given to students as they enter the classroom. This increases learning time, hooks students into the learning and reduces off task behaviour.

The mathematical and linguistic demands of the science curriculum are not to be underestimated, with an enormous amount of subject specific vocabulary being introduced and a minimum of 30% of the physics papers (20% in Chemistry and 10% in Biology) assessing the mathematical skills taught within science. As with working scientifically, these skills are embedded within the lessons and taught so that they are used to explain and understand the course concepts. This might be by using mathematical skills in the analysis and evaluation of practical results and data, or with the use of dedicated

numeracy and literacy “moments” where students spend a specified period of the lesson explicitly applying a specific skill to the content that they are currently studying.

We subscribe to a number of learning platforms that are used in school and at home. The two most significant of which are www.century.tech (Century) and www.lbq.com (learning by questions.) These programmes both help deliver instant and targeted feedback to students. Century in particular provides a differentiated and tailored learning pathway for each student depending on their responses up until that point. These programmes are used in lessons and also for specific small group intervention, the use of century also forms a vital part of students' home learning.

Impact

At the end of the Ks2 students have developed a strong understanding of the core concepts that underpin the Ks1 and 2 curriculum strands, the details of which can be seen in our curriculum map. They will also be able to demonstrate skills in working scientifically, including:

- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate
- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
- Using test results to make predictions to set up further comparative and fair tests
- Reporting and presenting 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
- Identifying scientific evidence that has been used to support or refute ideas or arguments

Building on the skills and knowledge learned in the primary phases, at key stage 3 students will develop their understanding across the three sciences. By the end of the Key stage they will show a strong understanding of the 10 big ideas outlined earlier in this document and will. A majority of students strive to take separate science at Ks4 Students will have also built upon their ability to work scientifically and will work and think critically, logically and with an enquiring mind. Students will be able to confidently and independently carry out scientific investigations and present their results in both written, graphic and verbal formats. Students will be able to apply their knowledge to novel situations and approach problems in an analytical way. Students progress will be demonstrated in regular testing.

Each half term students will sit a baseline assessment of the content they will learn, a working scientific assessment of one key strand from this part of the syllabus and an end of topic test at the end of the half term. Assessments are broken down with question level analysis which is fed back to students so that they know where their strengths and weaknesses lie and therefore where they need to improve.

By the end of key stage 4 students have a solid understanding of the Biology, Chemistry and Physics. They are critical thinkers and are able to apply their knowledge and skills in unfamiliar to unfamiliar concepts. Students are adept at answering longer answer questions and have a deep understanding of the required practicals across all three sciences. Students are able to analyse practical methods and equipment and suggest improvements to imperfect plans. They are able to look at results and data with a critical eye and spot outliers / anomalies before drawing accurate conclusions.

As in Key stage 3 students are tested three times throughout each half term with a baseline, working scientifically and end of topic assessment. Throughout year 10 and 11, once a sufficient amount of content has been covered, students regularly sit past papers under exam conditions to give the best possible understanding of where they currently are in terms of their progress.

A significant number of students end Key Stage 4 with a passion for science and are keen to take their learning further at Key Stage 5 and beyond.