Science

Curriculum Principles

By the end of their all-through education, a student of science at Dixons Kings will:

- The overall aim of the Science Faculty is to maximise each individual pupils' progress in their understanding of scientific concepts and their applications to the real world. Our curriculum in each year is designed to provide experiences, opportunities, knowledge and skills that enrich and challenge our students. We hope to help pupils gain the confidence to thrive in a society that is increasingly dependent on the application of science and technology.
- We understand that the curriculum is key in determining the life chances and choices for our students and therefore we will not compromise on providing the very best. We are purposeful in everything we do and students begin their GCSE pathway at the start of Year 9. Pupils follow the AQA combined trilogy or the AQA separate science routes. We maintain academic rigour for our brightest pupils by allowing them the opportunity to study separate science.

In order to truly appreciate the subject and create deep schema, topics within science have been intelligently sequenced with the following rationale:

- Students will develop a love for science and start to think like scientists by questioning and suggesting explanations for the science they see. Students are encouraged to link the science they learn to what they know about the world in which they live and ask questions about this.
- Scientific knowledge is broadly hierarchical in nature – students must have a secure understanding of each key block of knowledge before progressing onto the next stage. Therefore, in order to support this, topics have been meticulously planned and ordered to ensure that students are always building on and deepening their previous learning.
- We have looked in detail at best evidence for science teaching and mapped out the sequence of units based on the evidence provided to avoid misconceptions. The lessons are sequenced so the fundamentals are taught first and subsequent knowledge is built on the strong base.
- We visit primary partner schools so we have a better understanding of the knowledge that the students bring to Year 7 in terms of content, skills and language used. This has informed the content taught in Y7 (we no longer teach the solar system) allowing us to build on the knowledge they have.
- All students are taught a skills unit at the start of Year 7 through investigative work rather than skills in isolation. This is to ensure that students have had an attempt to master the skills that they will need throughout the year in a realistic context. These skills are constantly revisited and thus embedded throughout the year.
- Biology, Chemistry and Physics are interleaved to allow the students to make links across all areas of science and see them as linked rather than discrete subjects thus facilitating a deeper understanding. Spacing of topics built in within the scheme of work at the appropriate stages although this is more limited at Y7 as we are concerned with the basic principles with interleaving more evident in Y8 and above. This has been done where there are opportunities for example in heredity cell structure, cell specialisation is interleaved in the topic before the structure and function of the sperm and egg is delivered.
- The lessons are planned to a high standard by subject specialists. There are various opportunities for AFL in order to identify and address misconceptions using MWB activities in addition to Q&A between teacher and student. Activities are included to address any misconceptions identified. The lessons and tasks are structured to manage cognitive load whilst still maintaining challenge. Wherever possible we use modelling to help students develop a deeper understanding of scientific concepts, for example, the students have to create a 3D model of a cell during the Cells unit. The lessons encourage students to develop their thinking, question and investigate ideas for themselves.
- Practical work is a key priority in the KS3 scheme of work with all practicals included being compulsory. There are individual experiments to secure and embed knowledge of content and eight investigations through the year to allow constant repetition of planning, identifying variables, using a range of equipment effectively and safely, recording results in tables and graphs, creating tables and graphs, identifying anomalous results, analysing & synthesising results and evaluating results and methods. These investigations also secure and embed content knowledge
- We do not want lack of knowledge to be a barrier to application and recall of knowledge is a fundamental part of the end of topic assessments. In these assessments, 50% of the marks will be for pure recall. There are sanctions for falling below a pass mark which will link to the pupils' ability. A further 50% of the marks will be for application of the knowledge. Gaps in knowledge identified through this element of the test will be addressed through specific DIRT activities related to the ability of the student. Knowledge retrieval is also constantly assessed through the Do Now activities at the start of every lesson which will be monitored through MWB responses. The knowledge navigator sheets are also used, often as part of homework, to ensure students are constantly revisiting with spot tests

- We understand the need to push our highest ability students. The KS4 lessons are planned to challenge and develop the thinking of these students by including tasks aimed at grade 8/9.
- Practical work is compulsory in the KS4 scheme of work. There are individual experiments to secure and embed knowledge of content and eight investigations through the year to allow constant repetition of planning, identifying variables, using a range of equipment effectively and safely, recording results in tables and graphs, creating tables and graphs, identifying anomalous results, analysing & synthesising results and evaluating results and methods. These investigations also secure and embed content knowledge.

The science curriculum at Kings has been influenced by:

- Best Evidence Science Teaching University of York Science Education Group
- EEF Improving Secondary Science Report
- Working with Big Ideas of Science Education
- AQA Science KS3 Syllabus
- ASE Science Skills age 11-14
- AQA specification
- The order in which they have been taught and the content in each unit has been determined by the following:
- MAT wide policy
- BEST evidence science teaching which provides a clear sequence for the order in which scientific ideas and concepts should be taught.
- CPD from the maths department has allowed us to more closely align our sequencing of science content with maths. For example, calculating acceleration using the gradient from a graph has now been moved from Y7 to Y8 as this is when gradients are delivered in maths. The CPD ensures that the way we deliver the maths in science is consistent with the way it is delivered in maths.

Our science curriculum ensures that social disadvantage is addressed through:

- Exposing our students to content that provides a deeper understanding of the world around them. The construction of our science curriculum not only ensures that students are taught the relevant knowledge, but also provides them with the skills to interrogate the world around them. This innate ability to question the world and to analyse information gives all our students, but especially our disadvantaged students, a complement of skills that will benefit their long term learning. We believe that without the power to question and develop hypothesises using scientific methods, individuals are dependent on those that possess these attributes and are unable to challenge the world around them.
- Recognising the lack of cultural capital many of our students have. An example would be when Ecology is taught. Students have a very limited knowledge of the natural world and plants and animals within this. When this topic is taught pictures and videos of habitats, animals and plants are constantly used in order for students to visualise what they are being taught.
- At KS3 we run a trip to the science museum in London and a fieldwork trip to the Yorkshire Dales. Priority on both these trips is given to disadvantaged students
- Disadvantaged and SEN students have their books marked more frequently compared to their peers. This allows for rapid identification of any misconceptions and errors. SEN and disadvantaged students are highlighted on staff intervention folders thereby ensuring these students are receiving the attention they need.

We fully believe science can contribute to the personal development of students at Dixons Kings through:

- The social development of our students is nurtured through the explicit teaching and practice of effective teamwork and communication skills when working in groups for scientific investigations. Groups are selected by the teacher to ensure that students learn to effectively collaborate with others who may be from different backgrounds or from outside of their friendship circle.

- Science naturally provides many opportunities for balanced discussions of moral and ethical issues. For example, we explore the moral complexities of organ transplant, the controversial use of genetic engineering and the disputed use of stem cells for disease treatment. Students are given time to discuss these issues both in pairs and as a class to allow students to develop spiritually. This allows students to form and articulate informed opinions, whilst also carefully and respectfully listening to others viewpoints.
- When teaching topics such as the theory of evolution and the Big Bang theory, this provides a chance to develop students' cultural awareness as we can discuss viewpoints of these theories from different religions and cultures.
- Science lessons also provide a wealth of opportunities to explore personal development relating to physical and mental health. For example, students study the effects of smoking, drugs and alcohol from both a scientific and social perspective. When teaching about the digestive system, students are taught about the importance of a balanced diet and how to interpret nutritional information.
- We want students to become respectful and responsible citizens who contribute positively to society. For example, students are taught in detail about global warming, pollution and energy resources so that they understand the importance of recycling, reducing waste and cutting down their carbon footprint.

Our belief is that homework is used for deliberate practice of what has been taught in lessons. We also use retrieval practice and spaced revision to support all students with committing knowledge to long term memory.

- Spacing is regular and consistent throughout KS3 and KS4. Spacing opportunities are identified in the long term plans and lessons, as well as resources, are planned to support these lessons in KS3. All homework's in KS3 have a section on spacing where students are assessed on content previously taught. In KS4 more autonomy is given to teachers in terms the strategies employed to achieve spacing.
- Each unit in KS4 has a knowledge retrieval quiz which has many of the fundamental concepts covered in 15 questions on a single sided document. The KRQ are regularly assessed throughout KS4 to encourage students to practice retrieval and master knowledge recall.
- All Do Now questions are taken from the KRQ's and are spaced into the lessons, this encourages students to make the links between the three sciences and also ensure that they are constantly revising prior content. We encourage our learners to achieve mastery as well as allowing them to identify and self-remedy potential learning gaps through frequent low stakes testing.

Opportunities to build an understanding of social, moral and ethical issues are developed alongside links to the wider world, including careers:

- The schemes of work ensure topical issues are covered to allow students to have an educated and informed opinion on global issues. In Y7 this includes renewable and non-renewable sources of energy balancing the advantages and disadvantages of each; air, water and land pollution, looking at the causes & the impact, and how this can be managed; biodiversity and the need to maintain this.
- A KS3 field trip to the Yorkshire Dales provides an opportunity to see the theory they have learned in class in a real context
- During the morning line up a whole week in March is dedicated to 'National Science Week' where students are given a daily presentation on the relevant theme. This year (2020) we will highlight the contributions of those scientists who have not been widely recognised in the past. Historically the focus of achievements has been on that of white male scientists so science week 2020 will provide an additional narrative.
- There is an annual careers fair where the students can discuss potential careers of interest and learn about careers related to science.
- In KS3 we have a STEM Club which allows further opportunity to use science to solve problems. This has included finding out the best combination of chemicals to make an ice pack and then making the ice pack, and finding out what combination of ingredients makes the best bath bomb and the creating this.
- We run Solutions for the Planet with our Y7 cohort. This allows the students an opportunity to explore the real threats to our planet and all the plants and animals that inhabit this space and develop projects to tackle an area of interest that can be submitted to a national competition.

Remote working in our subject supports students to access the full curriculum in the following ways:

- A clear whole school structure is implemented and followed in science where the lesson resources are uploaded each week with a home learning instruction sheet. Students are expected to complete the work and email their subject teachers.
- Lessons are in line with the learning taking place in school and therefore students will not be behind upon their return.
- Students without access to IT are issued with a textbook (age/year group dependent) and chapters are allocated linking as closely as possible, to what is being studied in class.

Further Information can be found in:

- Long term plans
- Knowledge Navigator sheets
- Schemes of work
- EEF Improving Secondary Science Report
- Working with Big Ideas of Science Education
- AQA Science KS4 Specification