DIXONS KINGS ACADEMY

Science

Year 10 Curriculum Principles and Overview

At Dixons Kings we develop students to lead successful and happy lives and make a positive contribution to their community. Our curriculum in each year is designed to provide experiences, opportunities, knowledge and skills that enrich and challenge our students. We understand that the curriculum is key to determining the life chances and choices for our students and therefore we will not compromise on providing the very best.

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. 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 acknowledge that many careers involve the skills and knowledge that science can provide. 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.

By the end of Year 10 students at Dixons Kings studying science will be exposed to the following modules:

	Cycle 1	Cycle 2	Cycle 3
Content / Themes Introduced	**P4 Atomic Structure** **B4 Bioenergetics** **C3 Quantitative Chemistry**	**C4: Chemical changes** **B5 Homeostasis & Response** **C5: Energy changes**	**P5 Forces** **B7 Ecology**

By the end of Year 10 students at Dixons Kings studying science will be taught the following skills:

Students should learn the following skill	Examples of how this skill may be assessed
• Understand how scientific methods and theories develop over time.	• Give examples to show how scientific methods and theories have changed over time. Explain, with an example, why new data from experiments or observations led to changes in models or theories. Decide whether or not given data supports a particular theory.
• Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.	• Recognise/draw/interpret diagrams. Translate from data to a representation with a model. Use models in explanations, or match features of a model to the data from experiments or observations that the model describes or explains. Make predictions or calculate quantities based on the model or show its limitations. Give examples of ways in which a model can be tested by observation or experiment.
• Appreciate the power and limitations of science and consider any ethical issues which may arise.	• Explain why data is needed to answer scientific questions, and why it may be uncertain, incomplete or not available. Outline a simple ethical argument about the rights and wrongs of a new technology
• Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.	• Describe and explain specified examples of the technological applications of science. Describe and evaluate, with the help of data, methods that can be used to tackle problems caused by human impacts on the environment
• Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.	• Give examples to show that there are hazards associated with science-based technologies which have to be considered alongside the benefits. Suggest reasons why the perception of risk is often very different from the measured risk (e.g. voluntary vs

	imposed risks, familiar vs unfamiliar risks, visible vs invisible hazards).
• Recognise the importance of peer review of results and of communicating results to a range of audiences.	• Explain that the process of peer review helps to detect false claims and to establish a consensus about which claims should be regarded as valid. Explain that reports of scientific developments in the popular media are not subject to peer review and may be oversimplified, inaccurate or biased
• Use scientific theories and explanations to develop hypotheses.	• Suggest a hypothesis to explain given observations or data.
• Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.	• Describe a practical procedure for a specified purpose. Explain why a given practical procedure is well designed for its specified purpose. Explain the need to manipulate and control variables. Identify in a given context: • • the independent variable as the one that is changed or selected by the investigator • • the dependent variable that is measured for each change in the independent variable • • control variables and be able to explain why they are kept the same. • Apply understanding of apparatus and techniques to suggest a procedure for a specified purpose.
• Apply knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.	• Describe/suggest/select the technique, instrument, apparatus or material that should be used for a particular purpose, and explain why.
• Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations	• Identify the main hazards in specified practical contexts. Suggest methods of reducing the risk of harm in practical contexts.
• Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative.	• Suggest and describe an appropriate sampling technique in a given context.
• Make and record observations and measurements using a range of apparatus and methods.	• Read measurements off a scale in a practical context and record appropriately.
• Evaluate methods and suggest possible improvements and further investigations.	• Assess whether sufficient, precise measurements have been taken in an experiment. Evaluate methods with a view to determining whether or not they are valid.
• Presenting observations and other data using appropriate methods.	• Construct and interpret frequency tables and diagrams, bar charts and histograms. Plot two variables from experimental or other data.
• Translating data from one form to another.	• Translate data between graphical and numeric form.
• Carrying out and represent mathematical and statistical analysis.	• For example: • • use an appropriate number of significant figures • • find the arithmetic mean and range of a set of data • • construct and interpret frequency tables and diagrams, bar charts and histograms • • make order of magnitude calculations

	• • change the subject of an equation • • substitute numerical values into algebraic equations using appropriate units for physical quantities • • determine the slope and intercept of a linear graph • • draw and use the slope of a tangent to a curve as a measure of rate of change • • understand the physical significance of area between a curve and the x-axis and measure it by counting squares as appropriate.
• Representing distributions of results and make estimations of uncertainty.	• Apply the idea that whenever a measurement is made, there is always some uncertainty about the result obtained. Use the range of a set of measurements about the mean as a measure of uncertainty.
• Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions.	• Use data to make predictions. Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. Draw conclusions from given observations
• Presenting reasoned explanations including relating data to hypotheses.	• Comment on the extent to which data is consistent with a given hypothesis. Identify which of two or more hypotheses provides a better explanation of data in a given context.
• Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.	• Apply the following ideas to evaluate data to suggest improvements to procedures and techniques. • • An accurate measurement is one that is close to the true value. • • Measurements are precise if they cluster closely. • • Measurements are repeatable when repetition, under the same conditions by the same investigator, gives similar results. • • Measurements are reproducible if similar results are obtained by different investigators with different equipment. • • Measurements are affected by random error due to results varying in unpredictable ways; these errors can be reduced by making more measurements and reporting a mean value. • • Systematic error is due to measurement results differing from the true value by a consistent amount each time. • • Any anomalous values should be examined to try to identify the cause and, if a product of a poor measurement, ignored.
• Communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms.	• Present coherent and logically structured responses, using the ideas in 2 Experimental skills and strategies and 3 Analysis and evaluation, applied to the required practicals, and other practical investigations given appropriate information.
• Use scientific vocabulary, terminology and definitions. • Recognise the importance of scientific quantities and understand how they are determined. • Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate.	• Across the scheme of work.

• Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano). • Interconvert units. • Use an appropriate number of significant figures in calculation.	

In order to truly appreciate the subject and create deep schema science has been sequenced with the following rationale:

- The lessons are sequenced so the fundamentals are taught first and subsequent knowledge is built on the strong base. The students learn the introductory units for biology, chemistry and physics. We understand the importance of letting the students develop their scientific thinking before introducing more challenging units, examples of this in practice is with the C3 unit Quantitative Chemistry and P2 Electricity which have been moved to Year 10.
- 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.
- The end of cycle 3 in Y10 is for reteaching of common misconceptions in preparation for Y11. These are identified from the cycle 3 tests. Required practicals are revisited which student voice identified as something they needed.
- We understand the need to push our highest ability students. The lessons are planned to challenge and develop the thinking of these students by including tasks aimed at grade 8/9.
- The lessons are planned to a high standard. 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 and student to 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. The lessons encourage students to develop their thinking, question and investigate ideas for themselves.
- Practical work is a key priority in the KS4 scheme of work with all practicals included being compulsory. Required practicals are a key part of the course and up to 18% of marks for each science paper will focus on the required practicals which replaced the need for coursework in 2016. For this reason, time is spent developing skills to carry out these experiments and also applying these skills to exam questions. 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 students. The do now activities for Y10 focus on the retrieval of prior learning to improve transfer of the contents they have learned to long term memory.
- Staff carry out analysis of data from end of cycle assessments through the use of QLA's and identify students for intervention. QLA's and feedback from marking identify the areas for focus for the interventions
- Students need explicitly teaching the skills needed for the extended answer questions in science which are worth either four marks or six marks. The skills needed to answer these questions are varied. Students are taught to identify the command words in the question, how to analyse information in tables and in graphs to then apply this to a question and how to plan experiments. This is modelled through two different questions linked to a topic and then time given for independent practice.

The science curriculum at Kings has been influenced by:

- EEF Improving Secondary Science Report
- Working with Big Ideas of Science Education
- AQA Science KS4 Syllabus

The order in which they have been taught and the content in each unit has been determined by the following:

- MAT wide policy

The CPD ensures that the way we deliver the maths in science is consistent with the way it is delivered in maths. We teach tangents and finding the gradient of lines in science in the same way they do in maths. This reduces cognitive load and supports students in seeing that the maths we do in science is the same as the maths they do in maths. Formula triangles are not used in the science department

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. In Y10 we teach topics on contraception and control of fertility. Students are taught exactly how each method of contraception works and supported in how to give views on the ethical issues without using emotive language. This links with RE.
- 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.
- 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.

Our belief is that homework is used for deliberate practice of what has been taught in lessons.

- Homework in KS4 is designed to give students exposure to exam style questions and allow them to practise the skill of applying their knowledge.
- For our weaker learners we focus on ensuring they are able to learn and recall key content before providing the exam questions as they cannot apply what they do not know
- Homework is marked in class and students are then set targets based on their misconceptions.

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 Year 10 this includes water and land pollution, looking at the causes & the impact, and how this can be managed; biodiversity and the need to maintain this; fracking and the issues associated with it, type 2 diabetes and issues of health and ethical issues around different types of contraception.
- 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. We aim to 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 in science week we aim to 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.

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