DIXONS KINGS ACADEMY

Science

Year 7 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.

We achieve this in science through the below:

By the end of Year 7 students at Dixons Kings studying science will be exposed to:

- The fundamentals of biology, chemistry and physics outline in the Big Ideas of Science Education. We teach key ideas and build a strong core body of knowledge alongside ensuring that the students develop strong investigative skills.
- Students will develop a love for science and start to think like scientists by questioning and suggesting explanations for the science they see.
- An encouragement to link the science they learn to what they know about the world in which they live and ask questions about this.

	Cycle 1	Cycle 2	Cycle 3
Content / Themes Introduced	**Unit: Science skills** **Theme:** Repeating the same skills through different investigations **Unit: Energy** **Themes:** • Energy stores & transfers ensuring correct use of new terminology • Useful energy transfers & energy efficiency • Renewable & non renewable resources • Temperature & thermal energy transfer • Role of insulation in thermal energy transfer **Unit: Particles & Solutions** **Themes:** • Defining solid, liquids and gases and their properties in terms of particles • Change in state linked to cooling curves • Solutions as mixtures • Separating different types of mixtures • Chromatography as a separation process • Temperature and effect on solubility	**Unit: Cells & Cellular Biochemistry** **Themes:** • Characteristics of living and non-living things • Cell as the basic 3D unit of life • Specialised cells • Unicellular & multicellular organisms • Movement in and out of cells • The cell processes of respiration & photosynthesis **Unit : Forces** **Themes:** • Defining forces & different types of force • Balanced and unbalanced forces • Force diagrams • The effect of friction as a force **Unit: Heredity & Lifecycles** **Themes:** • Concept of heredity & lifecycles	**Unit: Acids & Alkalis** **Themes:** • Defining acids and alkalis • The role of indicators and different indicators • Neutralisation & salt production • Uses of neutralisation **Unit: Organisms & their Environment** **Themes:** • Food chains and webs and what they show • Biotic & abiotic factors • Predator prey relationships • Population changes and factors affecting these • Estimating population size • Measuring distribution across a transect and links to abiotic & biotic factors • Bioaccumulation • Environmental change • Biodiversity **Unit: Light Sound & Waves** **Themes:** • Light & sound waves

	Unit: Elements & Compounds **Themes :** • Elements, compounds, atoms & molecules • Symbols & formulae • Chemical reactions and conservation of mass • Atomic structure • Periodic table & groups Metals & non metals	• Human reproductive systems • Sexual reproduction in humans including development of the foetus • Sexual reproduction in plants including seeds and germination	• Reflection and refraction of light • Colour • The eye • Absorption & reflection of sound • The ear • Volume & pitch
Spaced Content	**Unit : Science Skills** The same skills are covered through four different investigations so the skills can be applied in different contexts		

By the end of Year 7 students at Dixons Kings studying science will be taught the following skills:

- Carrying out investigations to test hypotheses
- Identifying and using a wide range of scientific equipment safely & accurately
- Identifying independent, dependent & control variables
- Taking accurate measurements and observations using a range of instruments
- Recording measurements/observations effectively in tables
- Recording data in bar charts and line graphs
- Creating their tables, bar charts and line graphs to record data
- Drawing lines of best fit on line graphs
- Identifying trends in data
- Predicting further patterns based on trends seen
- Identifying anomalous results and sources of error in an experiment
- Evaluation of an investigation identifying improvements that could be made
- Using their scientific knowledge to explain the results seen
- Analysis and synthesis of results from a number of experiments to produce a scientific conclusion
- Calculating the mean from a range of results
- Performing simple calculations
- Measuring angles

	Cycle 1	Cycle 2	Cycle 3
Skills Introduced	• Carrying out investigations to test hypotheses • Identifying and using a wide range of scientific equipment safely & accurately	• Carrying out investigations to test hypotheses • Identifying and using a wide range of scientific	• Carrying out investigations to test hypotheses • Identifying and using a wide range of scientific equipment safely & accurately

	• Identifying independent, dependent & control variables • Taking accurate measurements and observations using a range of instruments • Recording measurements/observations effectively in tables • Recording data in bar charts and line graphs • Creating their tables, bar charts and line graphs to record data • Drawing lines of best fit on line graphs • Identifying trends in data • Calculating the mean from a range of results • Using their scientific knowledge to explain the results seen	equipment safely & accurately • Identifying independent, dependent & control variables • Taking accurate measurements and observations using a range of instruments • Recording measurements/observations effectively in tables • Recording data in bar charts and line graphs • Creating their tables, bar charts and line graphs to record data • Drawing lines of best fit on line graphs • Identifying trends in data • Predicting further patterns based on trends seen • Identifying anomalous results and sources of error in an experiment • Evaluation of an investigation identifying improvements that could be made • Using their scientific knowledge to explain the results seen • Analysis and synthesis of results from a number of experiments to produce a scientific conclusion • Calculating the mean from a range of results • Performing simple calculations	• Identifying independent, dependent & control variables • Taking accurate measurements and observations using a range of instruments • Recording measurements/observations effectively in tables • Recording data in bar charts and line graphs • Creating their tables, bar charts and line graphs to record data • Drawing lines of best fit on line graphs • Identifying trends in data • Predicting further patterns based on trends seen • Identifying anomalous results and sources of error in an experiment • Evaluation of an investigation identifying improvements that could be made • Using their scientific knowledge to explain the results seen • Analysis and synthesis of results from a number of experiments to produce a scientific conclusion • Calculating the mean from a range of results • Performing simple calculations • Measuring angles
Practicals	• How does the type of ball affect the height of bounce? • How does the length of bone affect the mass needed to break? • How does salt affect the balling point of water? • How does the strength of acid affect the time taken for magnesium to react?	• Observing and drawing cells using a microscope • Measuring forces • How does the surface affect the amount of friction? • Identifying the reproductive organs in a flower • What are the conditions needed for seeds to germinate?	• Making and testing indicators • Identifying acids & alkalis using indicators • Which indigestion remedy is the best? • Estimating the population of daisies on the school field • Measuring distribution along a transect

	• Investigating conduction & convection • Which insulator is the best? • Investigating the effect of temperature on solubility • Investigating conduction & convection • Measuring temperature of stearic acid as it cools and interpreting the cooling curve • Separating salt from rock salt • How do we know a chemical reaction has taken place? • Differences between metals and non-metals •	• Differences between metals and non-metals	• Measuring angles of incidence & reflection • Measuring angles of refraction
Spaced Content	The skills identified are revisited in each practical	The skills from cycle 1 are revisited	The skills from cycle 1 & 2 are revisited

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

- 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 visited our primary partner schools prior to the development of our new KS3 curriculum so we had 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 and 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. 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..
- 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, 40% of the marks will be for pure recall. There are sanctions for falling below a pass mark which will link to the pupil's ability. A further 60% 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

- All Year 7 students have booklets for each topic. These are planned and written by members of the department and it ensures that all the content they need is in one place alongside the activities they have completed to apply their knowledge and extend their understanding.
- Each booklet has a mindmap or them to build to show how the knowledge they are learning fits together. This allows them to build their schema around the topic making it easier to draw information form their long term memory.

Why do you plan lessons in a certain order? Is there a reason biology comes before physics for example? Or do you start with basic skills first?

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
- Rosenshine's principles
- Efrat Furst and building schema
- Misconceptions in Science by Adam Boxer
- Learning scientists – six effective learning strategies
- Fiorella and Mayer's Generative Learning in Action by Mark and Zoe Enser

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 align our sequencing of science content more closely with maths. For example, we no longer use triangles when learning and completing calculations. Students are taught the same method used in maths to change the subject of a formula. 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 Life centre in Newcastle 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.

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

- Homework is marked is set through Carousel learning. The focus is on ensuring the students learn the key facts for each unit and the platform allows an opportunity to quiz themselves on the questions before finally answering and submitting their answers. The platform allow teachers to identify any misconceptions for a particular homework across

the class or to identify individual misconceptions across a cycle. Students self mark their homework and it is checked by the class teacher

- Each homework contains questions from previous topics in order to practice retrieval of prior learning and to support all students with committing knowledge to long term memory.
- Students are introduced to a range of ways to revise at home

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
- There is an annual careers fair where the students can discuss potential careers of interest and learn about careers related to science.
- Each booklet for each science topic has a careers focus. This chooses a career for that particular area of science giving details of the career and how to train.
- In KS3 we have a STEM Club which allows further opportunity to use science to solve problems and an outdoor science club where environmental issues are explored.
- We in 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. We have had students reach the regional finals each year we have run this.

Further Information can be found in:

- Long term plans
- Knowledge navigator sheets
- Schemes of work
- 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