

Science

Learning Journey

Intent • Implementation • Impact



Curriculum Intent

Science Curriculum Learning Journey

Science is life, science is magic, science is not only factual but it develops the skills of pupils enabling them to be creative, solve problems and see fundamental links between science phenomena.

It is our belief at Parkside that a broad and balanced science education is the entitlement of every student regardless of ethnic origin, gender, class, aptitude or disability. The teaching of Science at Parkside Community School aims to promote reciprocity, resilience, resourcefulness and reflectiveness amongst all students.

The science department delivers a strong knowledge-based curriculum, providing opportunity for students to discover the **excitement of the sciences** and the phenomena surrounding the subject. The staff aim to instil a desire for **practical discovery**, while fostering the **inquisitive nature** of students.

A strong focus is also placed upon literacy within science. There is robust evidence that poor literacy skills result in low attainment in the subject. This potentially limits the number of students pursuing a scientific career after they leave school. Teachers will be aware of the vocabulary demands of a topic and will make a conscious choice to focus on the words that students most need to understand. New **scientific vocabulary** will be taught explicitly and by using direct instruction and modelling, students will quickly gain insight into how these words are linked to other aspects of science.

The department will also strive to provide a current foundation in the elements of **scientific method, theory, applicability and laboratory practice** that will encourage and inspire students to acquire an in-depth appreciation of the scientific endeavour. Students undertake experiments or view demonstrations where possible which, in addition to developing their practical skills, will also develop their ability to hypothesise, predict, analyse, interpret and evaluate. **We enable all pupils to feel they are scientists and capable of achieving.**

To fulfil this aim, the science staff will provide a safe environment in which students' views and personal aims are valued. Staff will encourage students to actively participate in their well-planned and highly differentiated lessons; where students of all abilities are given an appropriate level of challenge. Through a practically based course, skilled, deep and lifelong learning can be achieved, as students are prepared for the world of work and further study in the sciences.





S Welsh – Head of Science

Curriculum Implementation

The science curriculum has an interconnected structure which involves challenging pupils to think, speak, write and problem solve in a scientific manner. Pupils develop their knowledge and skills, through high quality teaching and an engaging learning environment, to enable them to be successful scientists of the future.

The science curriculum is a five-year learning journey which sees pupils build, retain, recall and apply core knowledge concepts. This journey begins by building the foundations of scientific knowledge via a thematic approach, which engages and challenges students in the 3 main disciplines of science. Our learning pathway then ensures pupils have strong foundations in these core concepts before moving on to develop pupils understanding further throughout GCSE.

All teaching staff are specialists in their subject disciplines and work collaboratively to support one another. Our thematic approach to teaching lower school provides pupils with a connection to their learning, allowing them to grasp and develop key ideas and incorporate working scientifically skills. Pupils are able to follow either the combined sciences AQA Trilogy route or the separate science AQA route. At this stage they are taught by subject specialists who ensure through modelling, questioning and practical methods, that students embed and deepen their knowledge in each of the science disciplines.

Memory retrieval is at the core of our curriculum, and pupils regularly revisit key learning concepts from previous topics to ensure they retain the knowledge of and are abler to apply the key ideas. We use regular low-stakes memory platform activities to support students and activate previous learning. We have been improving and enhancing our knowledge organisers to support memory and retrieval by enabling us to define the core curriculum knowledge our pupils require, and centering our approach around this.

A range of summative and formative approaches to assessment are utilised within the science curriculum. Topic progress checks focusing on key ideas will allow us to understand the progress pupils are making, alongside other more formative methods of assessment. Pupils will also be assessed at the two whole school assessment points in line with school policy and data captures. These assessments will cover a number of aspects from the curriculum in each year group, as well as varying question styles. It is hoped that this approach, alongside lesson revision and preparing for such assessments, will allow pupils to transition into Key Stage 4 more easily and develop the routines needed for future success. The outcomes of these assessments will then inform the planning of the science staff, allowing them to respond to curriculum and pupil needs.

We build the cultural capital of our pupils using experiences both in the classroom and within the community. We look at not only where scientific knowledge can take you directly, but how the skills pupils gain can result in careers as scientists, careers in science or careers from science.

Curriculum Impact





The impact of our Science Curriculum is defined through the accessibility pupils have to developing knowledge and the application of skills. This is determined through a number of measures:

- Knowledge and understanding of the 'Big Ideas'. Pupils will be able to speak with confidence about the scientific discoveries and explain how they have impacted our society today. Pupils will be able to analyse scientific information and data and be able to explain this verbally and through written responses. All pupils will be able to reach their own conclusions about scientific investigations and issues and justify their reasoning behind this.
- Formative Reporting of Pupil Progress will take place through assessments that take place each lesson and include pupil questioning, classroom discussion, the completion of examination style questions and the completion of homework.
- Summative Reporting of Pupil Progress takes place through GCSE style examination paper assessments that are undertaken by pupils at the midpoint and end point of each Learning Journey. Parents/Carers receive a report following each mid and end point assessment to understand their child's current depth of knowledge and the support they need to further develop this knowledge both inside and outside of school.
- In-lesson learning, participation and belonging is measured by continually measuring pupil punctuality to lessons, rewards and sanctions, behaviour referrals, pupil voice and work scrutiny. Our hope is that by continued positivity in these areas, the Science Curriculum is accessible and will, therefore, positively impact knowledge growth and skill application.
- GCSE Combined science outcomes demonstrate the overall impact of our pupils' Science Curriculum. GCSE Separate Sciences outcomes contribute to the Ebacc element of the school's Progress 8 score.
- Post-16 Progression has demonstrated a year-on-year increase in the number of pupils moving on to study A-Level Sciences at sixth form schools and colleges.



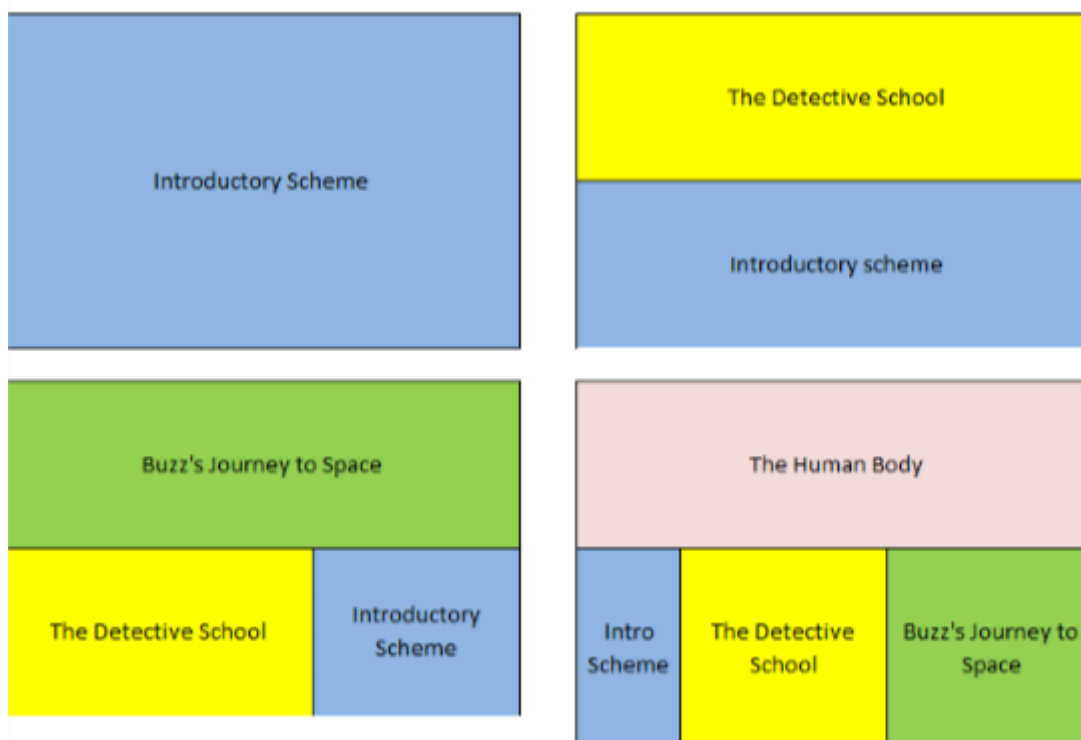
Learning Journey **overview**

Year 7: Topic summary

How we interleave topics to enable pupils to build and recall knowledge.

Year 7:

Science Curriculum Learning Journey



Introductory lessons

Pupils begin with an introduction to science and the science lab, outlining the importance of safety in the science labs and looking at the skills of scientific enquiry and its links to the real world. At the end of this short section of lessons pupils undergo a knowledge check to determine their level of understanding of key concepts from Key Stage 2, allowing staff to support pupils where gaps in knowledge become evident.

The Detective School

Pupils work alongside detective Pikachu to develop and apply scientific skills from the Chemistry elements of Key Stage 3. They discover the principles of the particle model, separation techniques, the pH scale and the rock cycle. These areas allow a foundation of key principles to be built before they continue to explore them in Year 8 and again at Key Stage 4. Not only do pupils look at these key ideas but they apply knowledge gained to a variety of detective Pikachu's problems and link them with problems faced by people in various countries across the world. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.





Buzz's Journey to Space

Pupils join Buzz Lightyear in his attempt to return to space to develop and apply scientific skills from the Physics elements of Key Stage 3. They look at force, energy resources, energy transfer and the solar system. During this scheme pupils will revisit some of the key chemistry concepts to deepen their understanding and build on this (for example the particle model linked to energy transfers). Not only do pupils look at these key ideas but they apply knowledge gained to a variety of Buzz's problems and link them with problems faced by people in various countries across the world. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.

The Human body

Pupils work alongside the cast of Inside Out to develop and apply scientific skills from the Biology elements of Key Stage 3. They discover how cells are the building blocks of life and how the various body systems (digestive, circulation and respiratory) made from them function. They compare human systems with that of plants and look at the creation of life through both plant and animal reproduction. During this they revisit key ideas from both previous topics. These areas allow a foundation of key principles to be built before they continue to explore them in Year 8 and again at Key Stage 4. Not only do pupils look at these key ideas but they apply knowledge gained to a variety of problem-solving activities. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.



Year 8: Topic summary

How we interleave topics

Science Curriculum Learning Journey

Our Living Planet		
Year 7 Detective School	Year 7 Buzz's Journey to Space	Year 7 Human Body
Chemistry of Life		
Year 7 Detective School	Year 7 Buzz's Journey to Space	Year 7 Human Body and Year 8 Our Living Planet
At the Music Festival		
Year 7 Detective School	Year 7 Buzz's Journey to Space and Year 8 At the Music Festival	Year 7 Human Body and Year 8 Our Living Planet

Our Living Planet

Pupils explore our living planet to develop and apply scientific skills from the Biology elements of Key Stage 3. They discover nutritional groups, respiration, photosynthesis and plant reproduction. They then explore variation, natural selection and inheritance. During this they revisit key ideas from both previous topics covered this year and recap key scientific concepts learnt in Year 7s Human Body topic. These areas allow a foundation of key principles to be built and developed before they continue to explore them again at Key Stage 4. Not only do pupils look at these key ideas but they apply knowledge gained to a variety of problem-solving activities. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.

The Chemistry of Life

Pupils look at the chemistry of life to develop and apply scientific skills from the Chemistry elements of Key Stage 3. They discover the principles of a variety of chemical reactions, the periodic table, properties of a range of material including metals and non-metals. They also begin to look at the composition of some materials such as polymers and composites. These areas allow a foundation of





key principles which build on the learning from the detective school before they continue to explore them again at Key Stage 4.

Not only do pupils look at these key ideas but they apply knowledge gained to a variety of problems and link them with issues faced by people in various countries across the world. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.

At the Music Festival

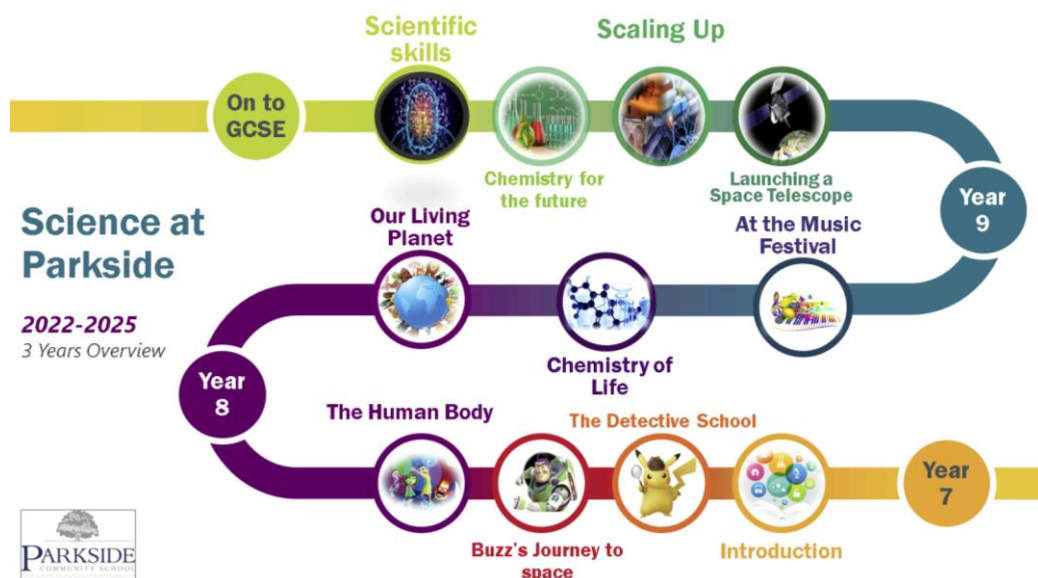
Pupils journey to a music festival to set up the stage, monitor a production and clear up afterwards in order to develop and apply scientific skills from the Physics elements of Key Stage 3. They look at motion, pressure, light, sound, electrical circuits and magnets. During this scheme pupils will revisit some of the key chemistry concepts to deepen their understanding and recap key scientific concepts learnt in Buzz's Journey to Space in Year 7 before they continue to explore them again at Key Stage 4. Not only do pupils look at these key ideas but they apply knowledge gained to a variety of problems and link them with issues faced by people in various countries across the world. They also look at how these skills can be used in scientific careers and the relevance of what they are learning to the real world.



Year 9: Topic summary

How we interleave topics

In year 9 we develop pupils substantive and disciplinary knowledge of science as we split science into the separate disciplines of Biology, Chemistry and Physics. Students have a specialist teacher for each subject discipline.



Pupils work to revisit and embed knowledge of the core concepts from each subject discipline, with care taken to highlight the knowledge of the products of science such as concepts, laws, theories and models. Alongside this student have specific science skills lessons used to develop their knowledge of how science grows and is generated, through enhancing practical skills, maths skills and literacy skills as part of a working scientifically scheme.

Practical skills

Student look at how to link scientific knowledge to scientific enquiry by developing their ability to construct experiments; plan using variables; test hypotheses; collect accurate data; present scientific data; estimate risks; analyse patterns and discuss limitations. This unit provides students with the knowledge of how to ask and answer scientific questions by carrying out different types of scientific enquiry.

Maths skills

Student use knowledge of scientific methods and skills from maths to aid recall of equations; model rearranging equations; apply correct units; understand standard for; draw and analyse graphs; calculate probability and ratios. This unit highlights the cross curricular links between science and maths and how these techniques from maths can be applied in the different science disciplines. The unit has been produced through collaborative planning with a focus on sequencing of concepts.





Literacy skills

Students use a variety of disciplinary literacy strategies to enhance their ability to talk, read and write like scientists. Students develop their ability to use key vocabulary and make links with real world examples; they then look at how to analyse scientific text, breaking it down to look for relevant information or understand wording of exam questions; finally, they apply this to scientific write ups, looking at how to structure and word information. This unit gives students an understanding and way to overcome literacy barriers.

Key Stage 4 Separate Science (Biology), Combined Science (Biology)

Year 10	Consolidation	B1 Cells and Transport Consolidation and application	B2 Cell division Consolidation and application	B3 Organisation and the Digestive System Consolidation and application	B4 Organising Animals and Plants Consolidation and application	B5 Communicable diseases Consolidation and application	B6 Preventing and treating disease Consolidation and application	B7 Non-communicable Disease Consolidation and application	B8 The human nervous system Consolidation and application	B9 Hormonal coordination Consolidation and application
Year 11	B12 Homeostasis GCSE Biology only Consolidation and application	B13 Reproduction Consolidation and application	B14 Variation and evolution Consolidation and application	B15 Genetics and evolution Consolidation and application	B17 Organising an Ecosystem Consolidation and application	B18 Biodiversity & Ecosystems Consolidation and application	Specific revision and testing	Specific revision and testing	Specific revision and testing	Specific revision and testing

Biology is the science of living organisms (including animals, plants, fungi and microorganisms) and their interactions with each other and the environment. The study of biology involves collecting and interpreting information about the natural world to identify patterns and relate possible cause and effect. Biological information is used to help humans improve their own lives and strive to create a sustainable world for future generations.

Pupils should be helped to understand how, through the ideas of biology, the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below. These ideas include:

- life processes depend on molecules whose structure is related to their function
- the fundamental units of living organisms are cells, which may be part of highly adapted structures including tissues, organs and organ systems, enabling living processes to be performed effectively
- living organisms may form populations of single species, communities of many species and ecosystems, interacting with each other, with the environment and with humans in many different ways
- living organisms are interdependent and show adaptations to their environment
- life on Earth is dependent on photosynthesis in which green plants and algae trap light from the Sun to fix carbon dioxide and combine it with hydrogen from water to make organic compounds and oxygen
- organic compounds are used as fuels in cellular respiration to allow the other chemical reactions necessary for life
- the chemicals in ecosystems are continually cycling through the natural world
- the characteristics of a living organism are influenced by its genome and its interaction with the environment
- evolution occurs by a process of natural selection and accounts both for biodiversity and how organisms are all related to varying degrees





Key Stage 4 Separate Science (Chemistry), Combined Science (Chemistry)

Year 10	Consolidation	C3 Structure and bonding	Consolidation and application	C4 Chemical calculations	Consolidation and application	C5 Chemical change	Consolidation and application	C6 Electrolysis	Consolidation and application	C7 Energy changes	Consolidation and application	C8 Rates and equilibrium	Consolidation and application	C9 Gases, O ₂ and Fuels	Consolidation and application
Year 11	C10 Organic reactions	Consolidation and application	C11 Polymers	Consolidation and application	C12 Chemical analysis	Consolidation and application	C13 The Earth's atmosphere	Consolidation and application	C14 The Earth's resources	Consolidation and application	C15 Using our resources	Consolidation and application	Specific reaction and being	Specific reaction and being	Specific reaction and being

Chemistry is the science of the composition, structure, properties and reactions of matter, understood in terms of atoms, atomic particles and the way they are arranged and link together. It is concerned with the synthesis, formulation, analysis and characteristic properties of substances and materials of all kinds.

Pupils should be helped to appreciate the achievements of chemistry in showing how the complex and diverse phenomena of both the natural and man-made worlds can be described in terms of a small number of key ideas which are of universal application, and which can be illustrated in the separate topics set out below. These ideas include:

- matter is composed of tiny particles called atoms and there are about 100 different naturally occurring types of atoms called elements
- elements show periodic relationships in their chemical and physical properties
- these periodic properties can be explained in terms of the atomic structure of the elements
- atoms bond by either transferring electrons from one atom to another or by sharing electrons
- the shapes of molecules (groups of atoms bonded together) and the way giant structures are arranged is of great importance in terms of the way they behave
- there are barriers to reaction so reactions occur at different rates
- chemical reactions take place in only three different ways: • proton transfer • electron transfer • electron sharing
- energy is conserved in chemical reactions so can therefore be neither created nor destroyed.

Key Stage 4 Separate Science (Physics) / Combined Science (Physics)





Year 10	Consolidation	P3 Energy demands Consolidation and application	P4 Electrical circuits Consolidation and application	P5 Electricity in the home Consolidation and application	P7 Radioactivity Consolidation and application	P8 Forces in balance Consolidation and application	P9 Motion Consolidation and application	P10 Forces and motion Consolidation and application	P11 Forces and Pressure Consolidation and application
Year 11	P12 Wave Properties	P13 Electromagnetic waves Consolidation and application	P14 Light Consolidation and application	P15 Electromagnetism Consolidation and application	P16 Space Consolidation and application	Specific revision and testing	Specific revision and testing	Contingency	Specified revision and testing

Science Curriculum Learning Journey

Physics is the science of the fundamental concepts of field, force, radiation and particle structures, which are inter-linked to form unified models of the behaviour of the material universe. From such models, a wide range of ideas, from the broadest issue of the development of the universe over time to the numerous and detailed ways in which new technologies may be invented, have emerged. These have enriched both our basic understanding of, and our many adaptations to, our material environment.

Pupils should be helped to understand how, through the ideas of physics, the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas which are of universal application and which can be illustrated in the separate topics set out below.

These ideas include:

- The use of models, as in the particle model of matter or the wave models of light and of sound
- The concept of cause and effect in explaining such links as those between force and acceleration, or between changes in atomic nuclei and radioactive emissions
- The phenomena of 'action at a distance' and the related concept of the field as the key to analysing electrical, magnetic and gravitational effects
- That differences, for example between pressures or temperatures or electrical potentials, are the drivers of change
- That proportionality, for example between weight and mass of an object or between force and extension in a spring, is an important aspect of many models in science
- That physical laws and models are expressed in mathematical form.

