



Applied Science Curriculum

Intent

Curriculum Vision

Applied Science inspires students to become critical thinkers about the natural and manufactured worlds. It empowers students to pursue their own curiosity and allows them to further explore the world around them.

Students learn a broad range of topics from each of the three sciences: physics, chemistry and biology.

In physics, students study the magnitude of the universe, from the depths of the cosmos, to the miniscule quarks which comprise subatomic particles. From cancer treatment to climate change, gaming to artificial intelligence, physics and physicists are on the front line, helping to shape the future.

The study of chemistry inspires students with a sense of curiosity and wonder about the fundamental nature of the world around them. It empowers students to make decisions about their own lives and critically evaluate scientific and technological developments that impact society. Students develop an in-depth knowledge of chemistry which can be applied to many industrial applications.

Biology is the study of life, and considers everything from the molecular level to whole ecosystems. Students cover information ranging from the human body to the exciting world of plant biology, drawing upon their knowledge of chemistry and physics to deepen their understanding of biological concepts.

The applied science sector is diverse and wide-ranging, including, for example, biomedical, forensic, physical and chemical sciences. It plays a crucial role in delivering economic growth in the UK allowing companies to compete in a rapidly enlarging global market. An understanding of more complex scientific vocabulary, processes and concepts not only allows progression to careers in health, technology, engineering, and agriculture, but also equips students to better understand an increasingly complex world.

Students will develop:

- Essential knowledge and understanding of different areas of sciences and how they relate to each other
- A deep appreciation of the skills, knowledge and understanding of scientific methods
- Competence and confidence in a variety of practical, mathematical and problem-solving skills
- Interest in and enthusiasm for the sciences, including developing an interest in further study and careers associated with the subject
- An understanding of how society makes decisions about scientific issues and how the sciences contribute to the success of the economy and society
- Students will develop work related skills that they can utilise to excel in any chosen career.

Concepts and Skills

The overarching concepts for Applied Science are:

- The Principles and Applications of Science
 - o Structure and bonding in applications in science
 - o Production and uses of substances in relation to properties
 - o Cell structure and function
 - o Cell specialisation
 - o Tissue structure and function
 - o Working with waves
 - o Waves in communication
 - o Use of electromagnetic waves in communication
- Practical Scientific Procedures and Techniques
 - o Titration and colorimetry in determining the concentration of solutions
 - o Calorimetry to study cooling curves
 - o Chromatographic techniques to identify components in mixtures
 - o Reviewing personal development of scientific skills for laboratory work
- Science Investigation Skills
 - o Planning and scientific investigation
 - o Data collection, processing and analysis/interpretation
 - o Drawing conclusions and evaluation
 - o Investigating enzymes
 - o Investigating diffusion of molecules
 - o Investigating plants and their environment
 - o Investigating energy content of fuels
 - o Investigating electrical circuits
- Physiology of Human Body Systems
 - o Impact of disorders of the musculoskeletal system and associated corrective treatments
 - o Impact of disorders of the lymphatic system and associated corrective treatments
 - o Physiology of the digestive system and corrective treatments for dietary-related diseases

The overarching skills we aim to develop in Applied Science are:

- Practical and Research Skills in Applied Science (Throughout)
 - o Experimental design
 - o Investigating types of variable
 - o Writing a plan
 - o Planning and investigation
 - o Implementing an investigation
 - o Recording data and observations
 - o Manipulating data
 - o Evaluating results and drawing conclusions
 - o Precision and accuracy
 - o Following written procedures
 - o Applying investigative approaches and methods when using instruments and equipment

- o Safely using a range of practical equipment and materials
- o Researching, referencing and reporting

Disciplinary Literacy

Disciplinary approach

In Applied Science we support the development of disciplinary vocabulary and the students' ability to read, write and communicate at an academic level so that they master the nuances of the curriculum.

We do this by carefully selecting tasks which encourage students to consider aspects of scientific literacy, such as bias, audience, rhetoric and vocabulary. Students have the opportunity to present information in a variety of ways, whether this be through written reports, spoken presentations, or other means of communicating science.

Interdisciplinary approach

In order to support the mastery of key concepts in Applied Science, our Interdisciplinary approach unites elements of:

- Mathematics, in terms of analysing and interpreting data, carrying out calculations of variables, and representing data graphically.
- English, in terms of understanding how to identify bias and to explore audience of scientific literature. Students have the opportunity to present information in a variety of ways, whether this be through written reports, spoken presentations, or other means of communicating science.
- Geography, in terms of an understanding of the environment and chemical impacts.
- Biology, in terms of an understanding of biological molecules and their interactions.
- Physics, in terms of an understanding of the behaviour of matter and energy.
- All core sciences in terms of application of scientific procedures and techniques.

Intellectual autonomy

In order to develop intellectual autonomy and confidence, we foster the willingness and ability of students in Applied Science to comprehend challenging texts, assimilate key concepts and synthesise them with prior learning. Students are equipped to think critically and apply strategies independently so that they can form their own cohesive conclusions and be able to express that in writing. This is facilitated by our "thinking bigger" lessons, where students explore aspects of scientific literature, science in the media, and concepts broader than the specification to assimilate and draw connections with prior learning.

In addition, students have access to the following Key Stage 5 resources held centrally in our library:

- *Physics Education* journal
- *Education in Chemistry* journal
- *Nuffield Book of Data*
- Palgrave Macmillan Foundations Series books
- A range of print copies of popular science magazines

Application of Mathematics

The curriculum recognises the need for students to be able to apply mathematics effectively. In Applied Science students use and develop their knowledge of data interpretation and analysis to reach conclusions from collected data on scientific phenomena. This requires students to be able to rearrange formulae, substitute values & interpret the data both numerically and graphically.

Independent Study

In Applied Science students undertake both directed and self-directed independent learning activities that support the strengthening of long-term memory and retrieval. Independent study helps our students achieve mastery in Applied Science and prepare students to work at an undergraduate level.

Directed independent learning tasks set in Applied Science can include background reading to build knowledge and deeper connections to the existing frame of learning or responding to interlocking questions on a given topic across more than one text source. Self-directed independent study in Applied Science involves retrieval practice which is a crucial component of mastery. As students

encounter challenges and learn to wrestle with demanding concepts and texts they not only develop their knowledge and understanding but they also develop resilience through perseverance.

Instead of revision being perceived as something which is crammed into a few weeks, independent study supports spaced practice throughout the curriculum. By repeatedly returning to content covered, students' knowledge has time to 'rest and be refreshed.'

We recognise that not all students process material at the same rate. Students who need extra support to achieve mastery are supported by targeted intervention in Applied Science, where a staged or 'scaffolded' process is used to enable students to move from being dependent learners to autonomous ones.

All students have access to our Academy library where a wide range of Academic texts, journals and other resources are available.

Implementation

Overview Statement

The curriculum in Applied Science is sequenced coherently so that knowledge, concepts and skills are rigorously developed over time. This supports all students, including the most disadvantaged, and those with high levels of need, especially SEND. Planning is informed by Rosenshine's Principles of Instruction and Cognitive Theory which support students in building secure schemas both within Applied Science, as well as in connection with other subjects.

Vocabulary is developed in Applied Science using the principles outlined in the Frayer Model and students are equipped to be able to read, write and speak like a skilled Scientist. This is done by the careful modelling of the use of scientific language and symbolic conventions and the high expectations for the correct use of these by students in their written work.

Through the use of independent study resources in Applied Science, students learn at greater depth so that they can become masters of the skills required to be intellectually autonomous.

Regular retrieval-based activities, including key skills checks completed in most lessons, strengthen long-term memory and aid fluency, as do our cumulative unit tests and end-of-year assessments.

Technology is employed through the use of an online platform to help support the systematic completion of independent study of all the key skills studied in Applied Science and feedback to students on this work.

Learning character is developed through a culture of reference to our six learning applications: awareness, collaboration, creativity, empathy, independence and resilience.

Impact

The Key Stage five curriculum builds upon students' initial understanding, extending their knowledge in the areas of substantive knowledge, and disciplinary knowledge.

Through developing their knowledge of substantive content, students are able to engage with application in disciplinary science.

Students also develop an understanding of the interdisciplinary nature of their studies, and this is supported through explicit cross-curricular links in physics, mathematics, chemistry, biology, psychology and geography.

Students use their knowledge of cognitive theory to recognise and use the most impactful methods of revision and retrieval practice. There is a high expectation for students to engage with practice of routine key skills through which they can develop independence.

Academic progress in Applied Science is recognised through BTEC Level 3 Extended Certificate in Applied Science, which acts as a measure of mastery and provides students with the national currency needed for access to higher education, apprenticeship courses as well as being well prepared for a career in any workplace.