The Bishop of Winchester Academy
Sapere Aude
Mallard Road
Bournemouth
Dorset
BH8 9PW

Science Curriculum

Intent

Curriculum Vision

Science inspires students to become critical thinkers about the natural and manufactured worlds. It empowers students to ignite their own curiosity and gives students the tools to explore the world around them.

An understanding of scientific vocabulary, processes and concepts not only establishes a solid foundation for careers in health, technology, engineering, and agriculture, but also equips all to better understand an increasingly complex world. A rich, broad and balanced scientific education will help everyone to approach public issues objectively and rationally.

Students will learn to:

- build a body of scientific knowledge that helps make sense of the past, present and future
- make connections between past, present and future scientific concepts
- apply scientific understanding to the real world

Concepts and Skills

The Science curriculum is underpinned by ten 'Big Ideas'. These ideas allow students to develop their ability to work scientifically (investigative skills) and interpret scientific information.

- Forces – what makes things move, and how do forces affect their movement?
  Students are able to explain what makes things move, and suggest how the changing resultant force on an object with mass will affect its motion. This is important for engineering, space travel, as well as simple understanding of stopping distances at different speeds when driving.
- Electromagnets – how do electricity and magnetism relate?
  Students are able to explain how electricity and magnetism are interlinked for application in the engineering sector with use in motors, generators and other moving components. It is also applicable to students regarding the safe use of electrical appliances at home.

- Energy – how is energy transferred and stored?
  Students learn how energy is transferred and stored. This is particularly important to students who wish to pursue engineering careers, but is also applicable more broadly in the home when assessing energy efficiency and calculating electricity and gas bills, as well as how to reduce these bills.
- Waves – how do waves transfer energy?
  Students learn about the electromagnetic spectrum, including the ionising nature of electromagnetic waves. From this, they make informed life decisions with regards to the safe use of mobile phones which use microwaves, selecting an appropriate SPF for sun protection and understanding why the Earth's atmosphere is increasing in temperature.
- Matter – what is everything made from?
  Students learn about the particle model of matter, and what different substances are made from. They discover the reasons behind the properties of different substances, and how these materials are suitable for specific jobs. Students apply this to broader life when carrying out DIY tasks at home, or simply understanding why they should not touch a metal handle of a saucepan which has been on a hotplate for a long period of time.
- Reactions – how does matter change during chemical reactions?
  Students learn about how matter changes in chemical reactions, which they apply to material understanding in explaining why iron rusts, and how different foods are made (for example thermal decomposition in the baking of bread to give a light, airy texture).
- Earth – how can we use the resources of Earth?
  Students learn how we can use the resources that the Earth provides, for example how we can mine for minerals and ores, and use chemical extraction techniques to obtain different usable materials.
- Organisms – how do living things work?
  Students learn what living things are made of, and how they can be affected by issues such as diseases. They also learn about the causes of injury, and the implications of nutritional groups on the diet, and subsequent impact on the body.
- Ecosystems – how do living things interact?
  Students learn how small changes as a result of human activity could have a large impact on the world around us. This will help us maintain our planet's biodiversity, and ensure the future of the human race with thought for sustainability, climate change and agriculture.
- Genes – how do living things develop different characteristics?
  Students learn about what makes humans similar and diverse. They develop understanding of how genes can bring about certain health conditions. They also learn, crucially, about the effectiveness of different types of birth control and contraception, and how pregnancy progresses over time after conception leading to birth.

Vocabulary

Science, from the Latin: *scientia*, (meaning "knowledge") is all about investigating and evaluating. Thinking and working scientifically relies on precision - precision of measurement, and precision of language. For example, in everyday parlance, the words "mass" and "weight" are often used interchangeably; in science, we know that these two words refer to two very different concepts.

Some particularly useful key words in each key area of science are as follows:

Biology	Chemistry	Physics	Enquiry Processes
Cell	Atom	Force	Hypothesis
Tissue	Molecule	Energy	Prediction
Organ	Compound	Store	Dependent Variable
Surface Area	Reaction	Transfer	Independent Variable
Structure	Exothermic	Potential Difference	Control Variable
Function	Endothermic	Current	Conclusion
Diffusion	Alkane	Resistance	Evaluation
Osmosis	Alkene	Resultant Force	Evidence
Active Transport	Mole	Electromotive Force	Data Analysis
Biodiversity	Temperature	Electromagnetic Wave	Theory

Homework

All students in years 7-11 have Sparx as part of their homework in Science. The Sparx content is in line with the sequencing of the curriculum. Self-quizzing supports the retrieval of and embedding of knowledge in long-term memory. Our low stakes Do Now's at the beginning of each lesson tests cumulative knowledge of multiple previous topics, giving students the opportunity to strengthen memory through retrieval practice. This is supplemented by our cumulative multiple choice Knowledge Organiser tests at the end of each term. Instead of revision being perceived as something which is crammed into a few weeks, our homework programme supports spaced practice throughout each academic year. By repeatedly returning to content covered, students' knowledge has had time to 'rest and be refreshed'.

Students in years 9, 10 and 11 complete additional weekly homework tasks which aid the retrieval of previously taught content needed to maximise learning in future lessons. This not only enables students to reach mastery in these topics, but can be used by teaching staff in a diagnostic manner to carefully identify need for intervention prior to the delivery of new content.

Year 11 students are also given guided application practice questions to develop a deep understanding of how exams function as benchmarks of mastery. Students who need extra support to achieve mastery are supported by our 10:10 programme in Science and all have access to our daily Homework Club.

Implementation

Overview Statement

We have sequenced the curriculum from year 7-11 so that the content flows from one to topic to another, and links to the previous term or year's learning are consistently revisited, adding new context and ideas that students have already covered. This supports students of all abilities, especially SEN students. All topics and key areas have been merged into "super topics" that will show pupils the real-world application of what they are learning and give them an idea of jobs and careers linked to science, some of which they may not have initially considered or been aware.

Planning is informed by Rosenshine's Principles of Instruction and Cognitive Theory. Cross curricular links are explicitly referenced and exploited in order to deepen understanding. Homework, daily retrieval-based 'Do Nows' and termly low stakes knowledge organisers quizzes strengthen memory as do mid-term and end-of- year assessments which are cumulative. Vocabulary is developed in Science through the Frayer Model and students are taught to read, write and speak like a Scientist. Technology is employed through use of state of the art data-logging apparatus, and practical equipment to strengthen learning. Learning character is developed each lesson through the use of the six Learning Applications (LApps). Assessments will follow the same concept of revisiting previous learning, and all assessments will contain questions from previous terms or even years to maintain consistent retrieval practice.

Impact

Key Stage Three

Through studying the Key Stage Three curriculum, students will be able to investigate scientific hypotheses with confidence. They will have developed a deep knowledge of structure and function of living organisms, understanding the properties of solids, liquids and gases and the transfer of energy involved in all interactions, and be able to apply this knowledge to their investigative conclusions.

Students develop all the LApps but especially their Awareness and Resilience through carrying out practical investigations to prove their hypotheses right or wrong. Students have a solid introduction to the disciplinary literacy required to be able to communicate like a scientists, and all opportunities to develop numeracy are fully exploited in context, such as through representation of scientific data and rearranging equations. Cognitive Theory is interleaved throughout the curriculum so that students gain a knowledge of how they learn and manage their cognitive load.

Key Stage Four

The Key Stage Four curriculum builds upon students' initial understanding, extending their knowledge in the areas of forces, energy, waves, electromagnets, matter, reactions, Earth, organisms, genes and ecosystems. Through developing their knowledge of how materials are made from atoms and how interactions of elements create compounds with a wide range of uses, evaluate the benefits of a balanced

diet and describe how forces affect motion, they are able to explain the reasons behind scientific observations made through investigations with clear scientific justification. Students also develop an understanding of the entwined nature of their studies, though explicit cross-curricular links and inter-disciplinary study. This includes strong links with Maths throughout the Science curriculum, enabling pupils to apply the knowledge they gain in Maths to scientific concepts. Further to this pupils will be consistently made aware of the scientific links to the other subjects they study as they progress through KS4, this will further allow them to understand the links between their subjects and the world around them. Their progress in Science is recognised through their GCSE entry, which acts as a benchmark of their mastery and provides them with the national currency needed for access to further education and employment. Students use their knowledge of cognitive theory to recognise and use the most impactful methods of revision and retrieval practice.