

Intent

What are the aims of this subject?

To nurture scientific thinkers to have an impact in an ever-changing world. To share the wonder of science and allow our students to be curious and inquisitive about the world. To enable them strategies and skills in order to find ways to answer their questions. For our students to recognise that science is happening everywhere and use science knowledge and skills in their own lives.

What are the broad areas of knowledge and skills being developed in this subject?

Key Stage 3

At KS3 students are taught a thematic curriculum that is based on the National Curriculum. Areas of knowledge include:

- Community – ecosystems, adaptations and plant nutrition.
- Celebrations – the science behind Bonfire Night and fireworks, Santa’s Sleigh Friction Investigation.
- Me, Myself and I –The human body and how different systems work together.
- The World Around Us – The Earth’s structure, our environment and the problems we face.
- Healthy Living – Healthy lifestyles, disease, substances and exercise.
- Belonging – Where we belong within the Universe.

Key Stage 4

At KS4 students study AQA GCSE Biology. Throughout the course students will be investigating, observing, experimenting or testing out ideas and thinking about them. Areas of knowledge include:

- Cell Biology
- Organisation
- Infection and Response
- Bioenergetics
- Homeostasis and Response
- Inheritance, variation and evolution
- Ecology

Implementation

How is this subject delivered/taught to students?

Key Stage 3

We plan to enable our students to develop their scientific practical skills and extend their knowledge and understanding across all 3 main Sciences; Biology, Chemistry and Physics. Students will learn how to be responsible scientists, working safely within a laboratory environment and use various skills to complete a number of investigations.

Key Stage 4

In Year 10 and 11 students will study AQA GCSE Biology. Due to time constraints and the skill set of our students, the decision to focus on Biology, rather than Combined Science, was made. Biology was chosen following students being baselined as they join KSSS. The majority of students have substantially more Biology knowledge, compared to that of Chemistry and Physics. We can still deliver other sciences to GCSE if the students have already started in their home schools. The subject content of GCSE Biology has been ordered over the two years in such a way that topics will be interleaved and revisited over the two years.

Topics Taught at Key Stage 3

Autumn Term:

- **Community:** Ecosystems within our community: food chains and food webs; biodiversity; population size.
The organisms within communities: adaptations. Plant structure, photosynthesis, reproduction, planting and growing plants in KSSS community.
- **Celebrations:** The science behind Bonfire Night and Fireworks; combustion, the fire triangle, flame testing metal ions. How we enjoy the celebrations; how the eyes work and how we see colours. The science behind Christmas; Santa's Sleigh Friction investigation.

Spring Term:

- **Me, Myself and I:** The body and how different body systems work together. Puberty including the menstrual cycle, reproduction and the stages of pregnancy. The skeletal/ muscle system, circulatory system, respiratory system and digestive system.
- **The World Around Us:** The Earth and the Atmosphere; the Earth's structure, types of rock, the rock cycle, fossils, crude oil. Our environment and the problems we face; atmosphere and climate, the carbon cycle, recycling and sustainability.

Summer Term:

- **Healthy Living:** Healthy lifestyles; nutritional food groups, balanced diets, food deficiencies. Disease; infectious and non-infectious diseases, vaccination, antibiotics. Substances: Alcohol, recreational drugs and medicinal drugs. Exercise; how exercise affects the body, investigating pulse rate.
- **Belonging:** Where we belong within the universe: our solar system. Gravity and how it changes on different planets. Our star, the Sun, and other stars in our universe. Planets in our solar system. Mars colonisation and space exploration.

Topics Taught at Key Stage 4

Year 10:

Autumn Term:

- Cell Biology; Animal and plant cells, microscopy, specialised cells.
- Organisation; Human digestive system, enzymes.
- Ecology; abiotic and biotic factors, adaptations, levels of organisation.
- Cell Biology; chromosomes, mitosis and cell cycle, diffusion and osmosis.

Spring Term:

- Organisation; plant tissues, organs and transport systems and active transport.
- Bioenergetics; photosynthesis, limiting factors and uses of glucose.
- Homeostasis and response; plant hormones, control and coordination.
- Organisation; the lungs, heart and blood vessels, heart disease, blood, health issues and cancer.
- Bioenergetics; aerobic and anaerobic respiration, response to exercise, metabolism.

Summer Term:

- Homeostasis and response; nervous system, the brain, the eye, control of body temperature, endocrine system, control of blood glucose concentration, kidney function.
- Infection and response; communicable diseases, human defence systems, vaccination, drugs.
- Inheritance, Variation and Evolution; Antibiotic resistant bacteria.

Year 11:

Autumn Term:

- Inheritance, Variation and Evolution; DNA, the structure of DNA, reproduction, meiosis, X and Y chromosomes, genetic diagrams, inherited disorders, variation, evolution, selective breeding, genetic engineering, cloning.
- Homeostasis and Response; puberty and the menstrual cycle, controlling fertility.

Spring Term:

- Ecology; Biodiversity and waste management, global warming, deforestation, food security and farming, biotechnology.
- Inheritance, Variation and Evolution: Fossils, speciation, classification.

Summer Term:

- Revision and exams

How is formative and summative assessment used in this subject to improve student's skills and knowledge?

When students arrive at KSSS they are baselined using an AQA Entry Level Science paper to assess knowledge across the 3 sciences; Biology, Chemistry and Physics. This is to ascertain prior knowledge, judge students' abilities and to plan for future learning.

In year 10 students sit mock exams in the summer term. This is to assess knowledge from the first year of GCSE content and to inform what knowledge gaps may exist, so that this can be covered during year 11. It also gives students the chance to experience actual exam conditions and timings. The students will then sit another mock at the end of Autumn term in Y11. This is to check progress and also re-assess working at and predicted grades.

How is enrichment (e.g. residentials, clubs) implemented to enhance the components of this subject?

Enrichment events, days and visits that support the science curriculum:

- British Science Week in March – running STEM events including nationally recognised CREST awards
- Creating a biodiverse outdoor area for students to enjoy, developing their understanding of the environment
- The Big Bang Show at the NEC
- The Think Tank Museum in Birmingham
- RAF Museum at Cosford
- Zoo Lab/Angie's Animal Antics

How are spiritual, moral, social and cultural values developed in this subject?

Spiritual: Students have the opportunity to reflect on their opinions in relation to different aspects of science. For example; origins of the Universe; evolution; genetic engineering and cloning, MMR vaccines, IVF treatment.

Moral: Students are taught to ask the question – what is the morality and ethics of different aspects of science. For example, testing new medicines on animals, cloning, fossil fuel usage and damage to the environment.

Social: Students use a range of social skills for discussions within lessons, whether it be ascertaining prior knowledge or new ideas. They also develop social skills as part of practical investigations, where they work as a team.

Cultural: Students have opportunities to understand that many scientific developments come from all areas of the globe, from many different cultures and collaborations.

Careers:

- **Recognise the importance of STEM in their lives and the lives of others** - Using examples from both the inspirational and the everyday to help students understand how STEM subjects are important to their lives and the lives of those around them.
- **Challenge the perception that "STEM isn't for me"** - Students are encouraged to see the STEM opportunities available to them, regardless of gender, race or academic ability.
- **Promote the value and transferability of STEM skills** - The transferability of STEM skills is highlighted to students, in particular, mathematics and digital skills, and examples of how these STEM skills can support their wider employability are provided.
- **Raise awareness of the wide range of roles available within STEM industries** - Students are supported to understand the wide range of jobs available in STEM sectors, including both STEM and non-STEM skilled roles.
- **Signpost and support the development of employability skills** – The curriculum includes time to develop employability skills and these opportunities are highlighted to students.
- **Provide information on STEM-specific further study routes and careers** - Space is created within the curriculum for students to be curious about careers. Students are helped to learn more about the STEM careers and range of further study routes available to them.

Wellbeing and Health: Discussing health related science issues.

Examples include -

- Students develop an understanding of some of the health issues associated with being overweight and dare encouraged to discuss some of the ways in which individuals and society can intervene in this problem.
- Students are helped to develop an understanding of the importance of a healthy liver and to consider some of the health and social issues associated with alcohol consumption. Discussion takes place on the many ways in which alcohol affects the lives of young people, including the dangers of drinking too much.
- Students develop an understanding of immunity and vaccines and the importance of vaccination programmes.
- Students are encouraged to discuss some of the issues and conflicts associated with global environmental issues; e.g. air pollution, global warming, habitat loss, malnutrition.
- Students are encouraged to discuss some of the issues and conflicts associated with preserving forests, providing habitats for wild animals within farmland and the importance of plants in the oceans.

British Values:

- **Democracy:** Students work together practically in groups which encourages them to share views and opinions and take instructions from others.
- **The Rule of Law:** Students follow laboratory rules for the safety of all. There are opportunities to discuss laws relating to science, such as the use of IVF, stem cells, genetic modification and DNA databases, maintaining biodiversity, use of energy sources, fishing and farming.
- **Individual Liberty:** There are opportunities for students to work independently and make choices in a safe environment when carrying out investigations. There are opportunities to debate issues where students can share their opinions and listen to the views of others. For example, the generation of electricity, the placement of quarries, the use of drugs, genetic modification, selective breeding and climate change.
- **Mutual Respect and Tolerance:** Students work together practically which encourages teamwork and respect for others. There are opportunities to learn about scientific discoveries by a diverse range of people from our culture and other cultures. Students learn about the continual evolution of scientific ideas which occurs through the acceptance that different people have different ideas about a concept. There are opportunities to consider conflict between religious beliefs and scientific understanding with respect and acceptance of people's values.

Impact – Top 5

1. **Progress in KS3 and KS4 is strong because of high expectations, differentiation, and consistent level of delivery to all students. By the end of KS4 students are able to apply their knowledge as part of summative assessment to achieve qualifications that reflect excellent progress from their starting points.**
2. **Students can be curious and inquisitive about the world; they have the necessary skills to enable them to ask pertinent and challenging questions, and have the strategies and skills to find ways to answer them.**
3. **Students recognise that science is happening everywhere: they can see the science in situations and use science knowledge and skills in their own lives.**
4. **Students can be fearless about the learning process: recognise that there are things they don't know yet, there are things that nobody knows, and that we can discover more by asking questions and discussing.**
5. **Teacher feedback on students' understanding of the components and implementation of the Science curriculum is strong, which supports the quality of implementation and sequence of learning.**